Thornley & Lumb Partnership Ltd.

MERCHANT ROKEBY GLOUCESTER, DOWNINGS GLOUCESTER (PHASE II)
ENERGY STRATEGY FOR PLANNING

PREPARED BY
THORNLEY & LUMB PARTNERSHIP LTD

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Project

Downings Gloucester (Phase II)

Document

Energy Strategy for Planning

Client

Merchant Rokeby Gloucester

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Executive Summary

This Energy Strategy produced by Thornley & Lumb on behalf of Merchant Rokeby Gloucester details sustainable building design relating to energy and carbon emissions of the proposed residential building development at Downings Gloucester (Phase II).

The building fabric first design philosophy and efficient building services analysis are combined with the available Low and Zero Carbon (LZC) technology to provide a methodology for achieving a sustainable low energy use development.

Building Control have confirmed that the heritage conversion units can be assessed as new dwellings with a material change of use under *Approved Document Part L1B* and would not require a SAP assessment. The existing retained thermal elements should be thermally upgraded as part of the work.
The new build areas should be assessed using the guidance contained within *Approved Document Part L1A*, with target CO_2 Emissions and Fabric Energy Efficiency standards not being exceeded

This process is illustrated by following the Energy Hierarchy which details the measures included at each stage. The Energy Hierarchy helps qualify the carbon emissions due to various measures by reporting the emission reductions at each stage known as Be Lean, Be Clean and Be Green methodology.

Be Lean Measures

- Low external envelope u-values.
- Low air permeability.
- Low energy LED lighting.
- Whole house mechanical ventilation with passive heat recovery.

Be Clean Measures

- Same as Be Lean.

Be Green Measures

- Ambient loop low temperature community heating scheme providing space heating to 88% of residential area.
- Ambient loop low temperature community heating scheme providing hot water services to 88% of residential area.

The new build site will be assessed using the block compliance method to account for the 16no. direct electrically heated studios and 96no. ambient loop heated flats.
This Energy Strategy therefore confirms a method where the overall development's carbon emissions could be reduced 21% below the Part L 2021 baseline.

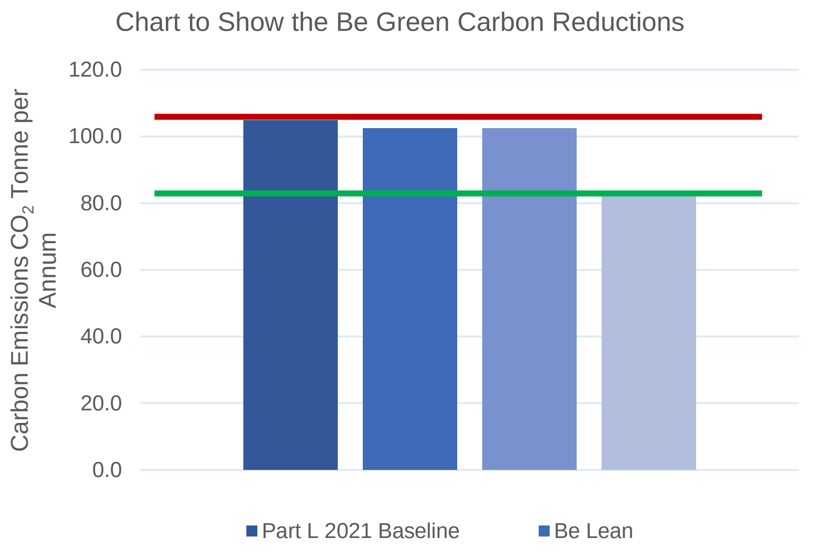

Chart to show the overall carbon reductions of the proposed development

Carbon Dioxide Emissions Per Annum Regulated & Unregulated

	Regulated CO_2 Tonnes per annum	Unregulated CO_2 Tonnes per annum
Baseline Part L (2021)	104.9	16.5
Including Be Lean Measures	102.5	16.5
Including Be Clean Measures	102.5	16.5
Including Be Green Measures	83.3	16.5

Regulated Carbon Dioxide Savings Per Annum at Each Stage of the Energy Hierarchy

	Tonnes CO_2 Per annum	Percentage Reduction %
Savings from Be Lean Measures	2.4	2.3
Savings from Be Clean Measures	0.0	0.0
Savings from Be Green Measures	19.2	18.7
Reduction Compared to Baseline	21.6	20.6

Contents

1.0 Introduction

The proposed residential building development at Downings Gloucester (Phase II), will consist of two buildings for residential occupancy. The development will involve adaptation of existing retained structure upgraded to modern accommodation and a new build tower. Both buildings will contain a mixture of apartments from 1 person Studios to 6 person Duplexes.

The proposed development will be designed with sustainability as the principal design metric and accordingly this Energy Strategy will detail how energy usage and carbon emissions have been minimised using the energy hierarchy Be Lean, Be Clean, Be Green as developed by the Greater London Authority (GLA).

Initial meetings with Building Control have confirmed that the heritage conversion units can be assessed as new dwellings formed by a material change of use and as such the guidance contained within *Approved Document Part L1B* would be acceptable to use for Building Regulation compliance. They would not need a SAP assessment to meet any CO_2 emission or fabric energy efficient target values. The existing retained thermal elements should be thermally upgraded as part of the work.

The new build block should be assessed using the guidance contained within *Approved Document Part L1A*, with target CO_2 Emissions and Fabric Energy Efficiency standards not being exceeded

The Energy Strategy considers future electricity grid decarbonisation and uses this to influence the proposed design. With the update of building regulations, Part L 2021, the decarbonisation of the Electricity Grid is now reflected in current carbon emissions calculations for Part L of the building regulations. However, the carbon reduction is also still illustrated using Part L 2013 carbon factors for the purposes of illustrating carbon reductions.

The carbon reductions detailed in this Energy Strategy have been calculated using Part L accredited compliance FSAP software, this is a building comparison tool design for Part L compliance. The software uses the CIBSE method for calculating heat losses and then calculates space heating energy usage, using typical operation and occupancy profiles.
More detailed energy usage and carbon emissions calculations could be undertaken using thermal modelling. The overheating calculations have used dynamic simulation thermal modelling to assess the overheating risk and the effectiveness of the overheating mitigation strategy.

Accordingly, this Energy Strategy will detail how the proposed development will be a low carbon sustainable development by following the four energy strategy design principles as detailed in Section 1.1 Sustainable Low Carbon Design.

Figure 1.1 Image to show the proposed development

1.1 Sustainable Low-Carbon Design

Thornley and Lumb will consider the sustainability of the proposed development and the building's energy usage throughout the design process by developing an energy strategy design philosophy. This will consist of four underling design principles which will be implemented to ensure the sustainability of the proposed development. The principles used to develop the energy strategy are:

- Reduce demand
- Meet demand efficiently
- Supply from low carbon sources
- Supply from renewables.

Energy Strategy Design Principles

Reduce Demand

The energy demand of the building is intrinsically linked to the design of the building envelope and its services. Therefore, ensuring a thermally efficient and relatively air-tight building envelope will enable passive reduction in energy usage.

Meet Demand Efficiently

The application of building services which improve upon the minimum efficiencies detailed in the government's document the *Domestic Building Services Compliance Guide (DBSCG),* will ensure that where energy is used for servicing the building, it is used efficiently with minimal wastage.

Supply from Low Carbon Sources

Where energy is used to service the building, the carbon emissions of the source will be considered as part of the design process. This involves using carbon factors of energy sources to calculate potential carbon emissions.

Supply from Renewable Sources

The further reduction of carbon emissions will be met with energy supply from renewable sources. These are zero carbon energy sources which provide servicing for the building without increasing the carbon emissions of the building.

2.0 Design Considerations

This section discusses the design considerations for the proposed residential development at The Downing's. This section will detail the design methodology and detail the planning criteria established by national and local policy.

2.1 Design Methodology

The energy usage figures used in this Energy Strategy have all been calculated using industry recognised software. The geometry of the building is modelled in the software and then all fixed building service efficiencies are integrated with the model to provide energy usage figures.

2.1.1 Part L Compliance Software

The Energy Strategy uses Part L compliance software FSAP developed by Stroma. This uses the CIBSE heat loss model to calculate average monthly heat loss and determine energy required for space heating. The Occupancy and typical usage profiles are then combined with architectural elements and building services to provide a building comparison estimate of energy usage relative to that of other buildings. Dynamic simulation modelling can be used to provide a more accurate design stage calculation of operational energy.

2.1.2 Overheating Modelling Software

The IES VE software is dynamic building simulation modelling DSM application which includes industry standard thermal modelling. The dynamic simulation model utilises partial differential equations which are based on first-principles models of conductive, convective and radiative heat transfer. The equations used in the software are then driven by real weather data, using local climate and weather data for the specific locations. This information is then combined with the proposed building geometry and fixed building services efficiencies to calculate an hourly annual analysis of the building's temperatures. This dynamic simulation modelling of building allows the overheating risk to be assessed.

2.1.3 Carbon Emissions Calculations

Following annual energy rate calculations, the carbon factors for each fuel type then allow for a prediction of the annual carbon emission of the development. This Energy Strategy uses carbon factors from Part L 2021, which references Table 29 of the *NCM Modelling Guide 2021 edition*. However, Part L accredited software still uses Part L carbon factors from L2A 2013 which overestimate carbon emission from electric building services by over 100%. Once Part L accredited software is updated in line with changes brought in by Part L 2021 the annual carbon emissions will be significantly lower.

The carbon factors have changed in recent years due to the increasing amount of zero carbon and renewables generation used to provide grid electricity. In 2021 low carbon electricity generation was 54.1% of total grid electricity.
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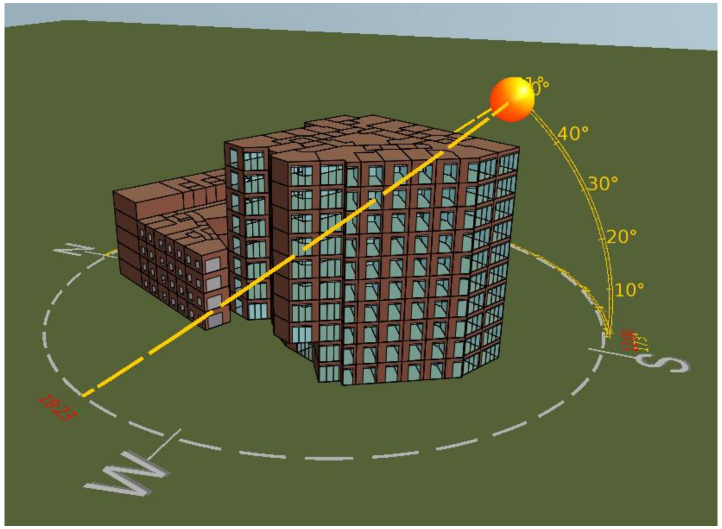
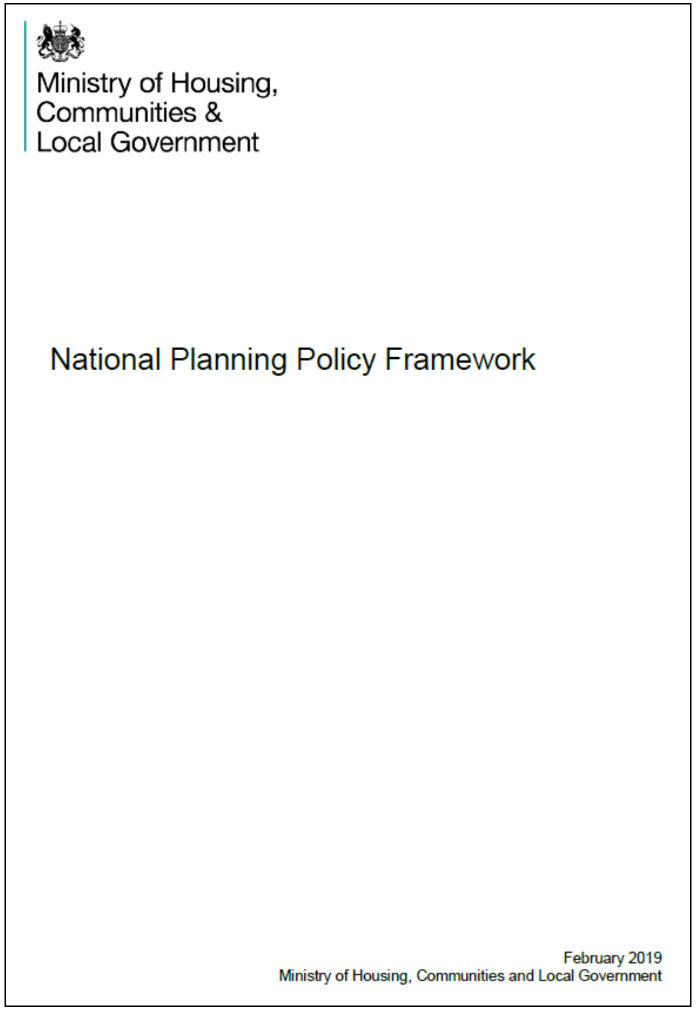


Figure 2.1 Image to show the orientation of the building in energy modelling software IES VE

2.2 National Planning Policy

The *National Planning Policy Framework* (NPPF) was updated in February 2019. The document details that “the purpose of the planning system is to contribute to the achievement of sustainable development”. Applications for planning permission are determined in accordance with the development plan and local planning policy. Achieving sustainable development means that the planning system has three overarching objectives, which are independent and need to be pursued in mutually supportive ways.


