Thornley & Lumb Partnership Ltd.

PI Chichester

Energy Strategy

Project

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Document

Energy Strategy

Client

Whitbread

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TLP Project Reference

C7065

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Document Control

Document	Energy Strategy
Project	PI Chichester
Client	Whitbread
Job Number	C7065
Issue	First Issue
Written By	Harry Forster
Checked By	Thomas Clark/Nikolas Sotnyk
Revised	01/03/2024
Revision	A

Executive Summary

This Energy Strategy produced by Thornley & Lumb on behalf Whitbread details aspects of sustainable building design relating to energy and carbon emissions of the proposed Premier Inn Chichester Hotel development.

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. 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.

Be Lean Measures

- Low external envelope U-values
- Low air permeability
- Low energy LED lighting with lighting controls
- Metering connected to BMS with auto monitoring and targeting of energy
- Mechanical ventilation with passive heat recovery (MVHR)

Be Clean Measures

- Same as Be Lean

Be Green Measures

- Air source heat pump (ASHP) providing space heating
- High efficiency air-to-water CO_2 Heat Pump for hot water services (HWS)
- Solar photovoltaic (PV) panels generating on site zero carbon electricity

This Energy Strategy therefore confirms a method where the development's overall carbon emissions could be reduced 32.6% below the Part L 2021 baseline.

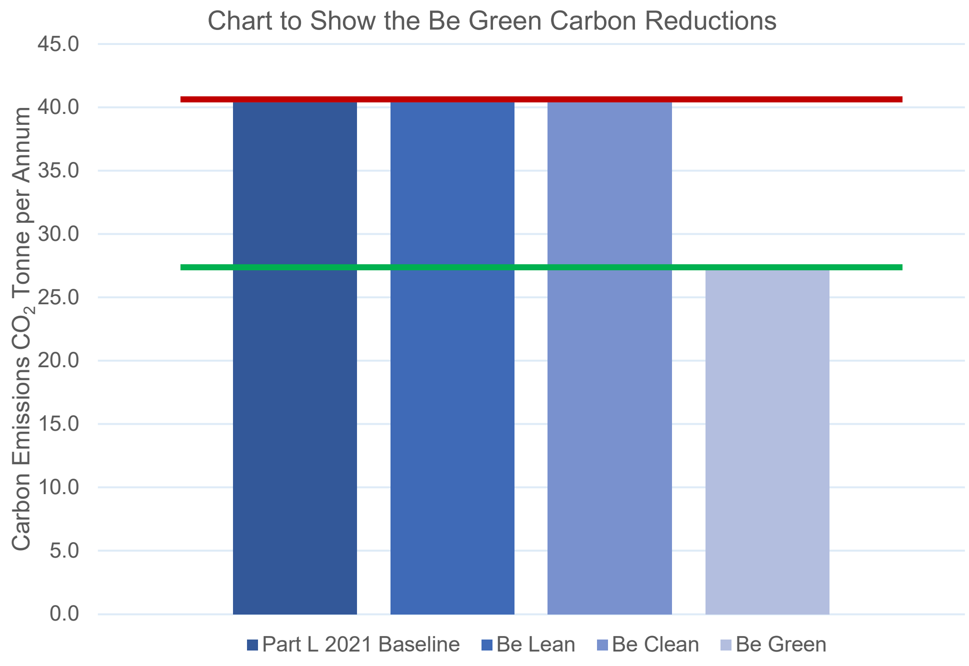


Chart to show the overall carbon reductions of the proposed development

Carbon Dioxide Emissions Per Annum for non-domestic Buildings

	Regulated CO_2 Tonnes per annum	Unregulated CO_2 Tonnes per annum
Baseline Part L (2021)	40.4	9.1
Including Be Lean Measures	40.4	9.1
Including Be Clean Measures	40.4	9.1
Including Be Green Measures	27.2	9.1

Regulated Carbon Dioxide Savings Per Annum for non-domestic Buildings

	Tonnes CO_2 Per annum	Percentage Reduction %
Savings from Be Lean Measures	0.0	0.0
Savings from Be Clean Measures	0.0	0.0
Savings from Be Green Measures	13.2	32.6
Reduction Compared to Baseline	13.2	32.6

Contents

1.0 Introduction

The proposed Premier Inn Chichester development will consist of a three-storey building for hotel use. The development will involve 82 bedrooms with staff amenities, restaurant, and reception spaces at ground level.

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).

The Energy Strategy considers future electricity grid decarbonisation and uses this to influence the proposed design principles.

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 within accredited software, and hence grid decarbonisation will be considered when developing this Energy Strategy.

The carbon reductions detailed in this Energy Strategy have been calculated using Part L accredited compliance dynamic simulation modelling (DSM) software IES VE Compliance DSM. This ensures that the proposed development's carbon emissions have been calculated using a more sophisticated carbon calculations methodology, as opposed to the more simplistic standard SBEM methodology.

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.

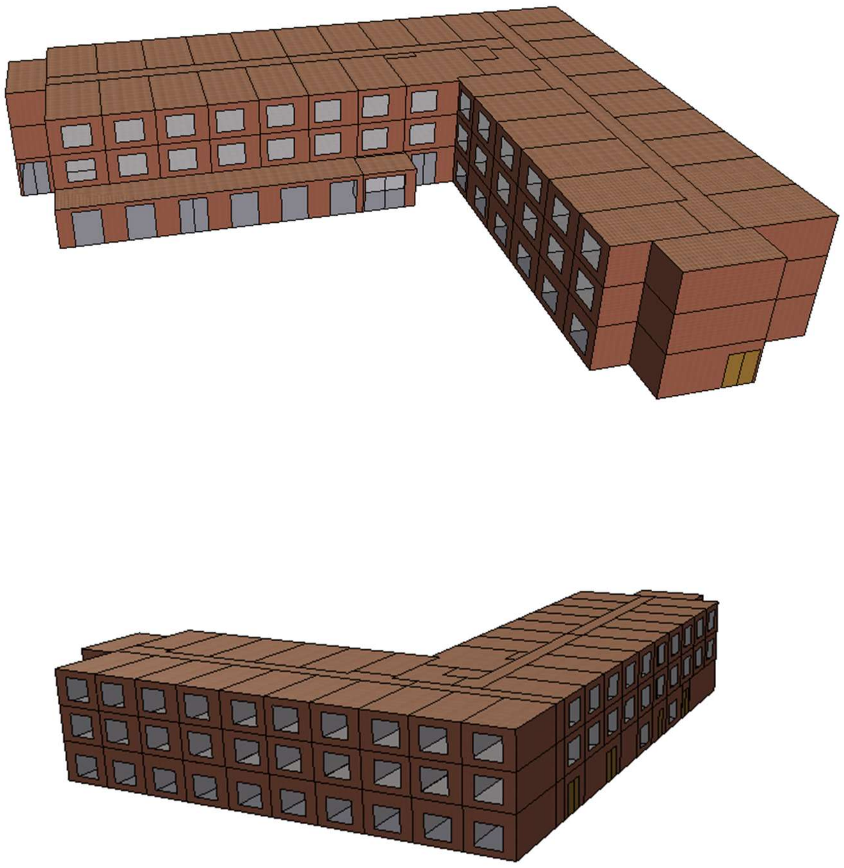


Figure 1.0 The proposed development building energy model

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 underlying 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 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 Non-Domestic Building Services Compliance Guide (NDBSCG), 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 Premier Inn Chichester Hotel development. It 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 Energy Modelling Software

The IES VE software is a dynamic building simulation modelling (DSM) application which includes industry standard thermal modelling and Part L compliance software.

