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Wickenden Manor Energy & Sustainability Statement

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Executive Summary

This Energy Assessment and Sustainability Assessment has been prepared by Integration Consultancy Limited in support of the full planning application for the proposed Wickenden Manor development, located in Mid Sussex. The development comprises the new-build extension of the manor and refurbishment of the existing buildings.

CARBON PERFORMANCE

The proposed new-build areas of the development are shown to achieve:

- **72% improvement in regulated CO₂ emissions compared to the standard set out by Part L 2021.**

The proposed design achieves this via high-performance building fabric, passive low energy design and low energy building services systems such as mechanical ventilation with heat recovery (MVHR) and LED lighting.

Following a Low and Zero Carbon (LZC) technology feasibility study, it is proposed to provide 35.4 kW_{peak} of ground-mounted solar photovoltaic (PV) modules and 100% of heating and hot water to the new-build areas via heat pumps.

The table below shows the regulated and unregulated energy use for the new-build areas for the proposed design compared to the Part L baseline.

Carbon dioxide emissions (Tonnes CO ₂ per annum)	Regulated	Unregulated
Baseline: Part L 2021 (Building Regulations) Compliance	5.3	3.6
Proposed Design	1.5	3.6
Savings from Baseline	3.8 (72%)	-

Table 1: New-build regulated and unregulated CO₂ emissions for proposed design compared to Part L baseline

SUSTAINABILITY PERFORMANCE

In addition to the low carbon performance set out above, the scheme benefits from several sustainability aspects, including the use of water saving devices to achieve the equivalent of a BREEAM Good standard for the 'Wat 01' water category in the new-build areas. Health and wellbeing are supported by aspects such as high levels of fresh air provided by mechanical ventilation with heat recovery.

The site has links to low energy public transportation, e.g. it is a half an hour walk to the Station Road bus stop or a 20-minute taxi ride to the Balcombe train station which is on the Thameslink line.

The scheme is also demand-side response (DSR) enabled through the provision of an electric-powered heat pump system with buffer vessel energy stores in order to work with National Grid signalling / time of use tariffs. This supports the transition to low carbon electricity and reduces energy costs.

1 Introduction

Integration Consultancy Limited has been appointed to undertake an Energy and Sustainability Assessment in support of the full planning application for the proposed Wickenden Manor development, located in Mid Sussex. This report is one of several that accompany the planning application and should be read in conjunction with these documents.

The importance of developing a robust well-considered energy and sustainability strategy cannot be overstated. This strategy sets out the roadmap for the entire project and ultimately the success of the strategy will translate into the success of the building's performance on practical completion and throughout its lifecycle.

Underpinning the energy strategy is the 'Be Lean', 'Be Clean' and 'Be Green' design framework:

- 'Be Lean' (energy demand minimisation through 'passive' and 'active' design measures)
- 'Be Clean' (efficient energy supply)
- 'Be Green' (renewable energy generation)

This report sets out the scheme's energy and sustainability aspirations and demonstrates, via the approved calculation methodologies, how these will be achieved through the detailed design and construction stages.

As part of this exercise, the feasibility of implementing a variety of low carbon technologies and renewable energy systems is considered based on aspects such as site location and climate, potential carbon savings, economic viability, environmental impacts and practical aspects such as integration and maintenance considerations.

1.1 THE DEVELOPMENT SITE

The site is located at Wickenden Manor, Chilling Street, East Grinstead, RH19 4JB.

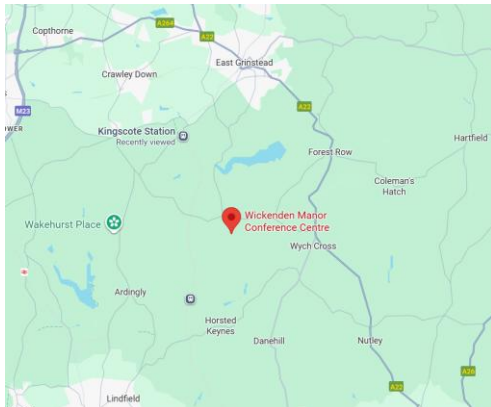


Figure 1: Site Location



Figure 2: Aerial view of site.

1.2 PROPOSED DEVELOPMENT OVERVIEW

The development comprises the new-build extension of the manor and refurbishment of the existing buildings.