Ministry of Housing,
Communities &
Local Government

National Planning Policy Framework

February 2019
Ministry of Housing, Communities and Local Government

2.2.1 Economic

Contributing to help building a strong, responsive, and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth, innovation, and improved productivity; and by identifying and coordinating the provision of infrastructure.

2.2.2 Social

Supporting strong, vibrant, and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities’ health, social and cultural well-being.

2.2.3 Environmental

Contributing 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 and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

2.3 Local Planning Policy

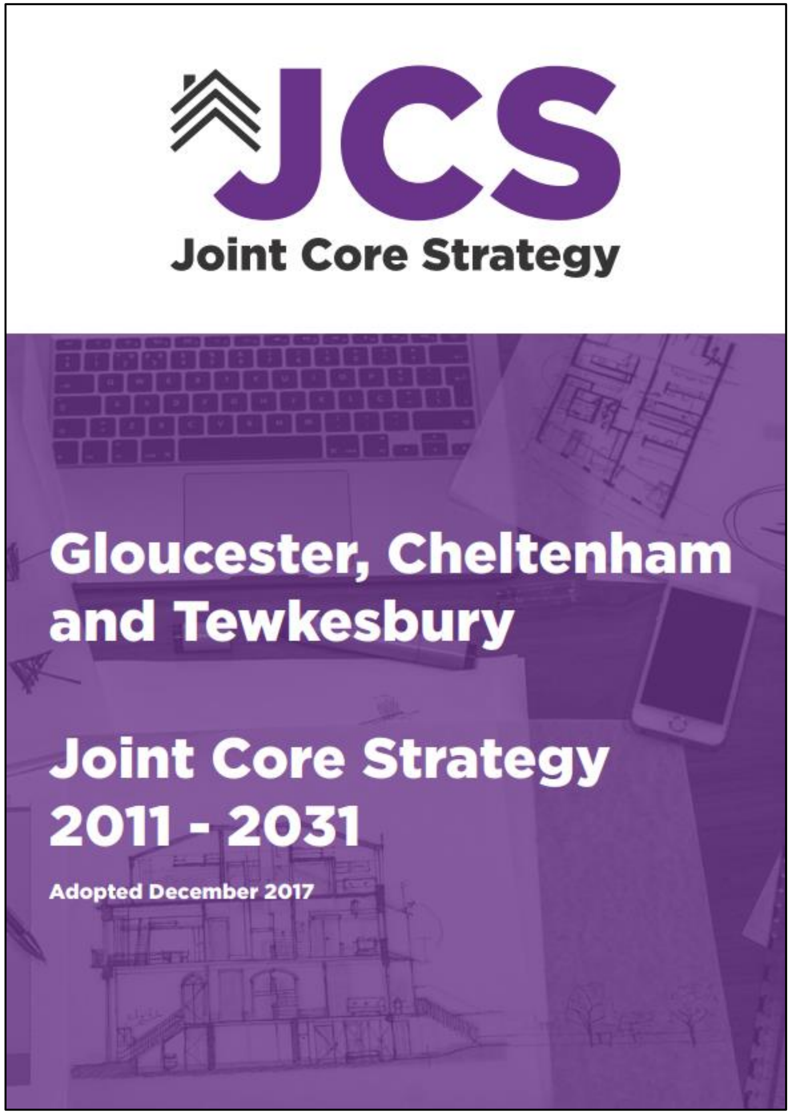
Gloucester City Council's Local Plan comprises two separate documents:

- *The Joint Core Strategy*; and
- *The City Plan*

Together these documents comprise the development framework for Gloucester until 2031.

The *Joint Core Strategy (JCS)* is prepared jointly by the authorities of Gloucester, Cheltenham and Tewkesbury. It sets out the strategic planning framework for the three authorities and establishes the level of development along with the broad principles of how development should be accommodated to the year 2031.

The *City Plan* is a locally specific planning document for the City that sits beneath the Joint Core Strategy. It is in general conformity with the Joint Core Strategy and brings together into one concise document a range of planning policies and proposals. It explains the Council's ongoing vision and influence for the regeneration of the City as an attractive place to live and work in accordance with the requirements of the JCS.



2.3.1 Policy SD1 – Sustainable Design and Construction

This requires Development proposals to demonstrate how they contribute to the aims of sustainability by increasing energy efficiency, minimising waste and avoiding the unnecessary pollution. Major planning applications must be submitted with an Energy Statement that clearly indicates the methods used to calculate predicted annual energy demand and associated annual Carbon Dioxide (CO_2) emissions.

2.3.2 Policy INF5 – Renewable Energy / Low Carbon Energy Development

This confirms proposals for the generation of energy from renewable resources, or low carbon energy development, will be supported considering the impact (or cumulative impact) of the scheme, including buildings and access roads, landscape character, local amenity, heritage assets or biodiversity;

3.0 Be Lean: Reducing Energy Demand

Consideration of energy usage is an integral part of any proposed development, and each aspect of the Low Energy Building Design includes methods of conserving energy and promoting sustainability. This section of the Energy Strategy looks at how demand has been reduced by the minimum required efficiency defined by building regulations, known as the 'limiting parameter'. This minimum efficiency or limiting parameter is then compared with the Low Energy Building Design to assess the energy use of the proposed residential building development at Downings, Gloucester.

3.1 Building Envelope and Fabric

The energy usage of a building is intrinsically linked to the efficiency of the building envelope design, accordingly this section details how energy use is minimised by limiting conductive heat loss through following energy strategy design principles in Section 1.1 and using a Passivhaus influenced fabric first design philosophy.

The reduction of conductive heat loss through the building fabric is the most effective method of passively reducing energy usage. This can be achieved by increasing the insulation in floors, walls and roofs whilst also specifying glazing which has a high thermal resistance and by proxy a low U-value.

Building services will be replaced multiple times over the life of the building but it is less likely that the building fabric will be upgraded. Building fabric could potentially remain as built for over sixty years and as such these measures will likely payback multiple times whereas building services will generally need to be replaced much more frequently. Therefore, the reduction of U-values and the adoption of the Passivhaus design philosophy is the most effective method of reducing energy usage and carbon emissions over the full life cycle of the building.

3.1.1 Thermal Properties of Building Fabric

The energy usage of the building services associated with controlling the space temperature is dependent on the building envelope. The efficiency of the building envelope significantly affects energy usage as this is essentially a measure of how efficiently the internal building environment is thermally isolated form the external environment. The more efficient the isolation of internal from external environment, the less energy will be required for use in servicing the internal environment to meet optimum comfort levels.

3.1.2 Thermal Bridging

The proposed development has been designed to use construction details which will limit thermal bridging or cold bridges which have less resistance to heat transfer than the surrounding building envelope. Cold bridges can be the result of interruptions to the insulation in the building envelope specifically this this relates to non-repeating or linear thermal bridges. A reduction in cold bridges through construction detailing can significantly reduce conductive heat loss through the building envelope.

	Limiting Fabric Parameters W m^{-2} k^{-1}	Low Energy Design Parameters W m^{-2} k^{-1}	Percentage Improvement %
Roof	0.18	0.10	44
External Walls	0.26	0.15	42
Ground Floor	0.18	0.15	44
External Glazing	1.60	1.40	13

Table 3.1: Table comparing the limiting fabric from Part L1 of the 2021 building regulations with the proposed Low Energy Design

3.1.3 Airtightness of Structure

The energy usage of the building services associated with controlling internal environment are heavily dependent on the airtightness of the building, which is essentially a measure of how efficient the building envelope is at resisting ingress of air from the external environment.

All buildings experience external air entering the building due to infiltration which is mainly due to the stack effect resulting for internal air buoyancy or external wind. These phenomena create a pressure differential over the building fabric which can result in infiltration or exfiltration through the building fabric, infiltration of external air can lead to exfiltration of internal conditioned air at another point in the building fabric reducing the ability of the building envelope to retain heat.

Ingress of air from the external environment will need to be conditioned by the building services to ensure the internal environment stays at the optimum level of comfort. Poor air tightness can result in higher operational energy costs and poor thermal comfort. Passivhaus standards specifically target very low air leakage rates associated with air-tight building to ensure operational energy is lowered and thermal comfort is improved.

Accordingly, the reduction in air permeability and thereby external air ingress will reduce the demand upon the building services conditioning the area and proportionally reduce energy usage.

	Limiting Air Permeability $m^3 hr^{-1} m^{-2}$	Low Energy Design Permeability $m^3 hr^{-1} m^{-2}$	Percentage Improvement %
Air Permeability	8.0	3.0	63

Table 3.2: Table comparing the limiting air permeability from Part L 2021 with the proposed design.

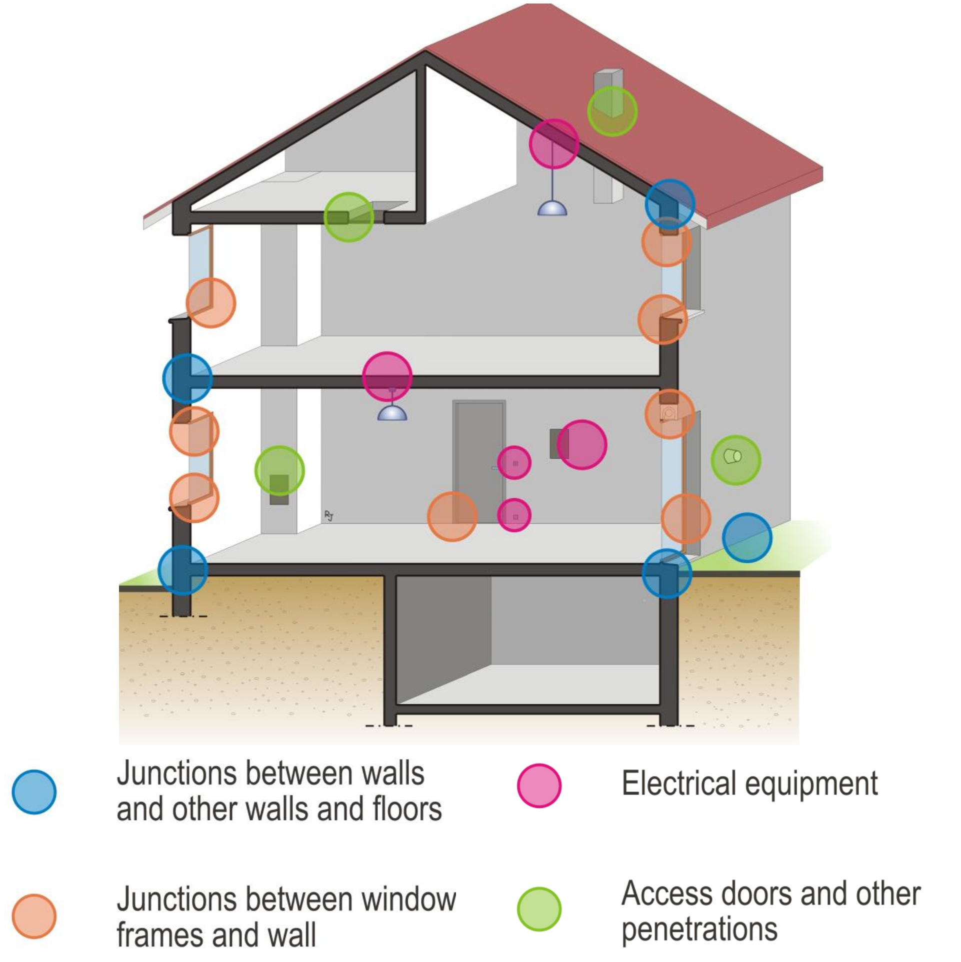


Figure 3.1: Image to show common air leakage pathways indicated on a typical residential development

3.1.4 Mechanical Ventilation

The proposed development will again take inspiration from the Passivhaus standard and utilise mechanical ventilation with passive heat recovery. As modern buildings become increasingly more air-tight, ventilation becomes more critical. It is possible to provide good indoor air quality with extract ventilation, however this would increase demand and operational energy usage of the space heating systems, increasing running costs of the building. Therefore, mechanical ventilation with passive heat recovery has been utilised which ensures the heat remains in the building internal environment, despite bringing in external atmospheric 'fresh' air to improve indoor air quality for the occupants.

The heat recovery unit uses an air-to-air heat exchanger to transfer heat from the internal spaces which is extracted to the incoming external air. The air paths do not cross and there is no mixing of the air, the heat exchanger enables heat recovery between supply and extract air streams. Thereby passively warming the external air and reducing the need for mechanical heating services to use energy to increase the temperature. This can reduce the heating energy required for the building by 95% and reduce wasted energy by ensuring less demand is placed on the space heating system.

The Specific Fan Power (SFP) of the heat recovery ventilation unit is a measure of how efficiently the unit can supply air to the space. This consists of a ratio of electrical absorbed power to volumetric airflow rate creating the specific fan power metric, in which a lower number is more efficient.

	Part L Limiting Values	Low Energy Design	Percentage Improvement %
Specific Fan Power (SFP) W l^{-1} s^{-1}	1.90	0.52 – 0.59	73 - 69
Heat Recovery Efficiency %	50	80	60

Table 3.3: Table comparing the limiting ventilation efficiencies with the proposed Design.