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 energy usage.

This dynamic simulation modelling of the building allows the operational energy to be predicted at design stage. Carbon factors are then used to convert this annual operational energy into future carbon emissions of the building.

2.1.2 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 variable carbon factors from Part L 2021, which references Table 29 / Table 30 and Table 31 of the NCM Modelling Guide 2021 edition for Part L 2021.

	Carbon Factor $kgCO_2.kWh^{-1}$	Primary Energy $kWhPE.kWh^{-1}$
January	0.163	1.602
February	0.16	1.593
March	0.153	1.568
April	0.143	1.53
May	0.132	1.487
June	0.12	1.441
July	0.111	1.41
September	0.112	1.413
October	0.122	1.449
November	0.136	1.504
December	0.151	1.558

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 2022, low and zero carbon electricity generation was 56.1% of total grid electricity.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1174283/UK_Energy_in_Brief_2023.pdf

2.2 National Planning Policy

The National Planning Policy Framework (NPPF) was revised on 20th July 2021. 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.

2.2.1 Economic

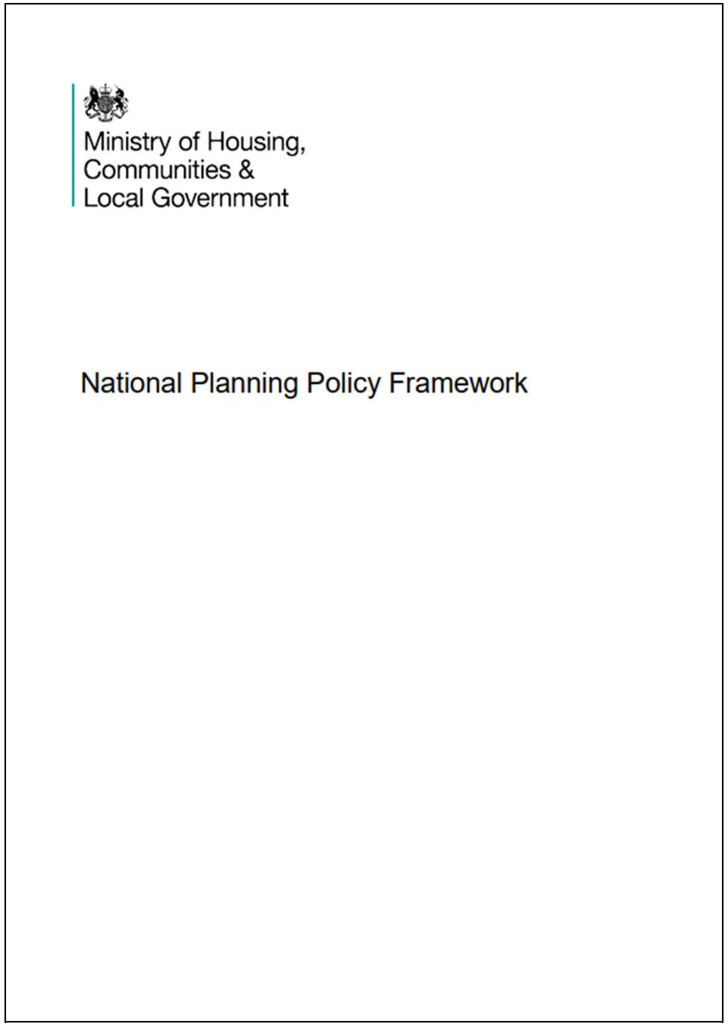
Contributing to help building a strong, responsive, and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth, innovation, and improved productivity; and by identifying and coordinating the provision of infrastructure.

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.


Ministry of Housing,
Communities &
Local Government

National Planning Policy Framework

2.3 Local Planning Policy

Chichester Council has a draft Local Plan setting out a vision for the local area from 2014 to 2029, which " Is designed to provide the vision and framework that will shape the future of Chichester District outside the South Downs National Park area. It provides clear guidance on how new development can address the challenges the Chichester area face and identifies where, when, how much, and how development will take place."