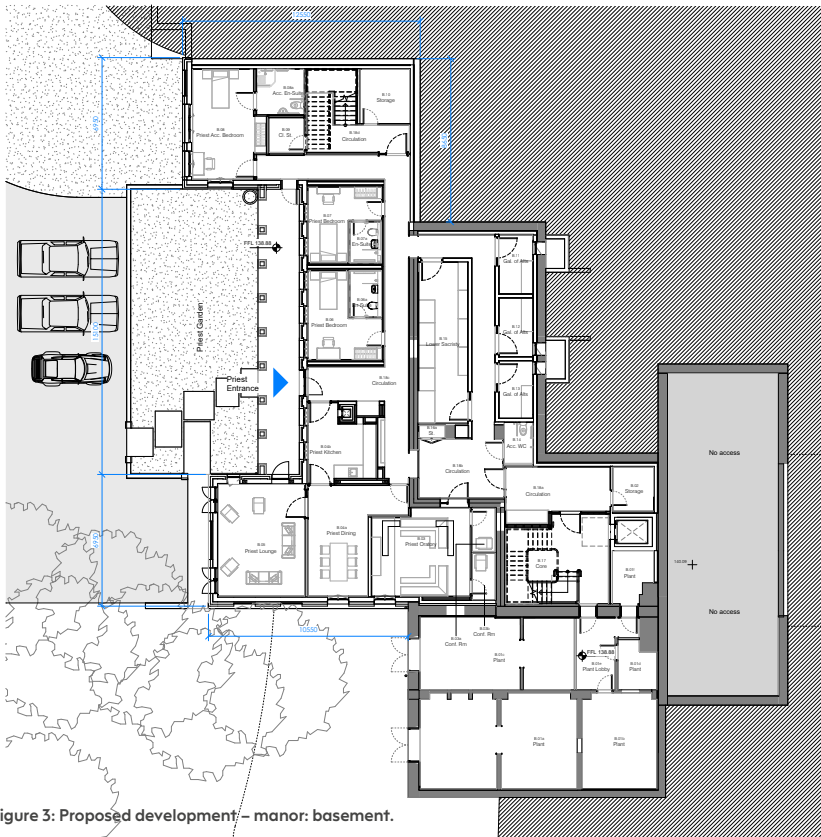


Figure 3: Proposed development – manor: basement.

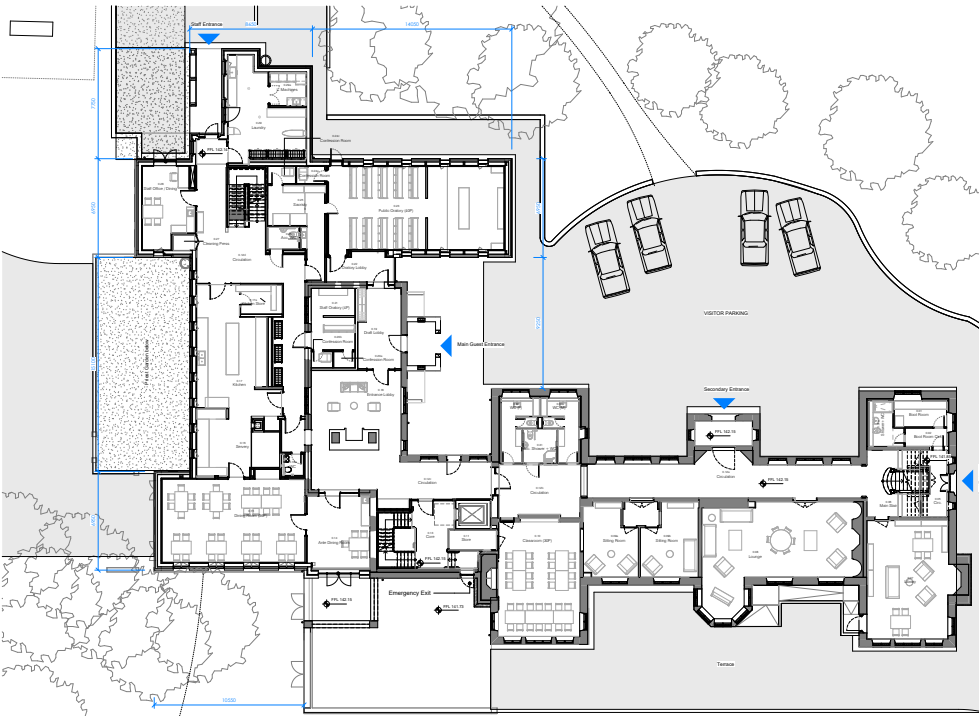


Figure 4: Proposed development – manor: ground floor.