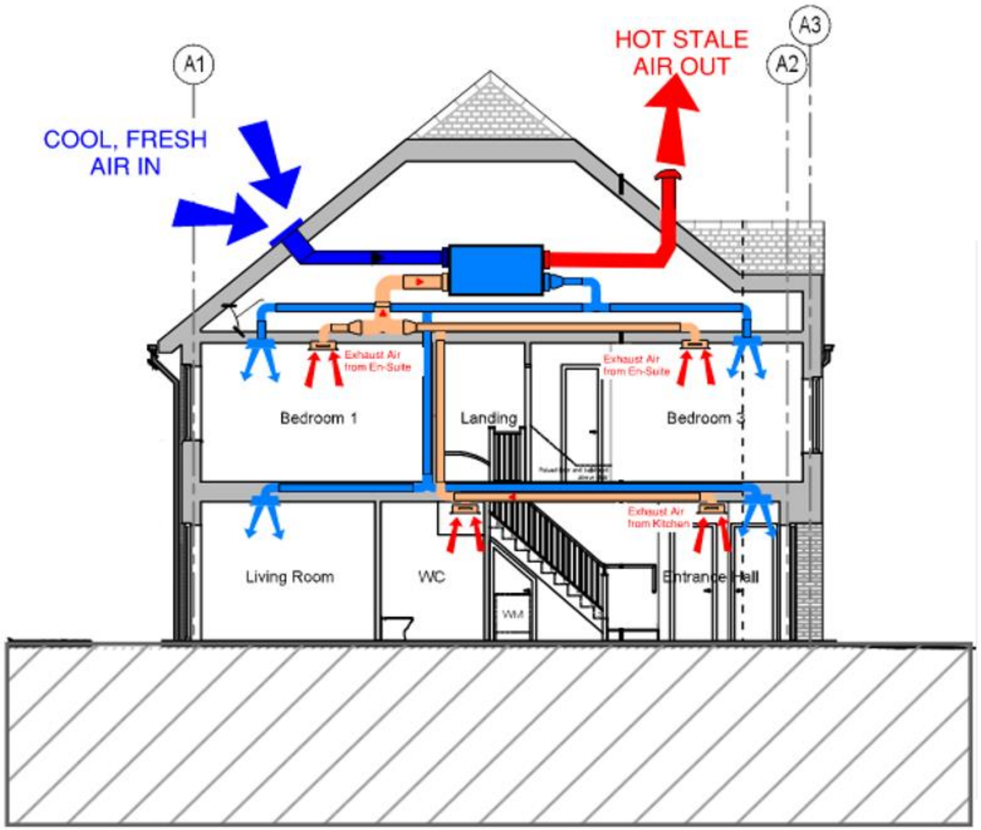


Figure 3.2: Image to show a standard whole house ventilation with a heat recovery ventilation unit.

3.1.5 Low Energy Lighting & Control

The energy required to illuminate the spaces of the development can be minimised by using low energy LED light fittings that minimise the energy and carbon emission used in artificial lighting. LED lighting use light emitting diodes to improve the lifecycle of lighting whilst also reducing operational energy usage. LED lighting can offer 30,000 hours of operation for modern LEDs which have been designed to operate at low temperatures and therefore reduce energy wasted through heat and the increase lifespan of the LED.

Lighting using LEDs typically enable lighting energy to be reduced by up to 90% when compared to traditional incandescent lamps. LED lamps require direct current DC voltage and as a result a conversion is needed between mains alternating current and DC required for the LED. This results in conversion losses. To account for the lighting required to illuminate the space and losses in AC DC conversion, lighting efficiency is expressed as a ratio of luminous efficacy.

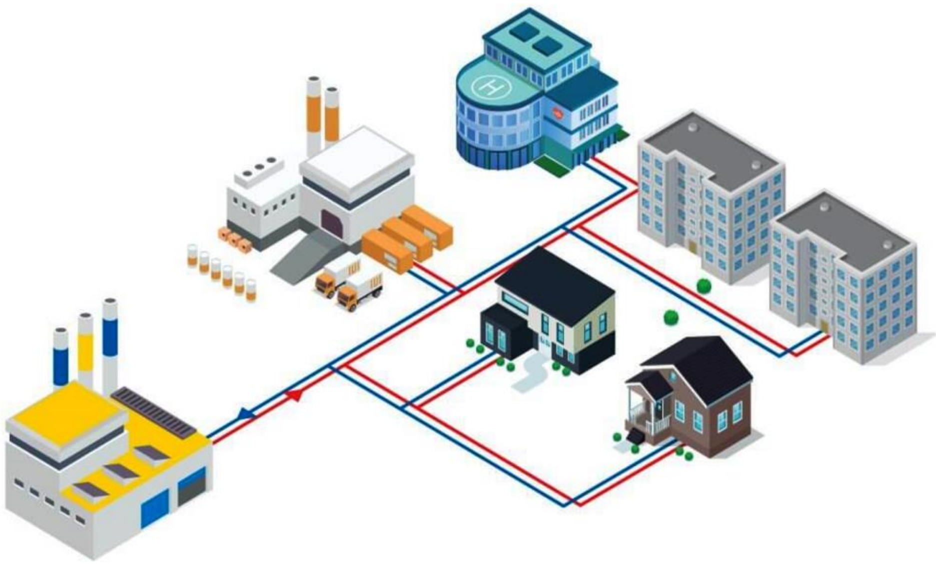
The luminous efficiency of lighting is a ratio of the luminous flux per electrical absorbed power, in which a higher number is more efficient i.e. an increased amount of visible light for a lower electrically absorbed input power. The LED lighting will be specified to be above a minimum 70 lm.W-1, this will ensure that where electricity is used for lighting system that more electricity is utilised for visible lighting and less is wasted in conversion from AC to DC and generated as heat in the light fitting.

	Limiting Lumens per Circuit Watt $Lm.W^{-1}$	Low Energy Design Value $Lm.W^{-1}$	Percentage Improvement %
Lighting Efficiency	95	110	16

Table 3.4 Table comparing the limiting lighting efficiency with the proposed Low Energy Design Value

4.0 Be Clean: Analysis of Decentralised Energy

Decentralising the energy supply to improve local air quality is important for high density developments, where the per flat or apartment application of renewable and LZC technology may have practical restrictions or offer poor lifecycle costs.
The annual carbon emissions are dependent on the energy sources of the district energy scheme and each development's annual carbon emissions calculations are required to determine whether decentralised energy or grid electricity would produce lower carbon emissions.



The proposed residential development's energy demand for heating and hot water services would have a year requirement. This consistent requirement for thermal energy could be supplied by a heat network, assuming the heat network uses heat generators which have low carbon emissions. Unfortunately, there are no regional heat networks close enough to the site location to be considered.

Historically, onsite CHPs could have been used to provide a site-specific network where a local heat network is unavailable.
However, the ongoing reduction in the electricity grid carbon factors combined with the high efficiency of heat pump systems has effectively ruled this option out and it would not be recommended for this site.

Avoiding CHP also has the benefit of reducing NOx emissions to help improve city centre air quality.

The low temperature ambient loop system proposed will achieve the benefits of utilising highly efficient decentralised plant without the disadvantages of CO_2 and NOx emissions.

5.0 Be Green: Analysis of Renewable Technology

5.1 Analysis of Available Renewable Technology

The available renewable technology which will be considered for Downings Gloucester (Phase II), Gloucester is detailed in the table below, along with potential benefits and any foreseeable issues. This table is provided to give a visual overview of the appropriate renewable technology and hence determine suitable renewable technology.

Technology Type	Description of Technology	Potential Benefits	Potential Issues	Valid for Application
PV Panels (Photovoltaic)	Photovoltaic solar arrays use solar radiation to create electricity, using a similar process to photosynthesis. Electrons are freed from atoms and the subsequent flow of electrons results in electric current.	Zero carbon emissions, 100% renewable technology Potential income via the SEG scheme Relatively maintenance free as no moving parts Visual impact can be low as can be placed out of sight. Noise free operation	Panels should face south and have sufficient angle to maximise capture Shadowing and detritus can lower performance over time Structure must be able to accommodate the weight of the panels. Roof access required for cleaning panels	Yes (Valid and recommended)
Wind Turbine Generation	Wind turbines installed on or around the building can generate renewable electricity. This process utilises the kinetic energy of the wind to drive electricity generating alternators.	Zero carbon emissions, 100% renewable technology Potential income via the SEG scheme	Visual impact potentially high due to ideal location of installation Potential planning issues Air turbulence generates a significant amount of noise May require an impact assessment for feasibility	No (Not valid for development)

Technology Type	Description of Technology	Potential Benefits	Potential Issues	Valid for Application
Solar Thermal **Solar water heating**	Solar thermal installations use solar radiation to heat water. Evacuated tubes are installed in an area of maximum solar radiation. The heat is then transferred to the water and the heated water is then used to supplement the hot water requirement of the building.	Zero carbon emissions, 100% renewable technology Relatively low maintenance as few moving parts Visual impact can be low as can be placed out of sight. Noise free operation	Tubes should face south and have sufficient angle to maximise capture Shadowing can affect energy generation performance The structure of the building must be able to accommodate the weight of the filled tubes. More benefit seen during the summer months	Yes (Valid but not recommended due to area required to achieve required carbon reduction)
Ambient Loop Air and Water Source Heat Pumps **(ASHP and WSHP)** **Hot Water Heating**	Air source heat pumps transfer low grade thermal energy in the atmosphere for use in heating spaces or water heating.	Efficient operation utilising the low-grade heat in the atmosphere. Proven and reliable technology	Potential for leak of refrigerant with high GWP relative to CO_2 Specialist maintained due to refrigerant handling laws External condenser fans create noise.	Yes (Valid and recommended)
Ambient Loop Air and Water Source Heat Pumps **(ASHP and WSHP)** **Space Heating**	Air source heat pumps transfer low grade thermal energy in the atmosphere for use in heating spaces or water heating.	Efficient operation utilising the low-grade heat in the atmosphere. Proven and reliable technology	Potential for leak of refrigerant with high GWP relative to CO_2 Specialist maintained due to refrigerant handling laws External condenser fans create noise.	Yes (Valid and recommended)

Technology Type	Description of Technology	Potential Benefits	Potential Issues	Valid for Application
Ground Source Heat Pump (GSHP) **Hot Water and Space Heating**	Ground source heat pumps use the Earth as a heat sink and transfer low grade thermal energy from the ground for use in the building. This energy can then be used for space heating/cooling or water heating.	Efficient operation utilising low grade heat in the ground Noise free operation	Not 100% renewable as electricity creates carbon emissions Ground survey required to determine feasibility of installation.	No (Not valid for this site)
(C)CHP **(Cogeneration)**	A cogeneration plant is a combustion engine using natural gas or biogas fuel to drive an alternator which produces electricity. The combustion process is cooled using water as a refrigerant. Trigeneration, or combined cooling, heat and power (CCHP), is the process by which waste heat produced by the cogeneration plant is used to generate chilled water for air conditioning or refrigeration, using an absorption chiller to provide this functionality.	Efficient generation of energy, minimising losses. Potential income via the SEG scheme	Need to have sufficient, constant heat, cooling and electrical load Needs to operate for a majority percentage of the year	Yes (Valid but not recommended due to lack of local network, NOx emissions and effect on air quality)

Table 5.1 Detailing the Low and Zero carbon technology options available for the proposed development

5.2 Ambient Loop Heating and Hot water system

The application of space heating air source heat pumps will allow space heating system to have efficiencies of around 400%, meaning that for every kWh of electricity used, 4 kWh of heat energy will be transferred from the external atmosphere into the building for use as space heating.

For this development a specialist innovative design is proposed, which uses external and internal heat pumps working in tandem to provide heat for space heating and hot water service from the external atmosphere to the majority of flats.

The Heritage block will have 2 external ASHPs on the roof and the Tower Building will have 3 external ASHPs. These external air source heat pumps heat an ambient water loop circa 20-25°C and circulates this around the building, thereby minimising heat losses and the risk of overheating the building.

Each flat connected to the ambient loop system will have its own internal water to water heat pump. These internal heat pumps then make use of the ambient loop as a heat sink and utilize this to provide space heating and hot water services.

	Limiting COP	Low Energy Coefficient of Performance	Percentage Improvement %
Ambient Loop System	2.50	3.53	41

Table 5.2: Table comparing the limiting heat pump Coefficient of Performance (COP) with the Low Energy Design Value

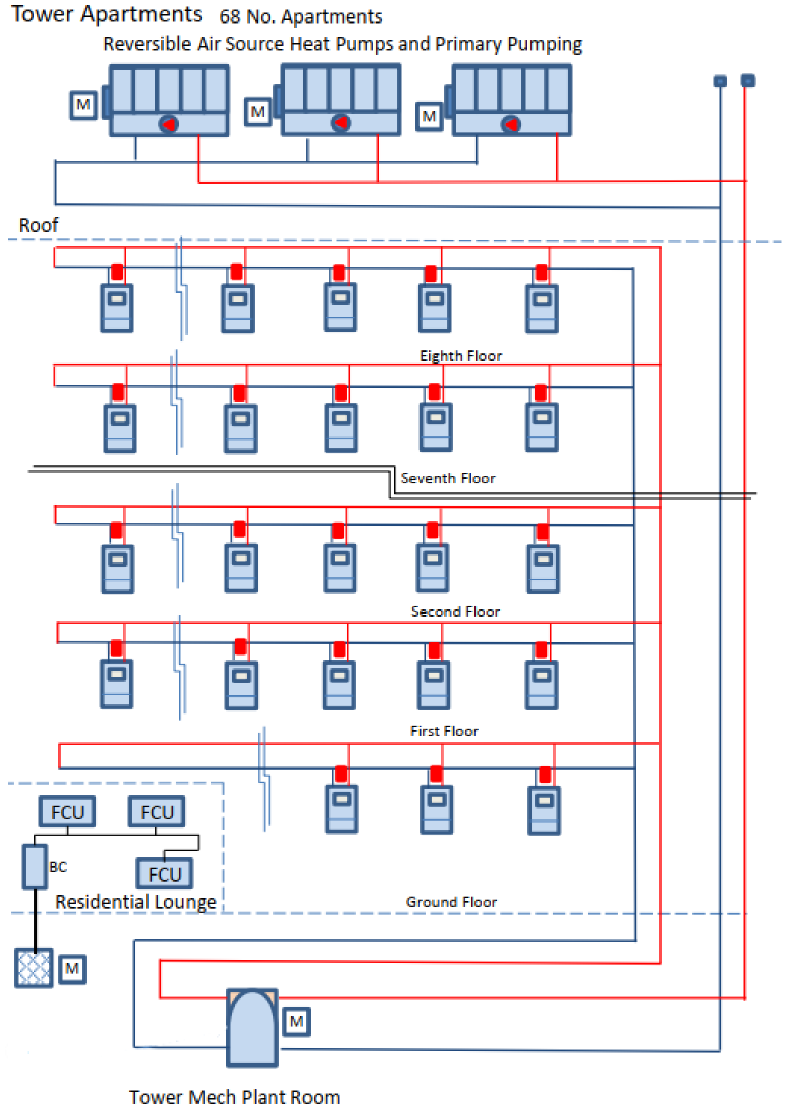


Figure 5.1: showing the Ambient Loop System to Tower Block flats. (Heritage Block flats have a similar ambient loop system, with exception of studios)

6.0 Carbon Emissions Reductions Energy

6.1 Low Energy Building Design and Energy Hierarchy

The Low Energy Building Design building and services design process uses the design principles outlined in Section 1.1 to ensure the energy use of the proposed development is as low as possible and that where energy is used, as little as possible is wasted.