2.3.1 Policy 1 – Presumption in Favour of Sustainable Development

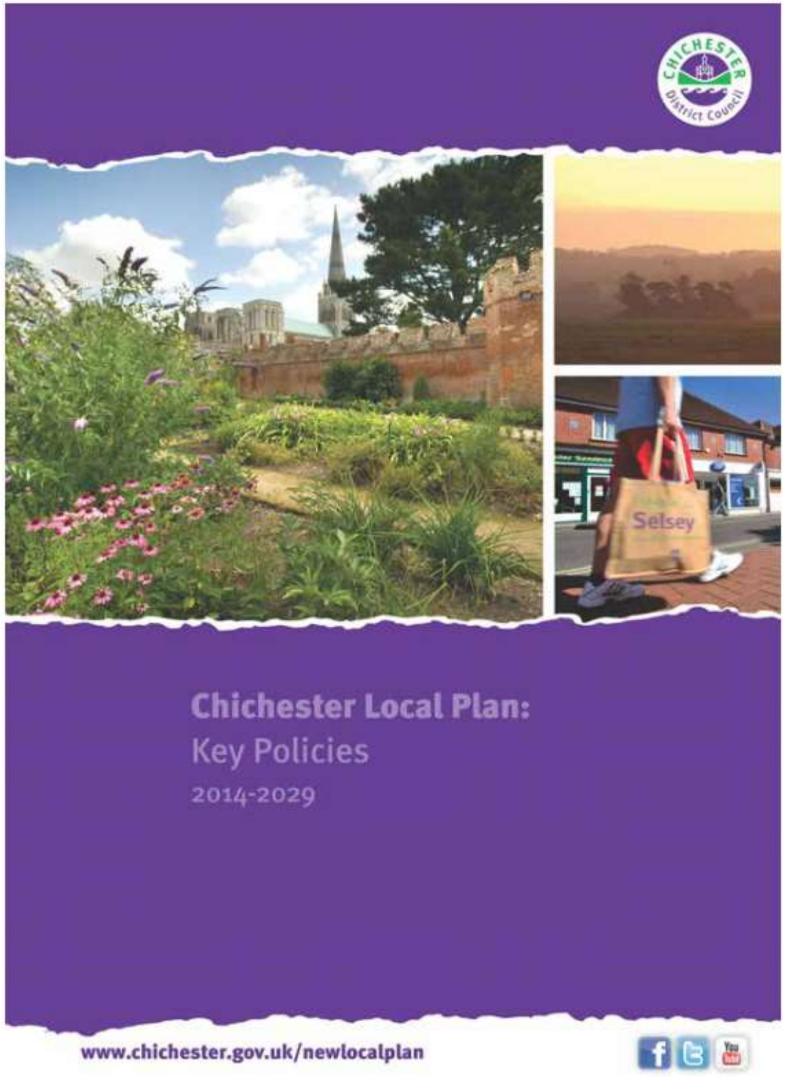
Within the draft Local Plan Section 4: Sustainable Development Principles, includes Policy 1 – Presumption in Favour of Sustainable Development. The aim of Policy 1 is to ensure that all new developments meet targets set out by the National Planning Policy presented earlier in this report. This aim should be achieved through the provision of new developments that utilise renewable energy sources and provide energy savings, however development shouldn't negatively impact the wider area massively.

2.3.2 Policy 40 – Sustainable Design and Construction

Section 19: The Environment includes Policy 40: Sustainable Design and Construction of New Development. This Policy states that "all new development proportionate of their size should follow a plan to protect and enhance both the built and natural environment. Also, all development should be achieving a minimum of 110 litres per person a day of water usage."

New development should comply with the Building for Life Standards Act or equivalent replacement national minimum standards. This requirement of Policy 40 ensures that the development is accessible to all and flexible towards change in the future as the needs of the environment changes.

Further in the policy several requirements for new development are presented; energy consumption should be minimised, and the amount of energy produced by renewables should be maximised to try and meet the needs of the building. These methods of delivering renewable energy should include an advanced solar design principle.



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 for 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 proposed Premier Inn York Layerthorpe Hotel development.

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 from 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. Where these specifically relate to windows and doors etc they are known as 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 %
External Walls	0.26	0.15	42
Ground Floor	0.18	0.15	17
Roof	0.18	0.10	44
External Glazing	1.60	1.00	38

Table 3.1 Comparing the limiting fabric from Part L 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.

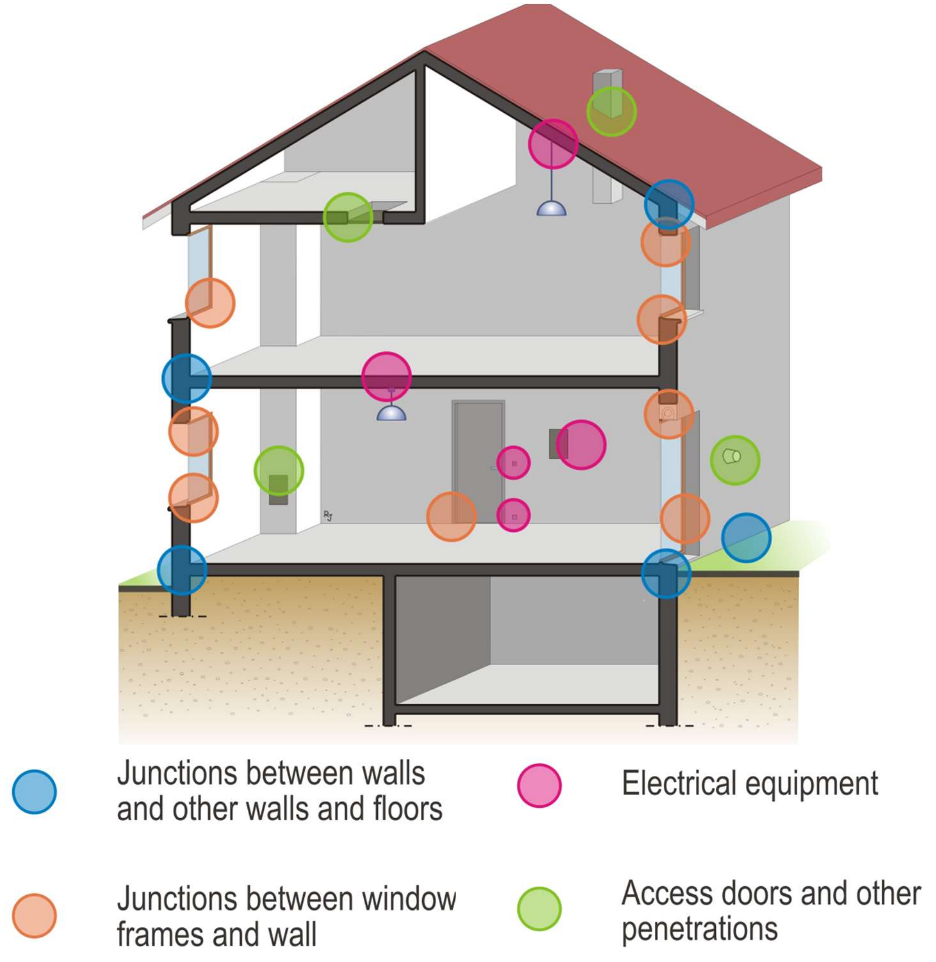
All buildings experience external air entering the building due to infiltration which is mainly due to the stack effect resulting for internal air buoyancy or external wind. These phenomena create a pressure differential over the building fabric which can result in infiltration or exfiltration through 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	62.5

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



Common air leakage pathways indicated on a typical residential development

3.1.4 Mechanical Ventilation

Premier Inn bedrooms will use the Vectaire heat recovery ventilation unit, 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 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 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 80%, reducing waste by ensuring less energy demand is placed on the space heating system. Air handling units use a thermal wheel (also known as a rotary heat exchanger) as an air-to-air heat exchanger. A thermal wheel consists of a circular honeycomb-like matrix of heat-absorbing material, which is rotated within the supply and exhaust streams of an air handling unit.

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	1.18	42
Heat Recovery Efficiency %	50	82	64

Table 3.3 Comparing the limiting ventilation efficiencies with the proposed Design.