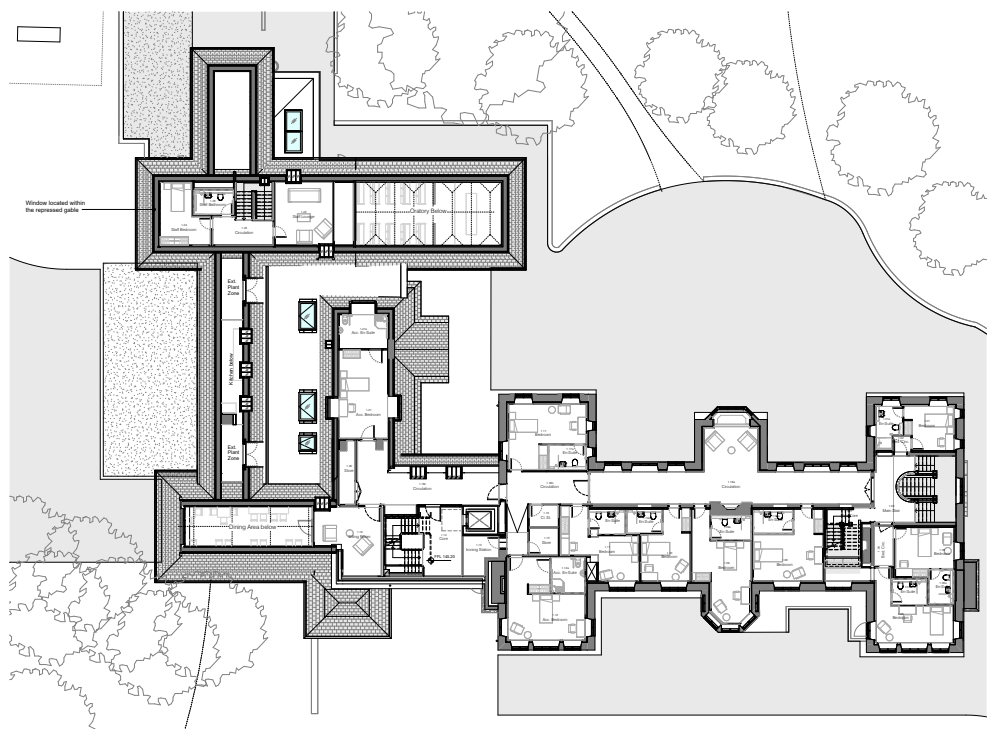


Figure 5: Proposed development – manor: 1st floor.

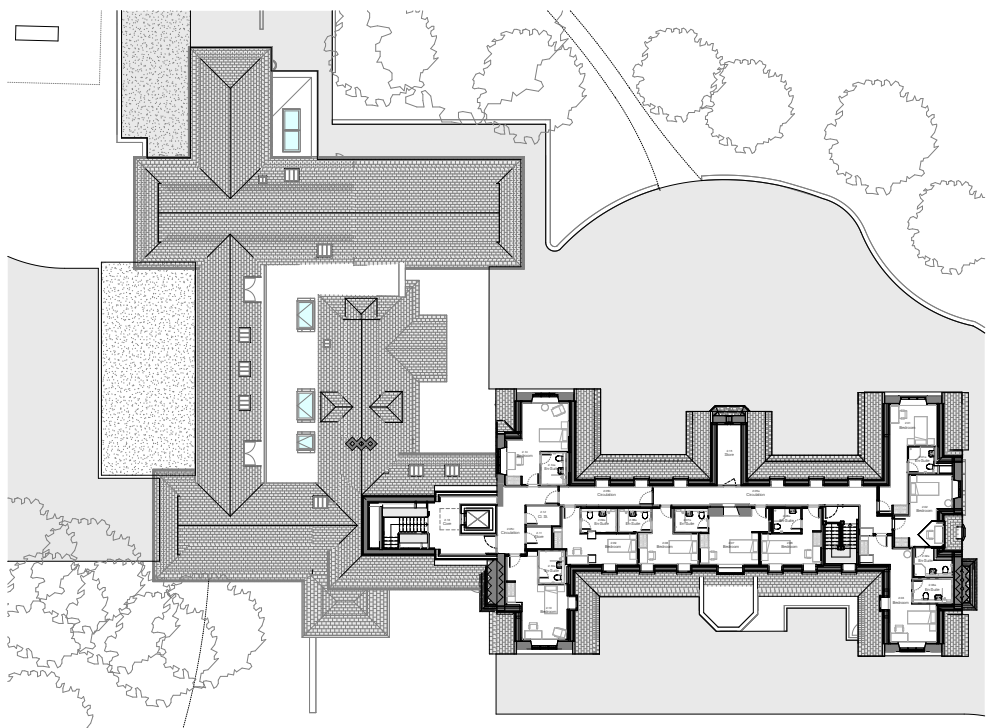


Figure 6: Proposed development – manor: 2nd floor.