The design concepts used in the Low Energy Building Design has taken elements of the Passivhaus fabric first approach to the building design process. This approach significantly lowers the energy demand before the building services are considered in the design process by applying passive zero energy usage measures.

Once the energy use of the building is sufficiently minimised, low energy building services and LZC technology are then utilised in the design. This ensures the carbon targets can be met and that energy needed to provide services and control the building internal environment is minimised.

The energy strategy has shown passive and active carbon reduction measures as part of the low energy building design. The carbon reductions for these measures will now be illustrated using the Energy Hierarchy. The energy hierarchy has been developed by the GLA for The London Plan and helps illustrate carbon reductions throughout each step of the low energy building design process.

The sustainability principles outlined in Section 1.1 are used to drive the low energy design philosophy. The energy hierarchy is used to present and visualise carbon reductions. This is a carbon reduction methodology consisting of three main stages: Be Lean, Be Clean, Be Green which highlight carbon emissions from passive measures through to LZC technology.

Be Lean

The first stage in the energy hierarchy is 'Be Lean' which includes demand reduction measures designed to reduce energy usage passively.

Be Clean

The second stage in the energy hierarchy is 'Be Clean' assessment of clean energy sources district heating and CHP.

Be Green

The third and final stage is the application of renewable energy technologies.

6.2 Establishing Baseline Emissions

The baseline carbon emissions are determined by assessing the proposed development against the building regulations Part L compliance software. The regulated carbon emissions for this project have been calculated using Part L compliance software FSAP produced by Stroma. This uses the CIBSE method for calculating heat losses and is predominantly a building comparison tool. The building fabric efficiency is combined with the building services to calculate the energy usage with typical occupancy and normalised heat loss taking the monthly average external temperature for the monthly heat loss.

This software uses the design information for the proposed development to create a notional 'target building' development. The carbon emissions for the notional building are then compared with the actual building's carbon emissions. Accordingly, a compliant development is then deemed to be one which the actual emissions DER is less than or equal to the notional 'target building' carbon emissions TER.

The notional building uses standard building fabric and typical efficiency building services as detailed in the domestic building services compliance guide and further details in the national calculation methodology Standard Assessment Procedure (SAP) Manual.

The regulated carbon emissions are calculated for Part L compliance while unregulated carbon emissions for small power items like laptops, televisions and chargers are not currently assessed for Part L building regulations compliance.

The baseline carbon emissions are qualified by multiplying the TER generated using Part L compliance software and the floor area of the development. The TER has been calculated using a notional baseline development which includes heating provided by gas boilers. This will provide the baseline metric, for which all additional carbon emissions reductions are calculated against.

The proposed baseline carbon emissions

The baseline carbon emission are 104.9 tonnes per annum

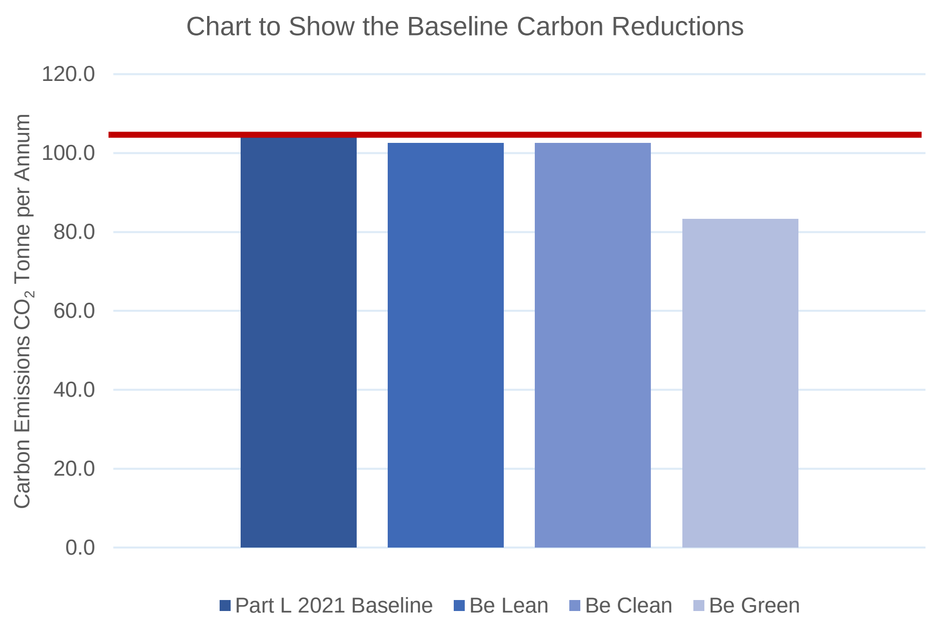


Chart 6.1: A chart to show the baseline carbon emissions of the proposed development

The red line shows the baseline building carbon emissions TER

6.3 Be Lean

The carbon emissions baseline has been calculated as detailed in Section 6.2. The Demand reduction phase of the energy hierarchy now uses the measures discussed in Section 3.0 to illustrate the passive measures which have enabled the development to reduce operational energy usage and reduce carbon emissions.

The passive measures used in the proposed development are designed to reduce energy demand without using fuel in the process. Passive measures are applied before building services or low and zero carbon technology or renewable energy are applied.

This includes passive architectural design measures such as low u-value external element building fabric and low air permeability to reduce air ingress. Thermal bridging using accredits construction details also enable the heat loss of the buildings to be minimised passively. Passive heat recovery ventilation can keep heat in the building by recovering heat from the external air using a heat exchanger. This heat can then be transferred to the incoming air without mixing of air streams or increase in energy usage of the building.

Low energy LED lighting can reduce energy usage and lighting controls can further reduce energy wastage by only utilising energy for the lighting services when they are needed.

The Passive Measures included in the development design are summarised below

- Low external envelope U-values
- Low air permeability
- Low energy LED lighting with lighting controls
- Mechanical ventilation with passive heat recovery (MVHR)

The carbon reductions due to the Be Lean measures

The Be Lean measures achieve a carbon reduction of 2.3 %

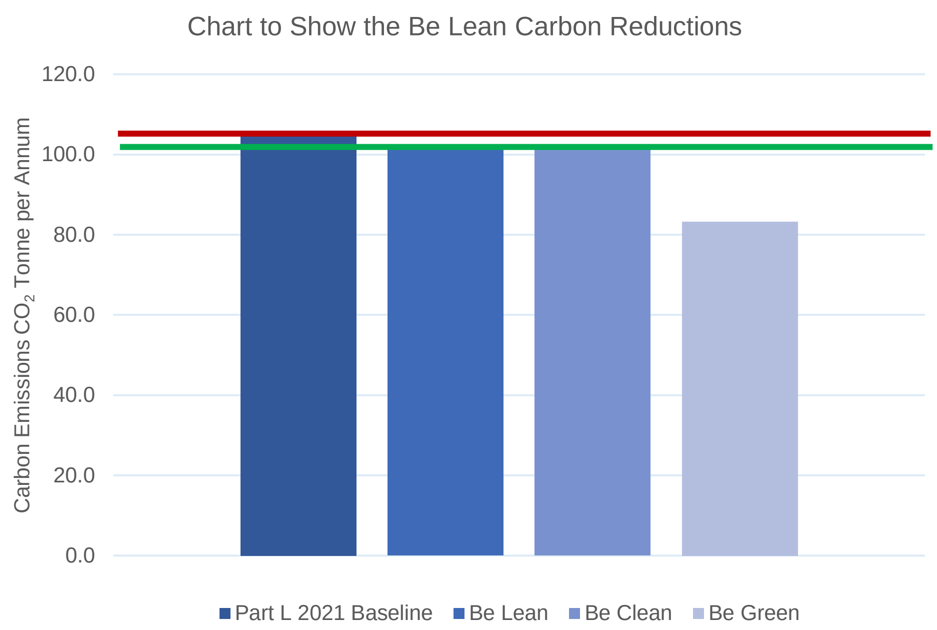


Chart 6.2: A chart to show the Be Lean carbon emissions reductions of the proposed development

The red line shows the baseline building carbon emissions TER

The green line shows the actual building carbon emissions BER

6.4 Be Clean

The analysis presented in Section 4.0 detailed the availability of heat networks which are currently in the vicinity of the proposed Downings Gloucester (Phase II) development.

The feasibility of utilising CHP for providing the heating and hot water services in the proposed development has been assessed at part of the preliminary building services design.
CHP can facilitate energy and cost saving by generating heat and power on site in one simultaneous process. The development could have a sufficient simultaneous demand for both heating for hot water services (HWS) and electricity demand of electrical baseload.

However, UK Electricity Grid decarbonisation is reducing the carbon emissions which previously would be gained from applying CHP as LZC technology.

Utilising on site CHP for reducing carbon emissions was not deemed to be the most appropriate method of meeting the carbon reduction targets, due minimal carbon reductions and the adverse effect on NOx emissions and hence air quality in the area.

The application of a district heating network will have no effect on local air quality and if the development could connect to an existing local network, it is feasible that heat could be provided by a district heat network. However, the development is not situated close enough to an existing heat network which would make connection unfeasible.

The carbon reductions are therefore constant between the Be Lean and Be Clean stages of the energy hierarchy and the Energy Strategy will focus on on-site renewable energy generation to facilitate further carbon reductions for the proposed development.

The carbon reductions due to the Be Clean measures

The Be Clean carbon emissions are constant at 2.3% reduction

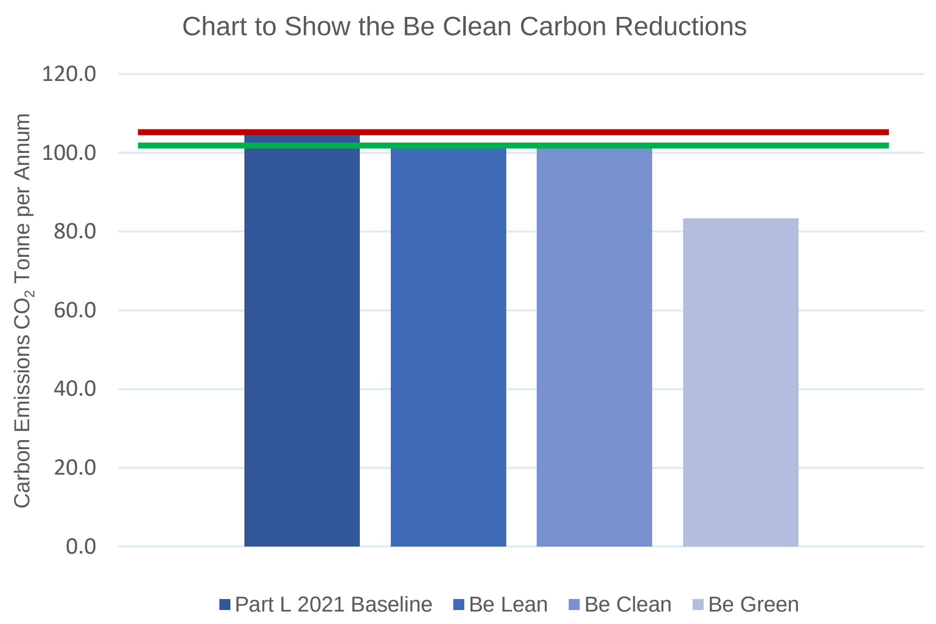


Chart 6.3: A chart to show the Be Clean carbon emissions reductions of the proposed development

The red line shows the baseline building carbon emissions TER

The green line shows the actual building carbon emissions BER

6.5 Be Green

The final stage of the energy hierarchy utilises renewable technology to further lower the carbon emissions of the development. Given that the measures in the Be Clean stage are unfeasible or would have an adverse effect on the air quality in the area, the carbon emissions reductions have been achieved using measures detailed as part of the Be Green stage of the energy hierarchy.

The application of space heating air and water source heat pumps will allow space heating system to have efficiencies of around 400%, meaning that for every kWh of electricity used, 4 kWh of heat energy will be transferred from the external atmosphere into the building for use as space heating.