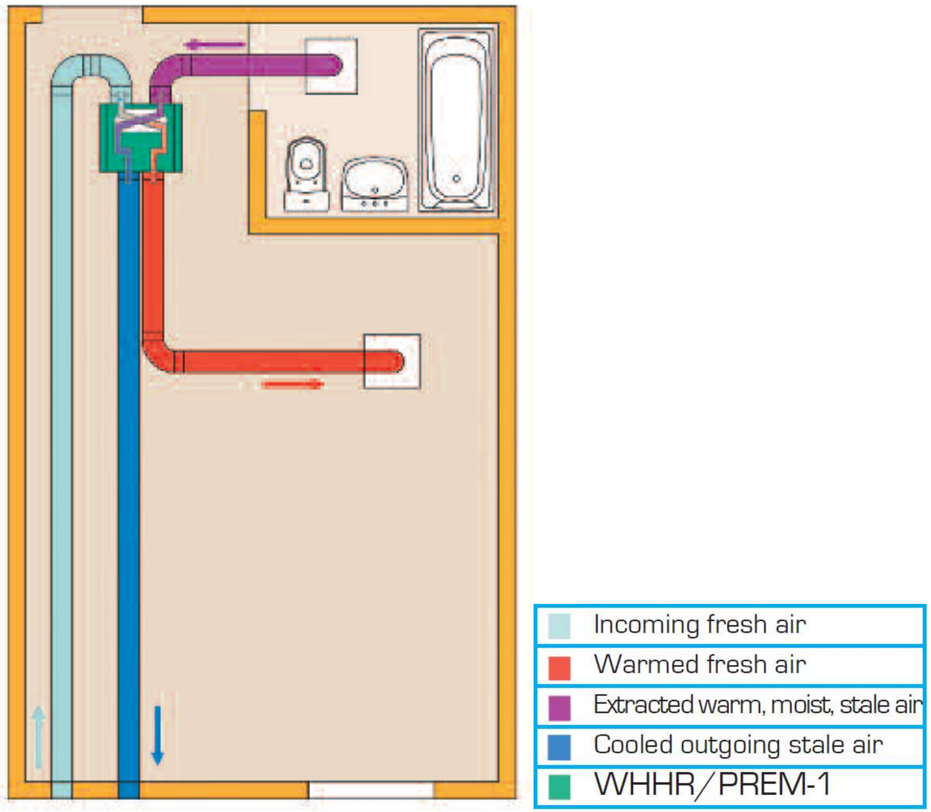


Figure 3.1: A standard bedroom combined with a heat recovery ventilation unit.

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. These will minimise the energy and carbon emission used in artificial lighting. The artificial lighting has also been designed to incorporate lighting controls which will ensure that no electricity used for artificial lighting is wasted. This will ensure that carbon emissions are not created unnecessarily and that the building is a sustainable development.

The lighting controls.

- Corridor – auto on/off control
- Stairs – auto on/off control
- Public Toilet – auto on/off control
- Office – auto on/off control
- Store – auto on/off control
- Team Room – auto on/off control
- Linen Room – auto on/off control

	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 Comparing the limiting lighting efficiency with the proposed Low Energy Design Value

4.0 Be Green: Analysis of Renewable Technology

4.1 Analysis of Available Renewable Technology

The available renewable technology which will be considered for the proposed Premier Inn Chichester hotel development 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)
Air Source Heat Pump (ASHP) **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)
Air Source Heat Pump (ASHP) **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	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 NOx emissions and effect on air quality)

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

5.0 Carbon Emissions Reductions Energy

5.1 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.

5.2 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 IES VE 2021 VE Compliance DSM.

This software uses the design information for the proposed development to create a notional 'target building'. 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 BER 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 non-domestic building services compliance guide and further details in the national calculation methodology NCM for energy assessment.

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. However, for new buildings with a total useful floor area over 1,000m^2 information handed over to the building owner should include a forecast of the actual energy use of the building. The energy forecast should include all metered energy uses, including unregulated loads.

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 heat pumps. 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 40.4 tonnes per annum

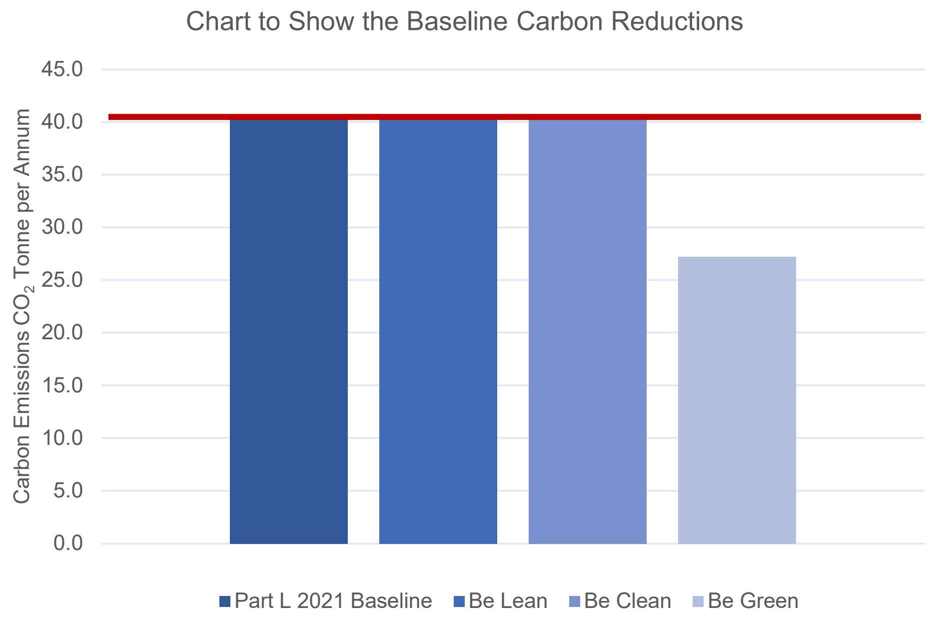


Figure 6.1 The baseline carbon emissions of the proposed development

The red line shows the baseline building carbon emissions TER

5.3 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 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.

These include passive architectural design measures such as low U-value external element building fabric and low air permeability to reduce air ingress.