Proposed Materials	
Roof	1. New clay tiles to match existing.
Wall	2. New & reused handmade bricks, English bond with lime mortar. 3. New hung clay tiles to match existing. 4. New reconstituted stone structural elements.
Windows	5. New thermally broken steel framed windows 6. New thermally broken steel framed doors 7. New conservation rooflight.
Other	8. New steel rainwater goods.

Figure 7: Proposed development – manor: west elevation (view of extension).

1.3 ENERGY AND SUSTAINABILITY ASPIRATIONS

The scheme has adopted energy and sustainability targets in line with the national and local policy as detailed in section 2. These include:

- Low CO₂ emissions:** Achieve a high on-site carbon reduction contribution for the new-build areas.
- Flexible Energy use:** The scheme aims to be able to use low-to-zero carbon electricity available at off peak periods to charge the buffer vessel energy stores that are part of the electric-powered heat pump system.
- Low Water Use:** Use of water-saving devices to achieve the equivalent of a BREEAM Good standard for the 'Wat 01' water category in the new-build areas.
- Sustainable Transport:** Promote sustainable transport.

2 Policy Review

2.1 NATIONAL PLANNING POLICY FRAMEWORK (NPPF – DECEMBER 2024)

Sustainable Development

The NPPF is very clear on the importance of sustainable development with the first line of the first main chapter stating “*The purpose of the planning system is to contribute to the achievement of sustainable development*”. Sustainable development meaning:

- a. *an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types 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;*
- b. *a social objective – to support 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 well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities’ health, social and cultural well-being; and*
- c. *an environmental objective – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*

At the heart of the Framework is a presumption in favour of sustainable development.

Meeting the Challenge of Climate Change

Section 14 of the NPPF relates to the challenge of climate change. Paragraph 161 states:

“The planning system should support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.”

Conserving and Enhancing the Natural Environment

Section 15 of the NPPF relates to conserving and enhancing the natural environment. Paragraph 199 states:

“...Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications...”

National Carbon Targets

The UK government declared a Climate Emergency and amended the Climate Change Act in June 2019 to set a legally-binding carbon emission target for the UK of “at least 100% of 1990 levels by 2050” i.e. net zero carbon emissions¹.

¹ Climate Change Act 2008 (c. 27) as amended by The Climate Change Act 2008 (2050 Target Amendment) Order 2019 [SI 2019 No. 1056]

2.2 LOCAL POLICY

Mid Sussex Validation Criteria for Planning Applications (2020)

The Mid Sussex Validation Criteria for Planning Applications states that the Energy & Sustainability Assessment should:

“contain all details necessary to demonstrate how the proposed development will be efficient in its use of energy, water and drainage to comply with Policy DP39 of the Mid Sussex District Plan and any relevant Neighbourhood Plan policy”.

The guidance additionally references policy DP39 of the Mid Sussex District Plan 2014-2031.

Adopted Mid Sussex District Plan 2014-2031

Mid Sussex District Council adopted the Mid Sussex District Plan 2014-2031 as a Development Plan Document at its meeting on 28th March 2018.

POLICY DP39: SUSTAINABLE DESIGN AND CONSTRUCTION

Strategic Objectives: 1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change.

Evidence Base: Gatwick Sub Region Water Cycle Study; West Sussex Sustainable Energy Study, Mid Sussex Sustainable Energy Study.

All development proposals must seek to improve the sustainability of development and should where appropriate and feasible according to the type and size of development and location, incorporate the following measures:

- *Minimise energy use through the design and layout of the scheme including through the use of natural lighting and ventilation;*
- *Explore opportunities for efficient energy supply through the use of communal heating networks where viable and feasible;*
- *Use renewable sources of energy;*
- *Maximise efficient use of resources, including minimising waste and maximising recycling/re-use of materials through both construction and occupation;*
- *[Residential only] Limit water use to 110 litres/person/day in accordance with Policy DP42: Water Infrastructure and the Water Environment;*
- *Demonstrate how the risks associated with future climate change have been planned for as part of the layout of the scheme and design of its buildings to ensure its longer term resilience.*

DP42: WATER INFRASTRUCTURE AND THE WATER ENVIRONMENT

Relevant policy:

Non-residential buildings should meet the equivalent of a ‘Good’ standard, as a minimum, with regard to the BREEAM water consumption targets for the development type.