For this development a specialist innovative design is proposed, which uses external and internal heat pumps working in tandem to provide heat for space heating and hot water service from the external atmosphere to the majority of flats.
The Heritage block will have 2 external ASHPs on the roof and the Tower Building will have 3 external ASHPs. These external air source heat pumps heat an ambient water loop circa 20-25°C and circulates this around the building, thereby minimising heat losses and the risk of overheating the building.
Each flat connected to the ambient loop system will have its own internal water to water heat pump. These internal heat pumps then make use of the ambient loop as a heat sink and utilize this to provide space heating and hot water services.

The energy mix of the electricity grid is currently supplied by zero carbon sources which make up over 50% of annual electricity generation. Over the lifecycle of the building carbon emissions are expected to be reduced further than detailed in this Energy Strategy as the electricity grid continues to be decarbonised towards the target of a zero-carbon electricity grid in 2035.

Be Green Measures

- Ambient loop heat pump system providing space heating
- Ambient loop heat pump system providing hot water services

The Be Green stage of the Energy Hierarchy enables the development to meet the carbon reduction targets and as such provides a low carbon development.

The carbon reductions due to the Be Green measures

The Be Green measures achieve a carbon reduction of 20.6%

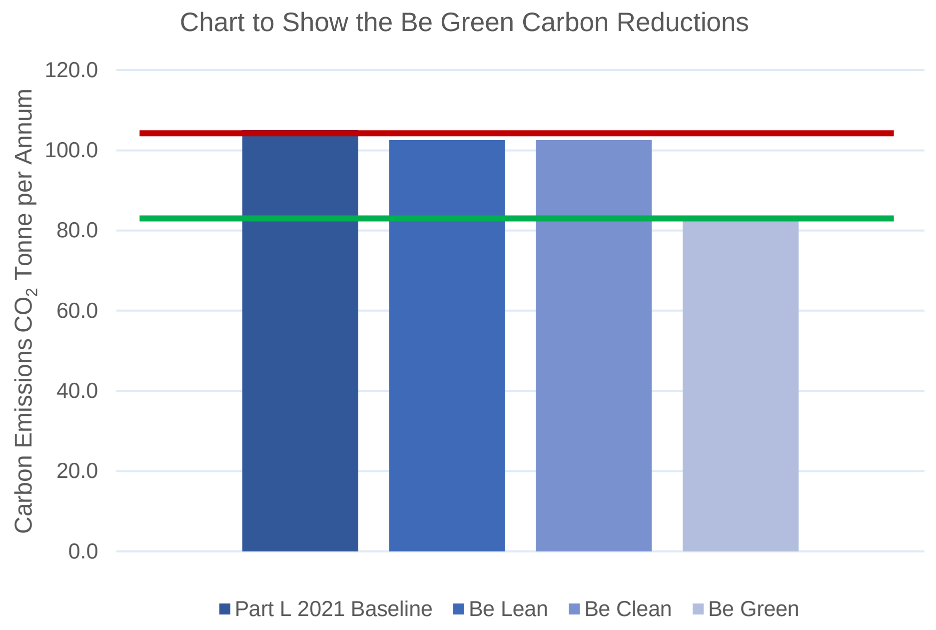


Chart 6.4: A chart to show the Be Green carbon emissions reductions of the proposed development

The red line shows the baseline building carbon emissions TER

The green line shows the actual building carbon emissions BER

6.6 Overall Carbon Reductions

Carbon Dioxide Emissions Per Annum Regulated & Unregulated

	Regulated CO_2 Tonnes per annum	Unregulated CO_2 Tonnes per annum
Baseline Part L (2021)	104.9	16.5
Including Be Lean Measures	102.5	16.5
Including Be Clean Measures	102.5	16.5
Including Be Green Measures	83.3	16.5

Table 6.1 to show the carbon emissions of the proposed development

Regulated Carbon Dioxide Savings Per Annum at Each Stage of the Energy Hierarchy

	Tonnes CO_2 per annum	Percentage Reduction %
Savings from Be Lean Measures	2.4	2.3
Savings from Be Clean Measures	0.0	0.0
Savings from Be Green Measures	19.2	18.7
Reduction Compared to Baseline	21.6	20.6

Table 6.2 to show the carbon emission reductions of the proposed development

7.0 Carbon Rating

This report uses the SAP 2012 Part L compliance software to calculate the predicted energy consumption for every property on this site.

The calculations take account of the 16no direct electrically heated studio flats, and the 96 units served by the ambient loop system, to allow calculation of their relative CO_2 emissions and assess the project's Part L Compliance as a Block. Of these, 8 Studios have a slightly excessive DER, though the block assessment proves the project achieve an overall reduction in CO_2 emissions of 21% below Part L requirements.

The software can then take the data from these calculations to produce the predicted Energy Performance Certificate (EPC), which will be required on completion for each property.

The SAP methodology assesses the energy consumption of each property against any 'on site' energy generation from renewable sources. The SAP rating scale runs between 1 and 100, representing an EPC rating of 'G' to 'A'.

When an 'A' rated property achieves a score of 100 or above this is regarded as Net Zero Carbon, as it has a neutral energy demand or fully offsets its demand using onsite renewable energy generation.

These SAP calculations confirm that the new build properties at Downings Gloucester (Phase II) could all achieve a 'B' EPC rating.

The calculation outputs of the Baseline SAP, Be Green SAP and EPCs for a sample of the flats shown are included in the Appendices and summarised in the adjacent table.

	DER	TER	EPC rating	SAP Score
Flat H006	13.21	28.48	B	84
Flat H213	11.31	23.51	B	86
Flat H301	15.01	29.16	B	82
Flat H104 (Studio)	36.65	36.45	B	84
Flat H307	11.76	23.88	B	85
Flat N001	13.21	28.27	B	84
Flat N004	9.94	20.52	B	86
Flat N206	10.88	24.34	B	85
Flat N707	10.41	21.22	B	86
Flat N804	10.67	19.83	B	86

Figure 7.1 to show the predicted EPC results for sample flats in the new build development

8.0 Conclusion

The proposed residential building development at Downings Gloucester (Phase II) has followed the GLA's London Plan method Be Lean, Be Clean, Be Green energy hierarchy to qualify the carbon emissions reduction targets have been met. This process has involved calculation of carbon emissions at each stage of the hierarchy using Part L compliance software FSAP.

This Energy Strategy proposes an all-electric building services strategy due to the adverse effect on local air quality proposed by decentralised or on-site combustion building services. This will ensure lower carbon emission at present and in addition, increasingly reduced carbon emissions as the electricity grid decarbonises.

The first stage Be Lean of the energy hierarchy incorporates the below measures

- Low external element U-values
- Low air permeability
- Low energy LED lighting with lighting controls
- Mechanical ventilation with passive heat recovery (MVHR)

The Be Lean measures facilitate a carbon reduction of 2.3%

The Be Clean second stage is detailed in Section 6.4.

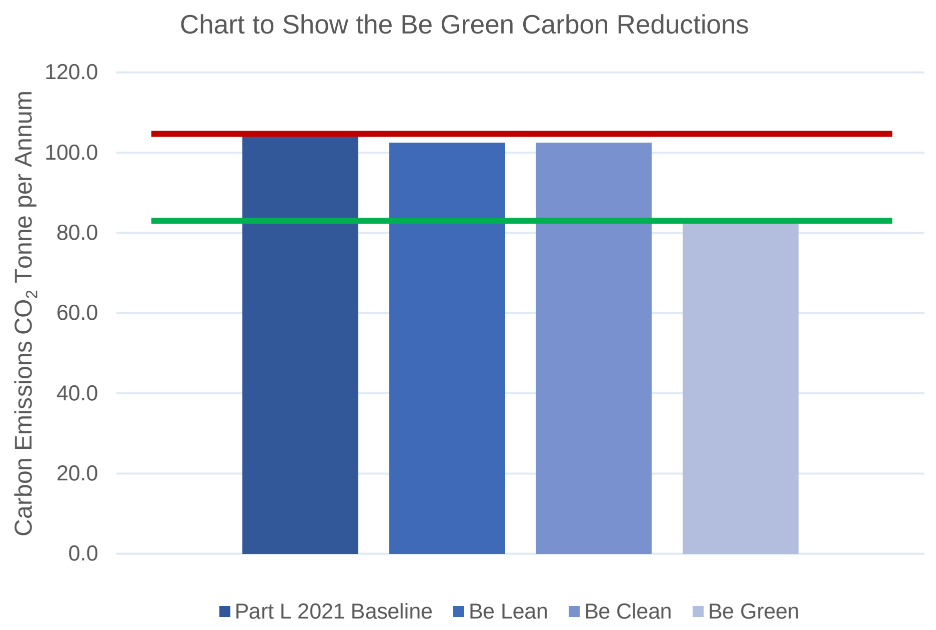
Third stage Be Green of the energy hierarchy includes

- Ambient loop heat pump system providing space heating
- Ambient loop heat pump system providing hot water services

The Be Green measures facilitate a carbon reduction of 21%

Accordingly, this Energy Strategy confirms that the overall development's carbon emissions will be reduced 21% below the Part L 2021 baseline.

The energy hierarchy carbon reduction methodology has minimised energy usage and carbon emissions of the Residential New Build works at Downings Gloucester (Phase II) hoito provide sustainable low energy buildings.



Appendices

Appendix 1 - Sample Part L SAP Calculations Baseline/Be Lean

Appendix 2 - Sample Part L SAP Calculations Be Green

Appendix 3 - GLA Carbon Emissions Reporting Spreadsheet

Appendix 4 - Sample Predicted EPCs

Appendix 1 - Sample Part L SAP Calculations Baseline / Be Lean

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:45:47

Project Information:

Assessed By: ()   **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE   Total Floor Area: 45.63m²

Site Reference : The Downings   **Plot Reference:** Type H5a - 1x (H006)

Address : Flat H006 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	19.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.57 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas	
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**
9 Summertime temperature		
Overheating risk (Severn valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North	2.52m²	
Ventilation rate:	2.00	
Blinds/curtains:	None	
10 Key features		
Air permeablility	3.0 m³/m²h	
Party Walls U-value	0 W/m²K	
Floors U-value	0.1 W/m²K	
Community heating, heat from boilers – mains gas		

Regulations Compliance Report

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Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 71.74m²

Site Reference : The Downings **Plot Reference:** Type H11a - 2x (H113 213)

Address : Flat H113 213 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	16.26 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.80 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Severn valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	5.04m²	
Windows facing: East	1.26m²	
Windows facing: West	2.52m²	
Ventilation rate:	3.00	
Blinds/curtains:	None	

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

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Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 66.37m²

Site Reference : The Downings **Plot Reference:** Type H13c - 1x (H301)

Address : Flat H301 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	19.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**Fail**

Excess emissions = 1.88 kg/m² (9.5 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	55.7 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	**OK**
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

Regulations Compliance Report

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs		OK
Hot water controls:	Cylinderstat		OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Severn valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: East	3.78m²
Windows facing: South	2.52m²
Windows facing: West	3.78m²
Windows facing: West	4.4m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Roofs U-value	0.1 W/m²K
Party Walls U-value	0 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

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Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 26.18m²

Site Reference : The Downings **Plot Reference:** Type H15a - 1x (H104) Studio

Address : Flat H104 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	25.33 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.45 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas	
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Severn valley):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	1.26m²
Ventilation rate:	2.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

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Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 91.04m²

Site Reference : The Downings

Plot Reference: Type H19 - 1x (H307)

Address : Flat H307 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	16.36 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.73 kg/m²	Fail

Excess emissions = 0.37 kg/m² (2.3 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	46.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	43.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

Regulations Compliance Report

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Severn valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: South	3.78m²
Roof windows facing: North	3.78m²
Roof windows facing: North	5.35m²
Ventilation rate:	2.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Roofs U-value	0.1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

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Printed on 26 April 2022 at 11:45:47

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 44.1m²

Site Reference : The Downings **Plot Reference:** Type N1a - 1x (N001)

Address : Flat N001 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	20.53 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.72 kg/m²	**Fail**

Excess emissions = 1.19 kg/m² (5.8 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	49.8 kWh/m²	
		Fail

Excess energy = 1.75 kg/m² (03.6 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.35 kWh/day
Permitted by DBSCG: 2.10 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	Yes		OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	OK
MVHR efficiency:	90%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Severn valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: North	5.4m²
Windows facing: East	8.1m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:45:47

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 69.6m²

Site Reference : The Downings **Plot Reference:** Type N4a - 1x (N004)

Address : Flat N004 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	15.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.39 kg/m²	Fail

Excess emissions = 1.35 kg/m² (9 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.1 kWh/m²	
		Fail

Excess energy = 3.65 kg/m² (10.9 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.35 kWh/day
Permitted by DBSCG: 2.10 kWh/day OK

Regulations Compliance Report

Primary pipework insulated:	Yes		**OK**

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Severn valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	7.2m²	
Windows facing: South West	10.7m²	
Ventilation rate:	3.00	
Blinds/curtains:	None	

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:45:47

Project Information:

Assessed By:	()	**Building Type:**	Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 48.8m^2	
Site Reference :	The Downings	**Plot Reference:**	Type N8a - 1x (N206)
Address :	Flat N206 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ		

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	17.81 kg/m^2	
Dwelling Carbon Dioxide Emission Rate (DER)	18.16 kg/m^2	**Fail**

Excess emissions = 0.35 kg/m^2 (2 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	36.2 kWh/m^2	
Dwelling Fabric Energy Efficiency (DFEE)	37.9 kWh/m^2	
		Fail