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
- Metering connected to BMS with auto monitoring and targeting of energy
- 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 0%

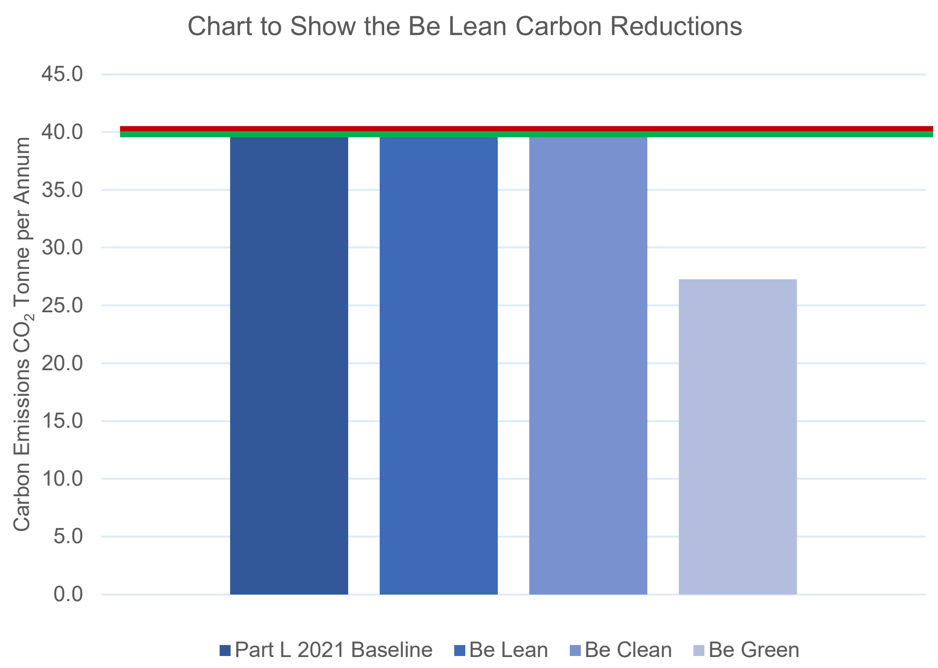


Figure 6.2 The Be Lean carbon emissions reductions of the proposed development

The red line shows the baseline building carbon emissions TER

The green line shows the actual building carbon emissions BER

5.4 Be Clean

The analysis presented in Section 4.0 detailed the availability of heat networks which are currently in the vicinity of the proposed Premier Inn Chichester development.

The feasibility of utilising CHP for providing the 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 hotel would have a sufficient simultaneous demand for both heating for hot water services HWS and electricity demand of electrical baseload and given the low cost of natural fossil gas, this could provide low running costs. 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 to 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 if the development could connect to an existing local network, it is feasible that the hot water services design could be provided by a district heat network.
However, the hotel 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 0% reduction

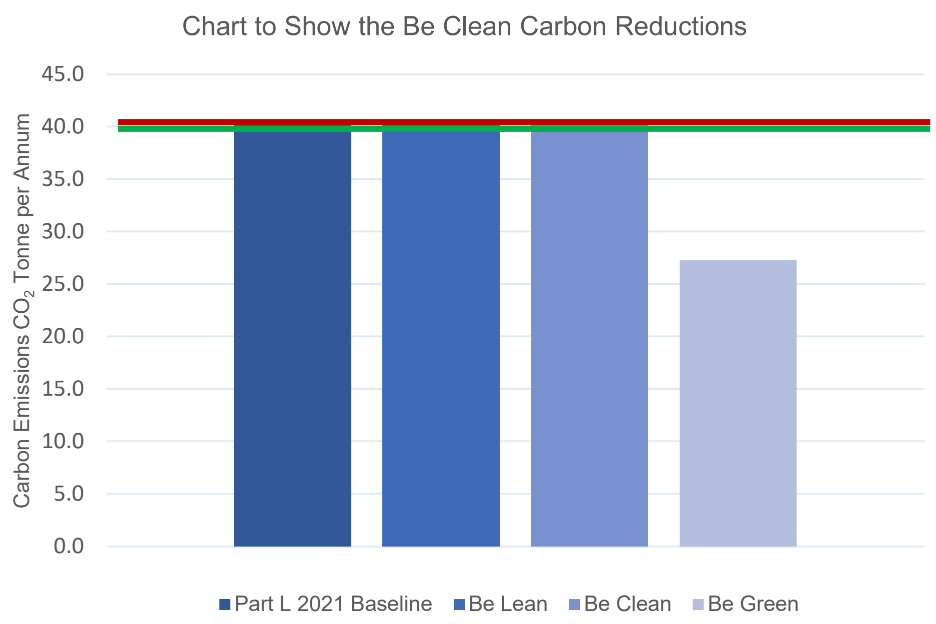


Figure 6.3 The Be Clean carbon emissions reductions of the proposed development

The red line shows the baseline building carbon emissions TER

The green line shows the actual building carbon emissions BER

5.5 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 building services design for the proposed Premier Inn Chichester development enables a significant reduction in carbon emissions by utilising Heat pumps for HWS and space heating of bedrooms and communal areas.

The application of space heating air source heat pumps will allow space heating system to have efficiencies of 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. The space heating air source heat pumps will be heat recovery heat pumps which can transfer energy between indoor units. This allows the air source heat pumps to transfer heat to other areas of the building, rather than constantly rejecting it into the external atmosphere. The use of heat recovery ASHP will allow heat transfer between areas of the building which have different activities and or solar gains lowering energy demand.

A CO_2 refrigeration cycle air source heat pump ASHP is to provide 100% of the hot water services, this enables a seasonal efficiency 420% using bin weather data. The high seasonal efficiency 4.2 SCOP of the heat pumps ensure that these are the lowest carbon method of providing hot water services. The high efficiency of the air source heat pumps reduces the energy demand for the hot water services, grid electricity usage and operational energy.

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.