Draft Mid Sussex District Plan 2021 – 2039

The District Plan 2021 – 2039 was submitted for Examination on 8th July 2024, and this is currently undergoing review.

3 Design Approach - Sustainability

3.1 WATER USE

The new-build areas of the development will use water-saving devices to achieve the equivalent of a BREEAM Good standard for the 'Wat 01' water category.

Fitting	Water Consumption
WC	4.0 litres
Shower	8 litres / minute
Washbasin	6 litres / minute
Kitchen tap: kitchenette	7 litres / minute

Table 2: Proposed water fitting standards for units.

The feasibility of grey water recycling has been considered. The piping infrastructure to collect water for each sink/shower would be significant with a corresponding high embodied carbon. Therefore, grey water recycling is not considered feasible.

3.2 AIR QUALITY

The scheme supports air quality by:

- The use of air-source heat pumps for all space heating and hot water use in the new-build areas, which means no fossil fuel combustion for the new-build areas.
- Mechanical ventilation with heat recovery (MVHR) offers a means for occupants to filter fresh air.
- Construction environmental management plan (CEMP) to incorporate best practice for air quality and dust control.

3.3 NOISE

Quality of life is improved by reducing the number of people adversely affected by noise and promoting more quiet and tranquil spaces. The scheme supports low noise impacts:

- High air tightness and MVHR reduces external noise ingress for occupants.
- Ensuring noise emissions from air source heat pump system are mitigated by means of a suitably designed acoustic enclosure.

3.4 BIODIVERSITY & URBAN GREENING

Please refer to the landscaping report prepared by Hill-Wood & Co.

3.5 SUSTAINABLE TRANSPORT

The site has links to low energy public transportation, e.g. it is a half an hour walk to the Station Road bus stop or a 20-minute taxi ride to the Balcombe train station which is on the Thameslink line.

3.6 SUSTAINABLE MATERIALS & MINIMISING WASTE

New materials will be sustainably procured and using local supplies where feasible, following the BRE Green Guide to Specification². The construction build-up for each element can be rated from A+ to E where A+ is least likely to affect the environment and E is likely to have the most impact. The materials for the development will aim to achieve a rating between A to C where feasible.

All timber used during the site preparation and construction will be Forest Stewardship Council (FSC) certified or Programme for the Endorsement of Forestry Certification (PEFC) and all non-timber materials are to be sourced from organisations with an environmental management system such as ISO 14001 or BES 6001. This standard enables construction product manufacturers to ensure and then prove that their products have been made with constituent materials that have been responsibly sourced. The standard describes a framework for the organisational governance, supply chain management and environmental and social aspects that must be addressed in order to ensure the responsible sourcing of construction products.

A construction waste recycling requirement will be included in the contractor specification to ensure a construction waste management plan is in place. This will include ways to design out waste, reduce amounts of packaging and to participate in packaging take back schemes as well as ensuring that all waste is sent to private local dedicated construction waste plants with very high landfill diversion rates.

The scheme has a dedicated waste storage and segregation area.

3.7 DEMAND SIDE RESPONSE

Demand side flexibility refers to the ability of a system to reduce or increase energy consumption for a period of time in response to an external driver (e.g. energy prices or signals from network managers).

Smart buildings have been identified and acknowledged as key enablers of future energy systems for which there will be a larger share of distributed and renewable power and heat generation. Demand side flexibility can allow demand/supply matching and make best use of existing network connections and local renewable energy generation capacity.

The scheme facilitates the use of Demand Side Response and reduces peak energy demand by:

- The use of electrical equipment such as heat pumps which can be turned up/down.
- Energy storage vessels that are part of the electric-powered heat pump system.
- Additional energy storage capacity via thermally massive internal floor slabs.
- Limiting demand such as peak solar gains (refer to cooling and overheating section).
- The installation of smart meters.
- The use of on-site generation, solar PV.

Integration has carried out a research project which quantifies the savings from flexible hot water and heating use. The study analysed real-life hourly carbon factors from the UK's electricity grid taken over a 12-month period. The graph below illustrates the diurnal cycling of carbon factors for 3 example days. As can be seen there are frequent opportunities where carbon savings can be made by using electricity during low carbon periods and avoiding use during periods where the carbon intensity is high. For instance, by charging the buffer vessel energy stores that are part of the electric-powered heat pump system at night and using the energy during the day.