Excess energy = 1.68 kg/m^2 (04.6 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Community heating schemes - mains gas
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	Yes		OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs		OK
Hot water controls:	Cylinderstat		OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	OK
MVHR efficiency:	90%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Severn valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: South West	5.7m²
Windows facing: West	2.2m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:45:47

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 71.8m²

Site Reference : The Downings **Plot Reference:** Type N9b - 5x (N307 to 707)

Address : Flats N307 to 707 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	15.08 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.29 kg/m²	**Fail**

Excess emissions = 0.21 kg/m² (1.4 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.7 kWh/m²	
		Fail

Excess energy = 0.10 kg/m² (00.3 %)

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	Yes		OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Severn valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: North	11.4m²
Windows facing: South West	5.7m²
Windows facing: West	3.8m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Community heating, heat from boilers – mains gas	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:45:46

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 124m²

Site Reference : The Downings

Plot Reference: Type N14 - 1x (N804)

Address : Flat N804 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)	14.33 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.05 kg/m²	**Fail**

Excess emissions = 1.72 kg/m² (12 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	45.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	45.9 kWh/m²	
		Fail

Excess energy = 0.76 kg/m² (01.7 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	**OK**
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	Yes		OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.77	
Maximum	1.5	OK
MVHR efficiency:	87%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Severn valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South	7.2m²
Windows facing: South West	10.7m²
Windows facing: South East	4.5m²
Windows facing: South	7.5m²
Windows facing: South West	7.6m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Roofs U-value	0.1 W/m²K
Party Walls U-value	0 W/m²K

Community heating, heat from boilers – mains gas

Appendix 2 – Sample Part L SAP Calculations Be Green

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:18

Project Information:

Assessed By:	()	**Building Type:**	Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 45.63m²	
Site Reference :	The Downings	**Plot Reference:**	Type H5a - 1x (H006)
Address :	Flat H006 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ		

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	28.48 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.21 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**
9 Summertime temperature		
Overheating risk (Severn valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North	2.52m²	
Ventilation rate:	2.00	
Blinds/curtains:	None	
10 Key features		
Air permeablility	3.0 m³/m²h	
Party Walls U-value	0 W/m²K	
Floors U-value	0.1 W/m²K	
Community heating, heat from electric heat pump		

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:18

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 71.74m²

Site Reference : The Downings

Plot Reference: Type H11a - 2x (H113 213)

Address : Flat H113 213 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	23.51 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.31 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Severn valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South	5.04m²
Windows facing: East	1.26m²
Windows facing: West	2.52m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Community heating, heat from electric heat pump	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:18

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 66.37m²

Site Reference : The Downings **Plot Reference:** Type H13c - 1x (H301)

Address : Flat H301 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.01 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	55.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Severn valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	3.78m²
Windows facing: South	2.52m²
Windows facing: West	3.78m²
Windows facing: West	4.4m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Roofs U-value	0.1 W/m²K
Party Walls U-value	0 W/m²K
Community heating, heat from electric heat pump	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:18

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 26.18m²

Site Reference : The Downings **Plot Reference:** Type H15a - 1x (H104) Studio

Address : Flat H104 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity		
Fuel factor: 1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	36.45 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	36.65 kg/m²	**Fail**
Excess emissions = 0.2 kg/m² (0.5 %)		

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	37.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Room heaters - electric
Efficiency 100.0

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework		

6 Controls

Space heating controls	Programmer and appliance thermostats	OK
Hot water controls:	Cylinderstat	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	OK
MVHR efficiency:	90%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Severn valley):	Medium	OK

Based on:

Overshading:	Average or unknown
Windows facing: North	1.26m²
Ventilation rate:	2.00
Blinds/curtains:	None

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:18

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.04m²

Site Reference : The Downings **Plot Reference:** Type H19 - 1x (H307)

Address : Flat H307 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.76 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	46.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	43.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Severn valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.78m²	
Roof windows facing: North	3.78m²	
Roof windows facing: North	5.35m²	
Ventilation rate:	2.00	
Blinds/curtains:	None	

10 Key features

Air permeablility	3.0 m³/m²h
Roofs U-value	0.1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from electric heat pump	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:17

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 44.1m²

Site Reference : The Downings **Plot Reference:** Type N1a - 1x (N001)

Address : Flat N001 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	28.27 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.21 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

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Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Severn valley):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	5.4m²
Windows facing: East	8.1m²
Ventilation rate:	3.00
Blinds/curtains:	None

10 Key features

Thermal bridging	0.038 W/m²K
Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from electric heat pump	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:17

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 69.6m²

Site Reference : The Downings **Plot Reference:** Type N4a - 1x (N004)

Address : Flat N004 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	20.52 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.94 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	29.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	27.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Severn valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	7.2m²	
Windows facing: South West	10.7m²	
Ventilation rate:	3.00	
Blinds/curtains:	None	

10 Key features	
Thermal bridging	0.005 W/m²K
Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from electric heat pump	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:17

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 48.8m²

Site Reference : The Downings **Plot Reference:** Type N8a - 1x (N206)

Address : Flat N206 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	24.34 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.88 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	26.9 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

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2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.52	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Severn valley):	Medium	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	5.7m²	
Windows facing: West	2.2m²	
Ventilation rate:	3.00	
Blinds/curtains:	None	

10 Key features	
Thermal bridging	0.013 W/m²K
Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Floors U-value	0.1 W/m²K
Community heating, heat from electric heat pump	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:17

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 71.8m²

Site Reference : The Downings

Plot Reference: Type N9b - 5x (N307 to 707)

Address : Flats N307 to 707 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	21.22 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.41 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.59	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature		
Overheating risk (Severn valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North	11.4m²	
Windows facing: South West	5.7m²	
Windows facing: West	3.8m²	
Ventilation rate:	3.00	
Blinds/curtains:	None	

10 Key features	
Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Community heating, heat from electric heat pump	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 26 April 2022 at 11:42:17

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: $124m^2$

Site Reference : The Downings **Plot Reference:** Type N14 - 1x (N804)

Address : Flat N804 - The Downings, Bakers Quay, Merchants' Road, Gloucester, GL2 5QZ

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	19.83 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.67 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	41.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump
Secondary heating system:	None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 2.10 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Flat rate charging, programmer and TRVs	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.77	
Maximum	1.5	**OK**
MVHR efficiency:	87%	
Minimum	70%	**OK**

9 Summertime temperature		
Overheating risk (Severn valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	7.2m²	
Windows facing: South West	10.7m²	
Windows facing: South East	4.5m²	
Windows facing: South	7.5m²	
Windows facing: South West	7.6m²	
Ventilation rate:	3.00	
Blinds/curtains:	None	

10 Key features	
Air permeablility	3.0 m³/m²h
Roofs U-value	0.1 W/m²K
Party Walls U-value	0 W/m²K
Community heating, heat from electric heat pump	

Appendix 3 GLA Emissions Reporting Spreadsheet

SAP 2012 Performance

Domestic

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	104.9	
After energy demand reduction (be lean)	102.5	
After heat network connection (be clean)	102.5	
After renewable energy (be green)	83.3	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	2.3	2%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	19.3	18%
Cumulative on site savings	**21.6**	**21%**

SAP 10.0 Performance

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	91.5	
After energy demand reduction (be lean)	87.6	
After heat network connection (be clean)	87.6	
After renewable energy (be green)	37.4	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: Savings from energy demand reduction	3.9	4%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	50.2	55%
Cumulative on site savings	**54.1**	**59%**

Appendix 4 Sample Predicted EPCs

Predicted Energy Assessment

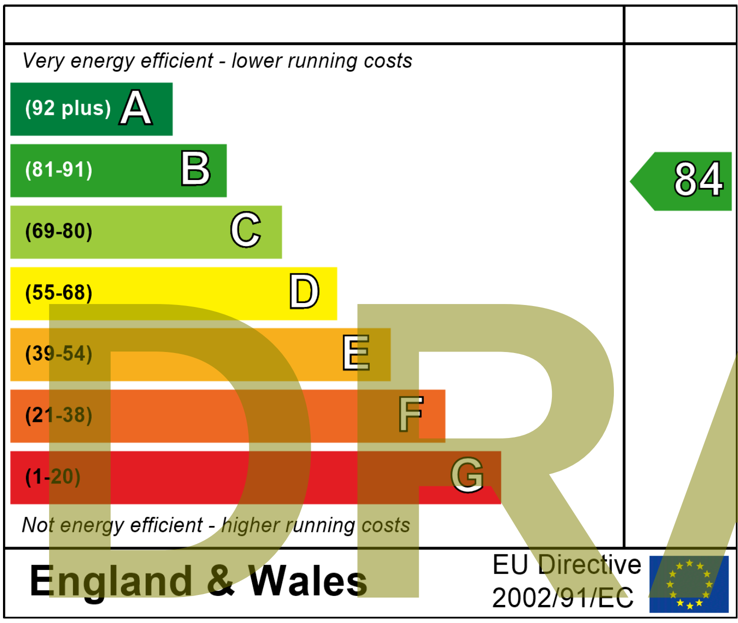
Flat H006 - The Downings
Bakers Quay
Merchants' Road
Gloucester
GL2 5QZ

Dwelling type: Ground floor Flat
Date of assessment: 23 February 2022
Produced by: Stroma Certification
Total floor area: 45.63 m²

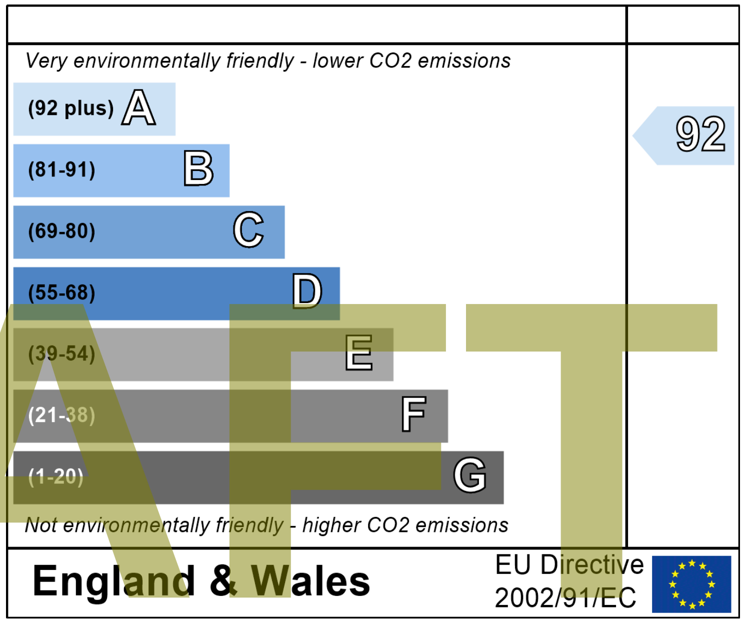
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment

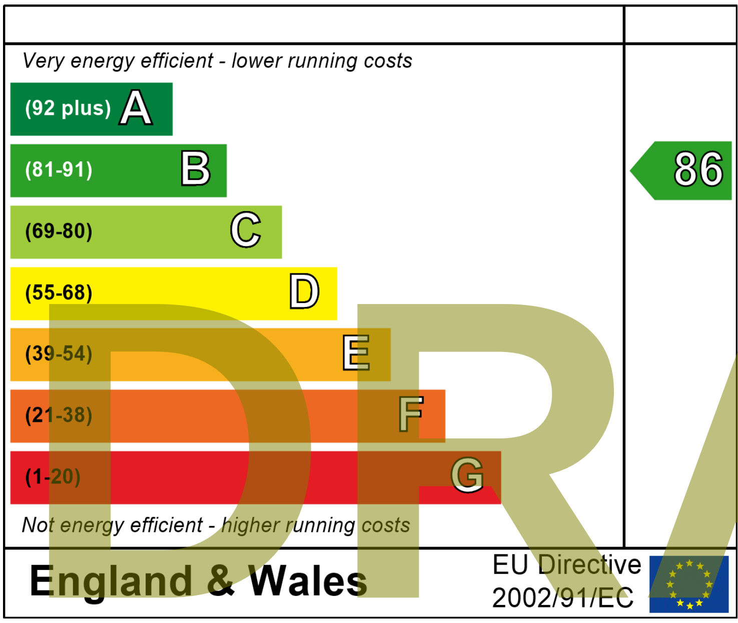
Flat H113 213 - The Downings
Bakers Quay
Merchants' Road
Gloucester
GL2 5QZ

Dwelling type:	Mid floor Flat
Date of assessment:	23 February 2022
Produced by:	Stroma Certification
Total floor area:	71.74 m²

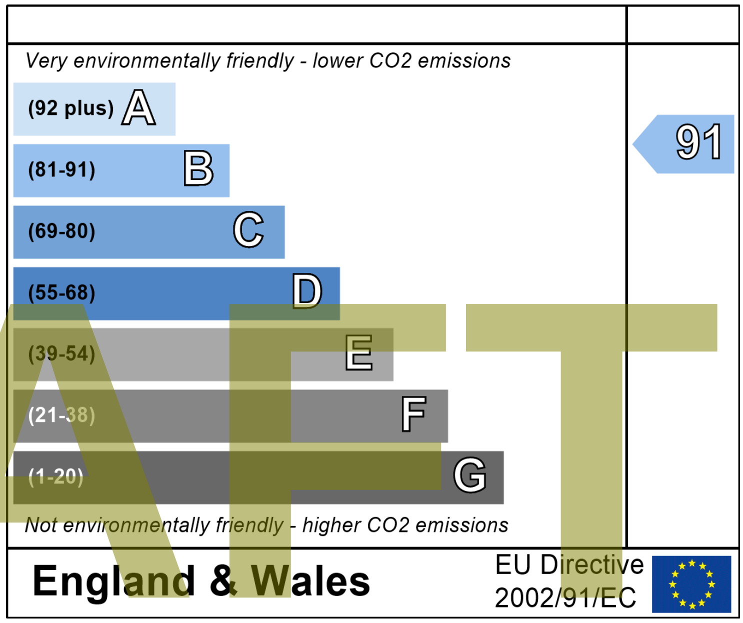
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