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 32.6%

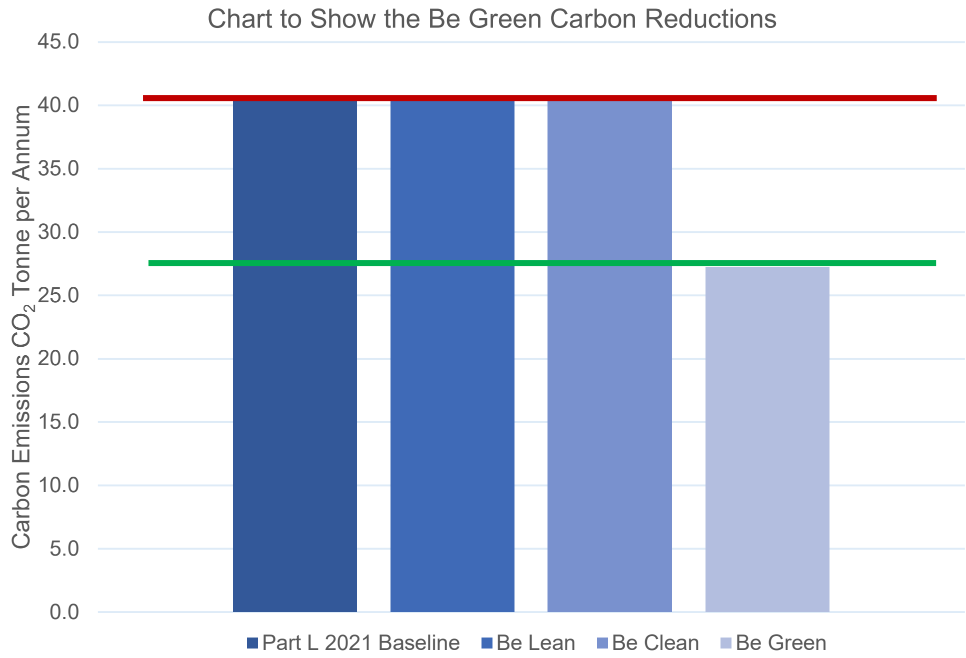


Figure 6.4 The Be Green carbon emissions reductions of the proposed development

The red line shows the baseline building carbon emissions TER

The green line shows the actual building carbon emissions BER

5.6 Overall Carbon Reductions

Carbon Dioxide Emissions Per Annum for non-domestic Buildings

	Regulated CO_2 Tonnes per annum	Unregulated CO_2 Tonnes per annum
Baseline Part L (2021)	40.4	9.1
Including Be Lean Measures	40.4	9.1
Including Be Clean Measures	40.4	9.1
Including Be Green Measures	27.2	9.1

Table 6.1 Carbon emissions of the proposed development

Regulated Carbon Dioxide Savings Per Annum for non-domestic Buildings

	Tonnes CO_2 per annum	Percentage Reduction %
Savings from Be Lean Measures	0.0	0.0
Savings from Be Clean Measures	0.0	0.0
Savings from Be Green Measures	13.2	32.6
Reduction Compared to Baseline	13.2	32.6

Table 6.2 Carbon emission reductions of the proposed development

6.0 Conclusion

The proposed Premier Inn Chichester development has followed the GLA's 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 building simulation software.

The carbon reductions detailed in this Energy Strategy have been calculated using Part L accredited compliance dynamic simulation modelling software IES VE Compliance DSM. This ensures that the proposed development's carbon emissions have been calculated using a more sophisticated carbon calculations methodology, as opposed to the more simplistic SBEM methodology.

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

- Low external envelope U-values
- Low air permeability
- Low energy LED lighting with lighting controls
- Metering connected to BMS with auto monitoring and targeting of energy
- Mechanical ventilation with passive heat recovery (MVHR)

The Be Lean measures facilitate a carbon reduction of 0%

The Be Clean second stage is detailed in Section 6.4.

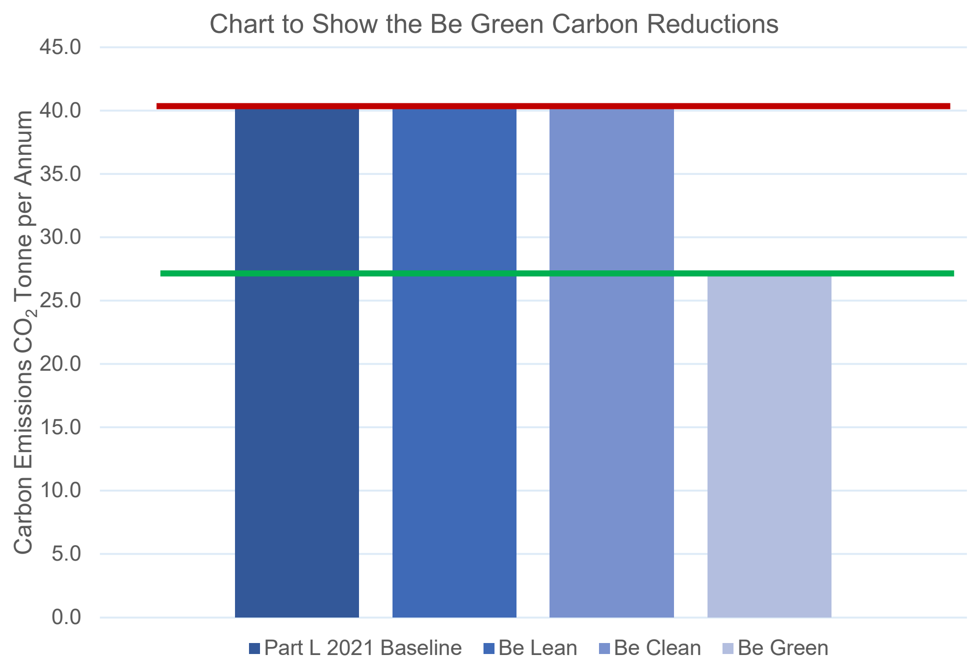
Third stage Be Green of the energy hierarchy includes

- Air source heat pump (ASHP) providing space heating
- High efficiency air-to-water CO_2 Heat Pump for hot water services (HWS)
- Solar photovoltaic (PV) panels generating on site zero carbon electricity

The Be Green measures facilitate a carbon reduction of 32.6%

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. Accordingly, this Energy Strategy confirms that the overall development's carbon emissions will be reduced 32.6% below the Part L 2021 baseline.

The energy hierarchy carbon reduction methodology has minimised energy usage and carbon emissions of the Premier Inn Chichester development to provide a sustainable low energy building.



Appendices

Appendix 1 Part L BRUKL report 2021 ‘Baseline/Be Lean’.

Appendix 2 Part L BRUKL report ‘Be Green’.

Appendix 1 Part L BRUKL Report Baseline/Be Lean

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

C7065 Pl Chichester v1

As designed

Date: Fri Mar 01 11:39:20 2024

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.24

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.24

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

Foundation area [m²]: 745.58

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

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	13.15	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	13.36	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	142.91	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	145.59	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	1F000006:Surf[3]
Floors	0.18	0.15	0.15	1F000006:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	1F00001A:Surf[5]
Windows** and roof windows	1.6	1	1	1F000007:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1	1	1F000006:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

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

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

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

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

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

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- xBe Lean PUZ-ZM35 4.00 Comms/Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.68	6.3	0	-	0.8
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

2- EP400 VRF 4.00 Restaurant

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.05	6.08	0	1.1	0.8
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

3- EP200 VRF 4.67 Bedrooms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.67	6.08	0	1.1	0.89
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
0F Team Room	-	-	-	1.1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
0F Office	-	-	-	1.1	-	-	-	-	-	-	N/A
0F Comms	-	-	-	1.1	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
0F BOH Lobby	124	-	-
0F Luggage	121	-	-
0F Bottle Store	121	-	-
0F Glass Wash	97	-	-
0F Cleaner Cupboard	95	-	-
0F Staff WC	98	-	-
0F Staff Shower	110	-	-
0F Staff WC	100	-	-
0F Team Room	97	-	-
0F Cellar	101	-	-
0F Office	107	-	-
0F BOH Corridor	114	-	-
0F Entrance Lobby	95	-	-
0F Reception and Restaurant	101	80	1.5
0F Bedroom Corridor	104	-	-
0F Riser	101	-	-
0F Stairs	99	-	-
0F Comms	97	-	-
0F Linen	112	-	-
0F Plant	96	-	-
0F Linen Intake	110	-	-
0F COSHH	176	-	-
0F Ensuite Bedroom	110	-	-
0F Ensuite Bedroom	110	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F External Escape Stair	112	-	-
0F Kitchen	107	-	-
0F External Escape Stair	115	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
0F Ensuite Bedroom	110	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
1F Stairs	106	-	-
1F Bedroom Corridor	104	-	-
1F Bedroom Corridor	96	-	-
1F Ensuite Bedroom	105	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	105	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Stairs	108	-	-
1F Bedroom Corridor	101	-	-
1F Bedroom Corridor	99	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	103	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Linen	105	-	-
1F Archive	114	-	-
1F Riser	101	-	-
1F Stairs	96	-	-
1F Ensuite Bedroom	103	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m^2]**
Standard value	95	80	0.3
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
0F Public WCs	105	-	-
2F Stairs	106	-	-
2F Bedroom Corridor	104	-	-
2F Bedroom Corridor	130	-	-
2F Ensuite Bedroom	105	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	105	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Stairs	108	-	-
2F Bedroom Corridor	101	-	-
2F Bedroom Corridor	99	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	103	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Linen	105	-	-
2F Archive	114	-	-
2F Riser	101	-	-
2F Stairs	96	-	-
2F Ensuite Bedroom	103	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0F Team Room	NO (-64.1%)	NO
0F Office	NO (-56.8%)	NO
0F Reception and Restaurant	NO (-9.9%)	NO
0F Comms	N/A	N/A
0F Ensuite Bedroom	NO (-6.8%)	NO
0F Ensuite Bedroom	NO (-54.6%)	NO
0F Ensuite Bedroom	NO (-32.6%)	NO
0F Ensuite Bedroom	NO (-33.4%)	NO
0F Ensuite Bedroom	NO (-33.4%)	NO
0F Ensuite Bedroom	NO (-32.6%)	NO
0F Ensuite Bedroom	NO (-71.6%)	NO
0F Ensuite Bedroom	NO (-73.1%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
0F Ensuite Bedroom	NO (-28.5%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
0F Ensuite Bedroom	NO (-28.5%)	NO
0F Ensuite Bedroom	NO (-26.6%)	NO
0F Ensuite Bedroom	NO (-28.5%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
1F Ensuite Bedroom	NO (-6.9%)	NO
1F Ensuite Bedroom	NO (-34.2%)	NO
1F Ensuite Bedroom	NO (-32.6%)	NO
1F Ensuite Bedroom	NO (-32.6%)	NO
1F Ensuite Bedroom	NO (-32.6%)	NO
1F Ensuite Bedroom	NO (-54.6%)	NO
1F Ensuite Bedroom	NO (-73.1%)	NO
1F Ensuite Bedroom	NO (-28.5%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-28.5%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1F Ensuite Bedroom	NO (-71.6%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-32.5%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-72.5%)	NO
1F Ensuite Bedroom	NO (-32.5%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-74.4%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-57.8%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-57.8%)	NO
1F Ensuite Bedroom	NO (-56.6%)	NO
1F Ensuite Bedroom	NO (-57.8%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-56.6%)	NO
2F Ensuite Bedroom	NO (-6.9%)	NO
2F Ensuite Bedroom	NO (-34.2%)	NO
2F Ensuite Bedroom	NO (-32.6%)	NO
2F Ensuite Bedroom	NO (-32.6%)	NO
2F Ensuite Bedroom	NO (-32.6%)	NO
2F Ensuite Bedroom	NO (-54.6%)	NO
2F Ensuite Bedroom	NO (-73.1%)	NO
2F Ensuite Bedroom	NO (-28.5%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-28.5%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-71.6%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-32.5%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-72.5%)	NO
2F Ensuite Bedroom	NO (-32.5%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-74.4%)	NO
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-57.8%)	NO
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-57.8%)	NO
2F Ensuite Bedroom	NO (-56.6%)	NO
2F Ensuite Bedroom	NO (-57.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-56.6%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	3073.6	3073.6
External area [m^2]	3692.1	3692.1
Weather	SOU	SOU
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	812.4	1360.01
Average U-value [W/m^{2}K]	0.22	0.37
Alpha value* [%]	25	10

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

Building Use

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.78	4.84
Cooling	1.02	1.1
Auxiliary	16.94	14.96
Lighting	7.91	8.03
Hot water	69.53	67.8
Equipment*	33.33	33.33
TOTAL**	**97.17**	**96.72**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	42.97	66.78
Primary energy [kWh$_{PE}$/m^2]	145.59	142.91
Total emissions [kg/m^2]	13.36	13.15

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	37.6	12.6	2.3	0.8	9	4.48	4.13	4.67	6.08
	Notional	71.1	15	7.1	0.9	14.1	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	39.8	80.2	2.8	5.4	12.9	3.89	4.13	4.05	6.08
	Notional	27.1	102.5	2.7	6.2	17.6	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	59.7	90.5	6.3	5.3	4.6	2.63	4.71	2.68	6.3
	Notional	83.2	78.7	8.3	4.7	1.4	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Appendix 2 Part L BRUKL Report Be Green

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

C7065 PI Chichester v1

As designed

Date: Fri Mar 01 11:54:38 2024

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.24

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.24

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 745.58

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	13.15	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	8.57	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	142.91	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	92.76	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	1F000006:Surf[3]
Floors	0.18	0.15	0.15	1F000006:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	1F00001A:Surf[5]
Windows** and roof windows	1.6	1	1	1F000007:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1	1	1F000006:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

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

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

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

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

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

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

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- PUZ-ZM35 4.00 Comms/Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	6.3	0	-	0.8
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

2- EP400 VRF 4.00 Restaurant

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.05	6.08	0	1.1	0.8
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