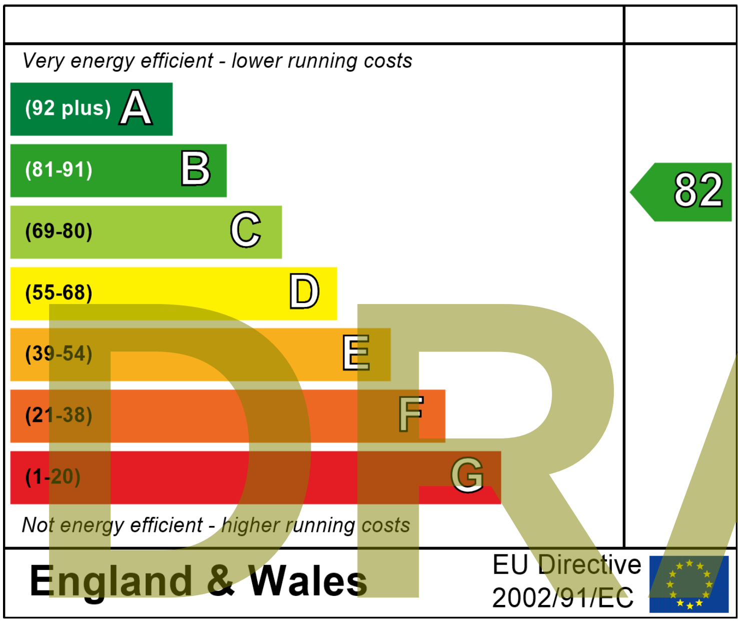
Predicted Energy Assessment

Flat H301 - The Downings Bakers Quay Merchants' Road Gloucester GL2 5QZ	Dwelling type: Date of assessment: Produced by: Total floor area:	Top floor Flat 23 February 2022 Stroma Certification 66.37 m²

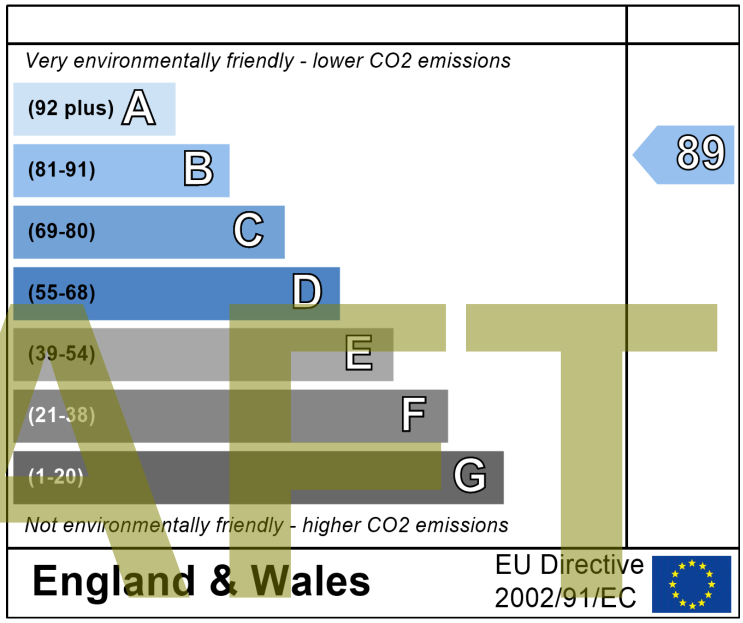
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

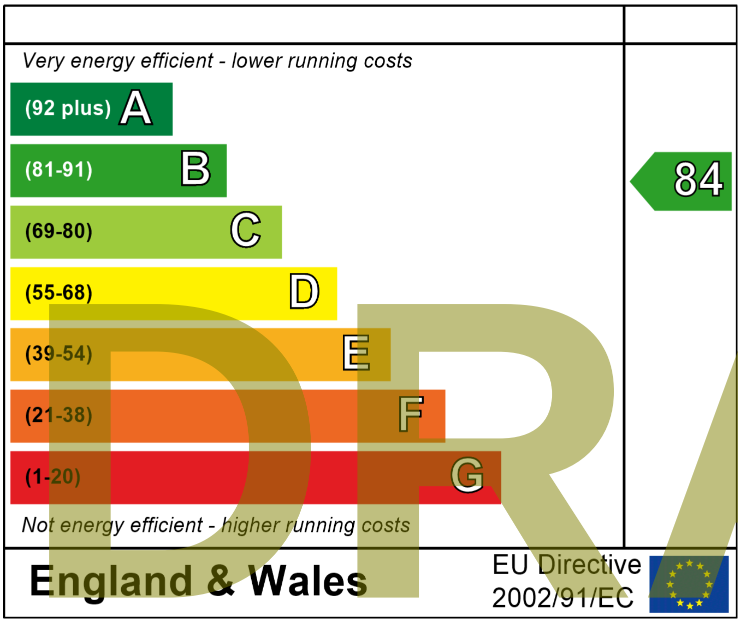
Predicted Energy Assessment

Flat H104 - The Downings		Dwelling type:	Mid floor Flat
Bakers Quay		Date of assessment:	23 February 2022
Merchants' Road		Produced by:	Stroma Certification
Gloucester		Total floor area:	26.18 m²
GL2 5QZ			

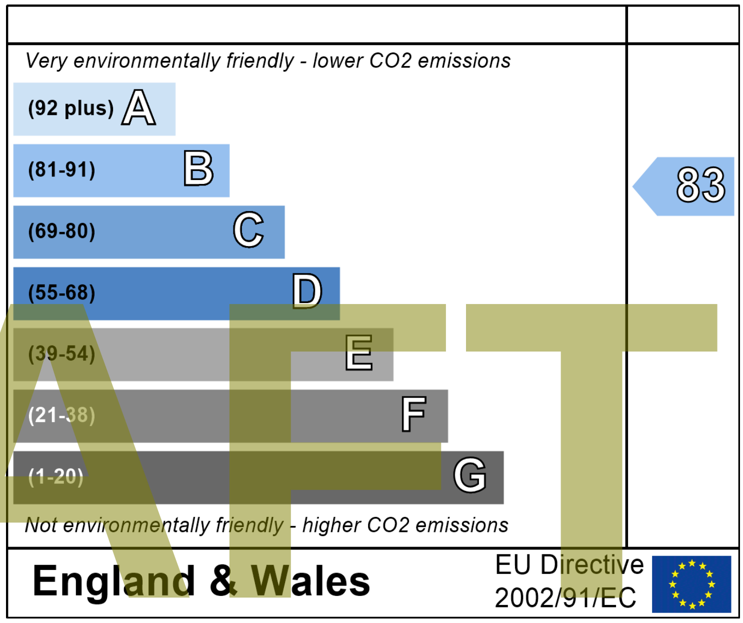
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment

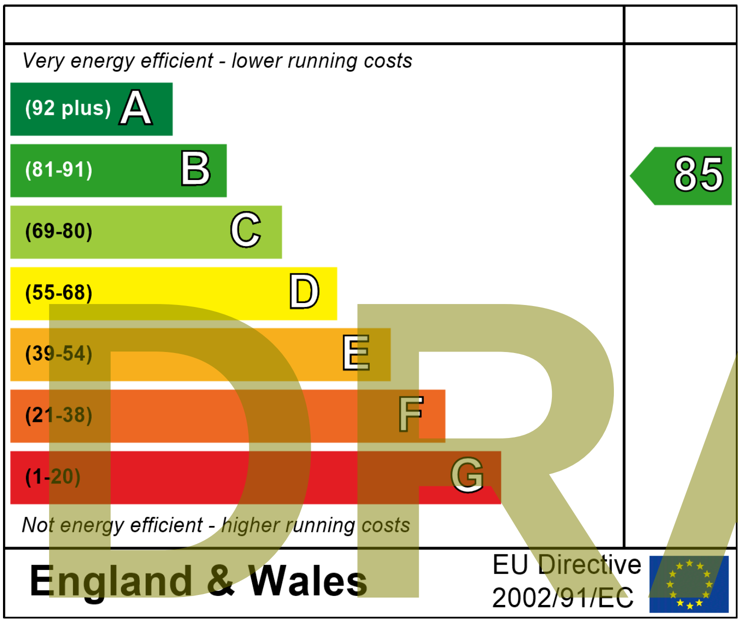
Flat H307 - The Downings
Bakers Quay
Merchants' Road
Gloucester
GL2 5QZ

Dwelling type: Top floor Flat
Date of assessment: 23 February 2022
Produced by: Stroma Certification
Total floor area: 91.04 m²

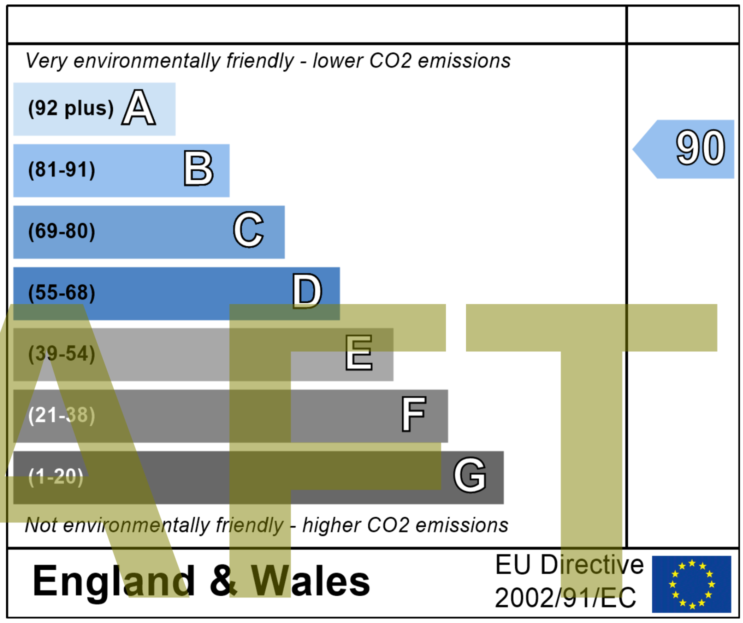
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment

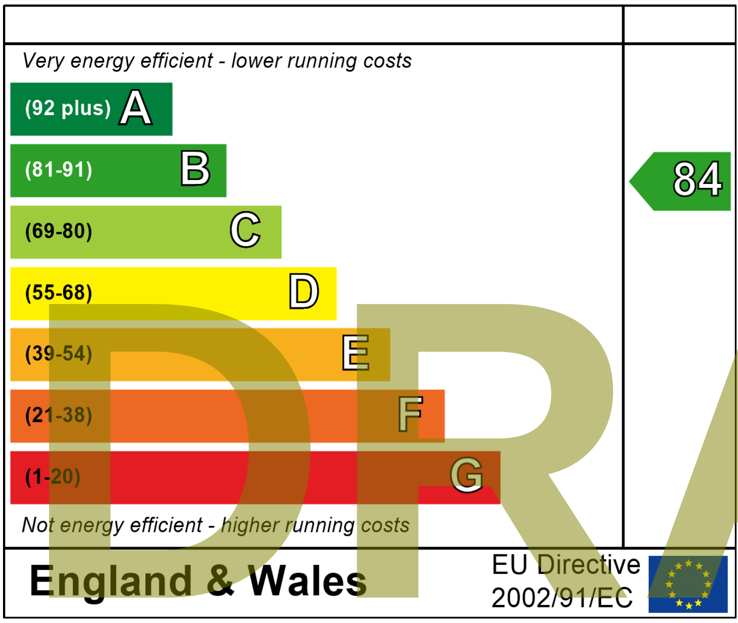
Flat N001 - The Downings
Bakers Quay
Merchants' Road
Gloucester
GL2 5QZ

Dwelling type:	Ground floor Flat
Date of assessment:	23 February 2022
Produced by:	Stroma Certification
Total floor area:	44.1 m²

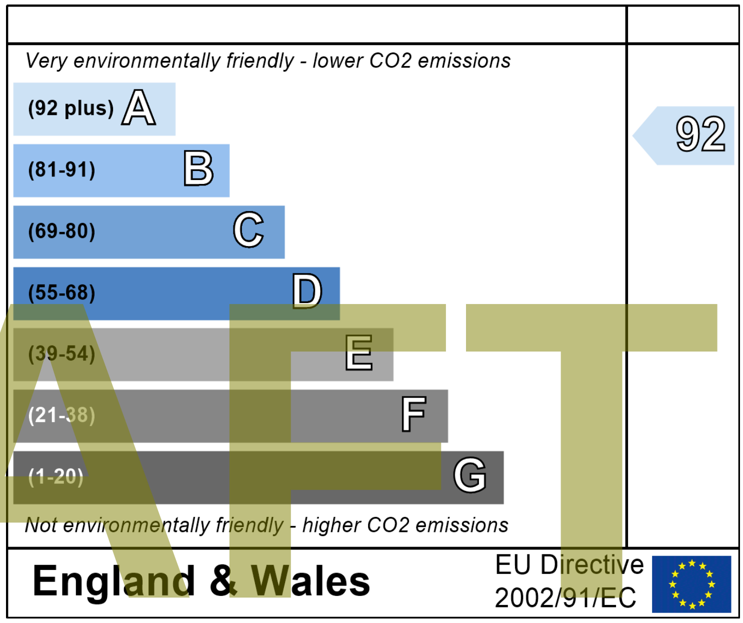
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment

Flat N004 - The Downings		Dwelling type:	Ground floor Flat
Bakers Quay		Date of assessment:	23 February 2022
Merchants' Road		Produced by:	Stroma Certification
Gloucester		Total floor area:	69.6 m²
GL2 5QZ			

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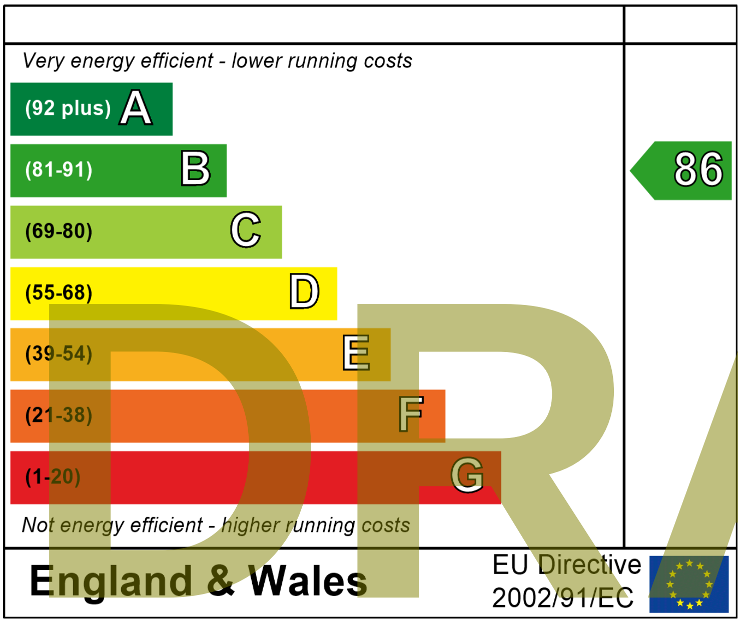
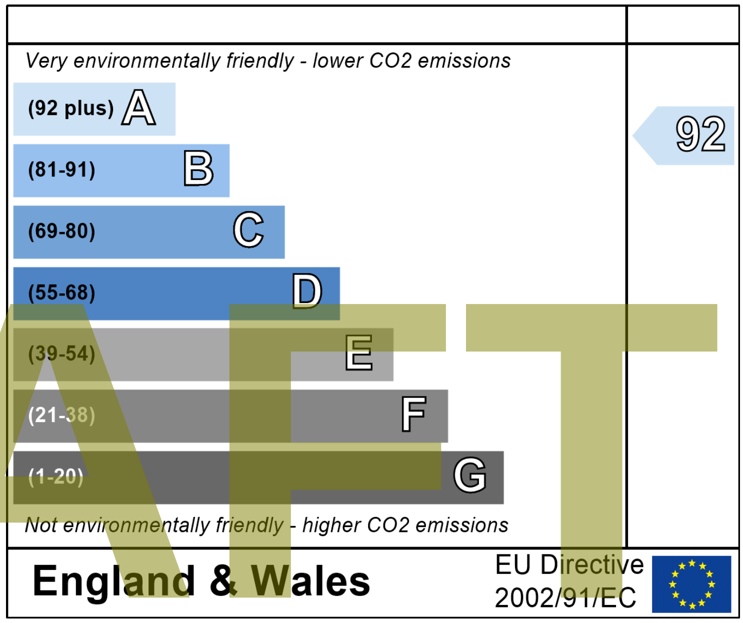
Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

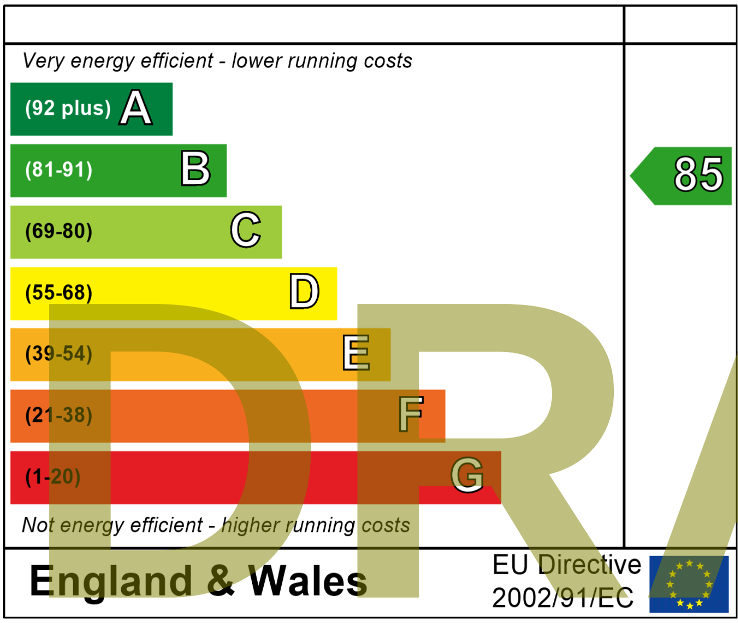
Predicted Energy Assessment

Flat N206 - The Downings		Dwelling type:	Mid floor Flat
Bakers Quay		Date of assessment:	23 February 2022
Merchants' Road		Produced by:	Stroma Certification
Gloucester		Total floor area:	48.8 m²
GL2 5QZ			

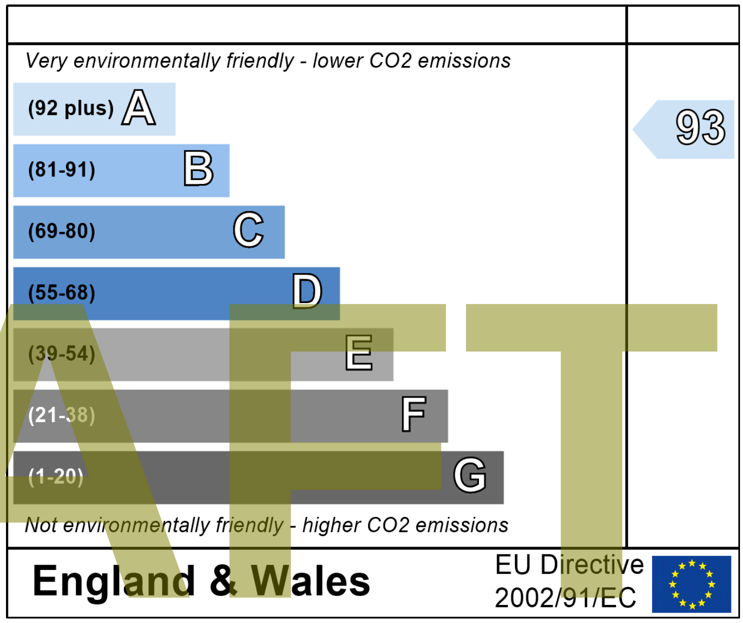
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment

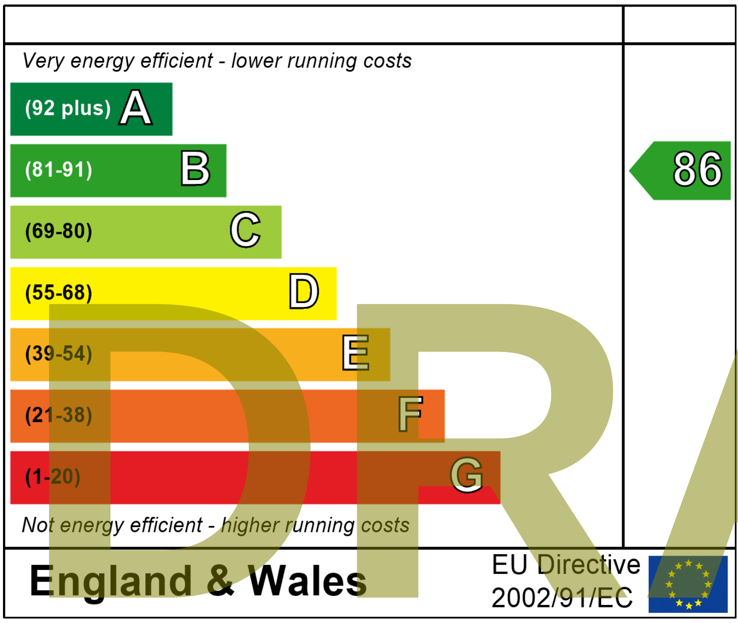
Flats N307 to 707 - The Downings
Bakers Quay
Merchants' Road
Gloucester
GL2 5QZ

Dwelling type:	Mid floor Flat
Date of assessment:	23 February 2022
Produced by:	Stroma Certification
Total floor area:	71.8 m²

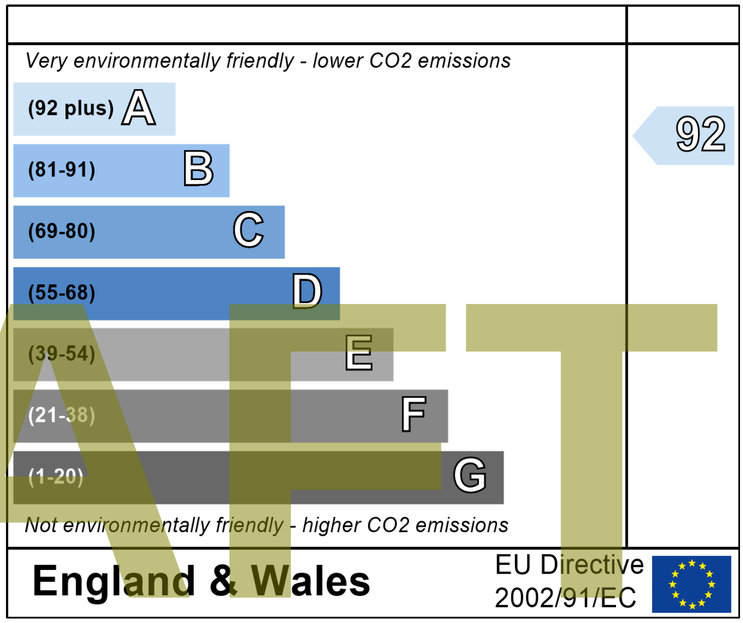
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

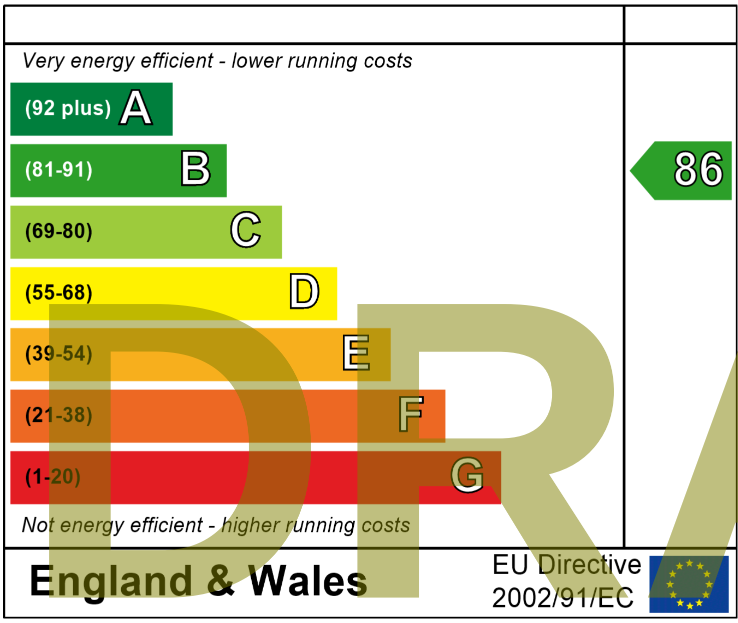
Predicted Energy Assessment

Flat N804 - The Downings		Dwelling type:	Top floor Flat
Bakers Quay		Date of assessment:	23 February 2022
Merchants' Road		Produced by:	Stroma Certification
Gloucester		Total floor area:	124 m²
GL2 5QZ			

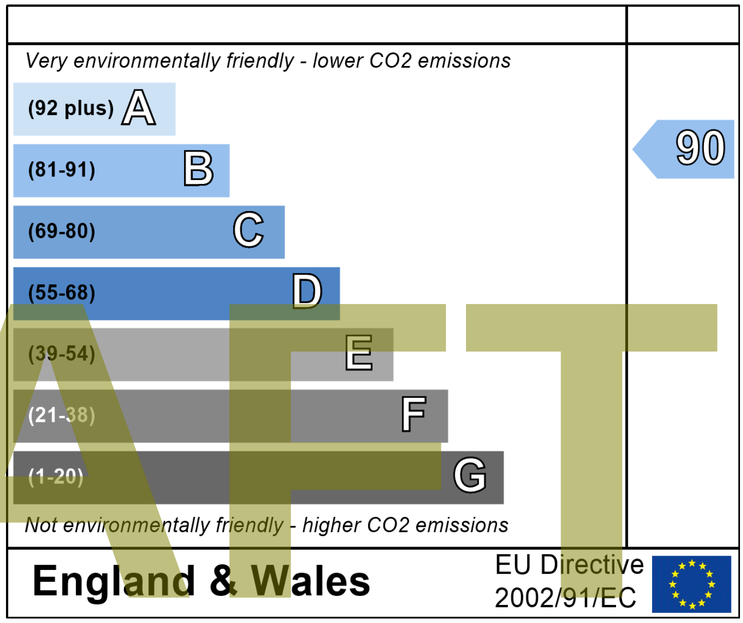
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.