3- EP200 VRF 4.67 Bedrooms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.67	6.08	0	1.1	0.89
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
0F Team Room	-	-	-	1.1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
0F Office	-	-	-	1.1	-	-	-	-	-	-	N/A
0F Comms	-	-	-	1.1	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
0F BOH Lobby	124	-	-
0F Luggage	121	-	-
0F Bottle Store	121	-	-
0F Glass Wash	97	-	-
0F Cleaner Cupboard	95	-	-
0F Staff WC	98	-	-
0F Staff Shower	110	-	-
0F Staff WC	100	-	-
0F Team Room	97	-	-
0F Cellar	101	-	-
0F Office	107	-	-
0F BOH Corridor	114	-	-
0F Entrance Lobby	95	-	-
0F Reception and Restaurant	101	80	1.5
0F Bedroom Corridor	104	-	-
0F Riser	101	-	-
0F Stairs	99	-	-
0F Comms	97	-	-
0F Linen	112	-	-
0F Plant	96	-	-
0F Linen Intake	110	-	-
0F COSHH	176	-	-
0F Ensuite Bedroom	110	-	-
0F Ensuite Bedroom	110	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	105	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F External Escape Stair	112	-	-
0F Kitchen	107	-	-
0F External Escape Stair	115	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
0F Ensuite Bedroom	110	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
0F Ensuite Bedroom	109	-	-
1F Stairs	106	-	-
1F Bedroom Corridor	104	-	-
1F Bedroom Corridor	96	-	-
1F Ensuite Bedroom	105	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	101	-	-
1F Ensuite Bedroom	105	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Stairs	108	-	-
1F Bedroom Corridor	101	-	-
1F Bedroom Corridor	99	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	103	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Linen	105	-	-
1F Archive	114	-	-
1F Riser	101	-	-
1F Stairs	96	-	-
1F Ensuite Bedroom	103	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
1F Ensuite Bedroom	104	-	-
0F Public WCs	105	-	-
2F Stairs	106	-	-
2F Bedroom Corridor	104	-	-
2F Bedroom Corridor	130	-	-
2F Ensuite Bedroom	105	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	101	-	-
2F Ensuite Bedroom	105	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Stairs	108	-	-
2F Bedroom Corridor	101	-	-
2F Bedroom Corridor	99	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	103	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Linen	105	-	-
2F Archive	114	-	-
2F Riser	101	-	-
2F Stairs	96	-	-
2F Ensuite Bedroom	103	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-
2F Ensuite Bedroom	104	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0F Team Room	NO (-64.1%)	NO
0F Office	NO (-56.8%)	NO
0F Reception and Restaurant	NO (-9.9%)	NO
0F Comms	N/A	N/A
0F Ensuite Bedroom	NO (-6.8%)	NO
0F Ensuite Bedroom	NO (-54.6%)	NO
0F Ensuite Bedroom	NO (-32.6%)	NO
0F Ensuite Bedroom	NO (-33.4%)	NO
0F Ensuite Bedroom	NO (-33.4%)	NO
0F Ensuite Bedroom	NO (-32.6%)	NO
0F Ensuite Bedroom	NO (-71.6%)	NO
0F Ensuite Bedroom	NO (-73.1%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
0F Ensuite Bedroom	NO (-28.5%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
0F Ensuite Bedroom	NO (-28.5%)	NO
0F Ensuite Bedroom	NO (-26.6%)	NO
0F Ensuite Bedroom	NO (-28.5%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
0F Ensuite Bedroom	NO (-27.5%)	NO
1F Ensuite Bedroom	NO (-6.9%)	NO
1F Ensuite Bedroom	NO (-34.2%)	NO
1F Ensuite Bedroom	NO (-32.6%)	NO
1F Ensuite Bedroom	NO (-32.6%)	NO
1F Ensuite Bedroom	NO (-32.6%)	NO
1F Ensuite Bedroom	NO (-54.6%)	NO
1F Ensuite Bedroom	NO (-73.1%)	NO
1F Ensuite Bedroom	NO (-28.5%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-28.5%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO
1F Ensuite Bedroom	NO (-27.6%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1F Ensuite Bedroom	NO (-71.6%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-32.5%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-72.5%)	NO
1F Ensuite Bedroom	NO (-32.5%)	NO
1F Ensuite Bedroom	NO (-31.6%)	NO
1F Ensuite Bedroom	NO (-74.4%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-57.8%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-57.8%)	NO
1F Ensuite Bedroom	NO (-56.6%)	NO
1F Ensuite Bedroom	NO (-57.8%)	NO
1F Ensuite Bedroom	NO (-57.2%)	NO
1F Ensuite Bedroom	NO (-56.6%)	NO
2F Ensuite Bedroom	NO (-6.9%)	NO
2F Ensuite Bedroom	NO (-34.2%)	NO
2F Ensuite Bedroom	NO (-32.6%)	NO
2F Ensuite Bedroom	NO (-32.6%)	NO
2F Ensuite Bedroom	NO (-32.6%)	NO
2F Ensuite Bedroom	NO (-54.6%)	NO
2F Ensuite Bedroom	NO (-73.1%)	NO
2F Ensuite Bedroom	NO (-28.5%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-28.5%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-27.6%)	NO
2F Ensuite Bedroom	NO (-71.6%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-32.5%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-72.5%)	NO
2F Ensuite Bedroom	NO (-32.5%)	NO
2F Ensuite Bedroom	NO (-31.6%)	NO
2F Ensuite Bedroom	NO (-74.4%)	NO
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-57.8%)	NO
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-57.8%)	NO
2F Ensuite Bedroom	NO (-56.6%)	NO
2F Ensuite Bedroom	NO (-57.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
2F Ensuite Bedroom	NO (-57.2%)	NO
2F Ensuite Bedroom	NO (-56.6%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	3073.6	3073.6
External area [m^2]	3692.1	3692.1
Weather	SOU	SOU
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	812.4	1360.01
Average U-value [W/m^{2}K]	0.22	0.37
Alpha value* [%]	25	10

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

Building Use

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.76	4.84
Cooling	1.02	1.1
Auxiliary	16.94	14.96
Lighting	7.91	8.03
Hot water	45.19	67.8
Equipment*	33.33	33.33
TOTAL**	**72.82**	**96.72**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	11.05	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*11.05*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	42.97	66.78
Primary energy [kWh_{PE}/m^2]	92.76	142.91
Total emissions [kg/m^2]	8.57	13.15

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	37.6	12.6	2.3	0.8	9	4.48	4.13	4.67	6.08
	Notional	71.1	15	7.1	0.9	14.1	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	39.8	80.2	2.8	5.4	12.9	3.89	4.13	4.05	6.08
	Notional	27.1	102.5	2.7	6.2	17.6	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	59.7	90.5	4.2	5.3	4.6	3.92	4.71	4	6.3
	Notional	83.2	78.7	8.3	4.7	1.4	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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