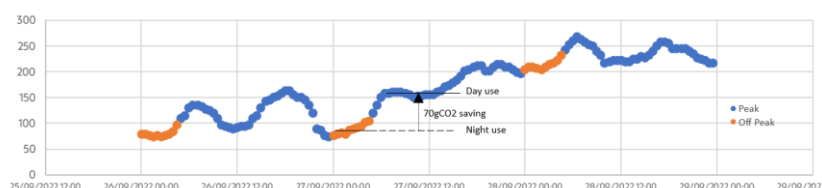


Figure 8: Example daily carbon intensity variations (example off peak thermal store charging from midnight to 4am shown in orange).

As the UK electricity grid continues to decarbonise, the performance benefits will increase significantly. As well as saving money on energy bills by being flexible, energy users can also earn money. The first demand side response scheme has already been launched by National Grid, marking a new era of energy use. This scheme highlights the value to shifting electric use during peak times. National Grid paid £3 for each kWh shifted which is more than seven times the value of daytime electricity and more than 23 times the cost of nighttime electricity. This means shifting 1 kWh of energy use from peak times allows you to use 23 kWh at nighttime for free.

² <https://www.bregroup.com/greenguide/podpage.jsp?id=2126>

4 Design Approach - Energy

4.1 THE ENERGY HIERARCHY

The energy hierarchy sets out a three-stage approach to strategic decision-making for the reduction of energy and associated greenhouse gas emissions. The evaluation of the scheme’s carbon emissions, as presented in the subsequent sections, follows this structure.

BE LEAN - Minimise Energy Demand

Passive design such as high-performance building envelope, optimising form, orientation and site layout, natural ventilation with thermal mass, daylight and solar shading, as well as active design measures such as LED lighting and efficient mechanical ventilation with heat recovery.

BE CLEAN - Deliver Energy Efficiently

Efficient energy provision for space heating, hot water and cooling infrastructure.

BE GREEN - Use Renewable Energy

Energy supply derived from local renewable resources including solar, wind energy, hydropower and local heat sources such as geothermal energy. Provision of non-local options can also be considered.

4.2 CLIMATE ANALYSIS

The local climate is heating dominated, hence the key passive measures to be implemented are high levels of insulation and air-tightness. Temperatures in the summer can occasionally rise above comfortable levels and this will tend to intensify as a consequence of climate change and further urbanisation.

The diurnal temperature variations are high with an average daily temperature swing of 8-10°C even during peak summer. This creates potential for passive summertime cooling using night-time cooling via openable windows or mechanical ventilation.

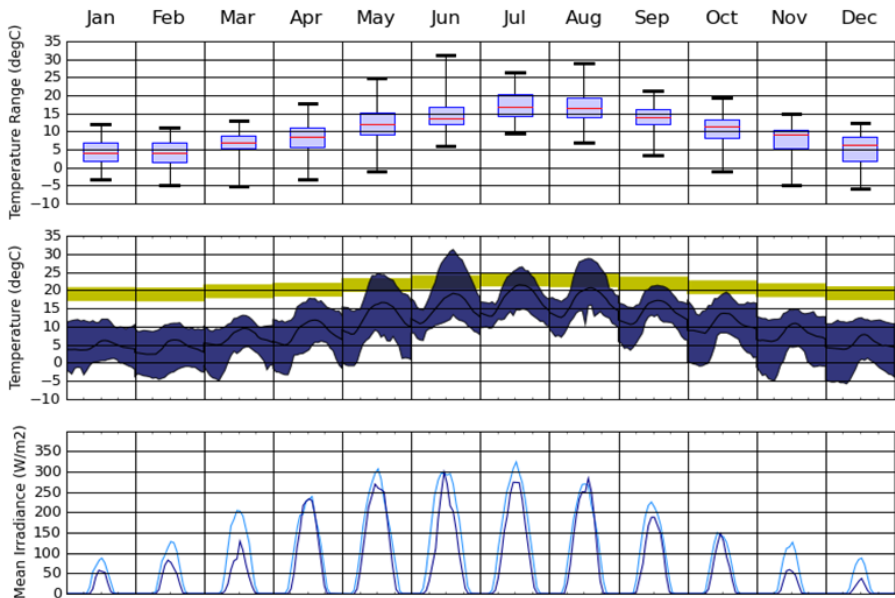


Figure 9: Average historic local climate data

4.3 BUILDING FABRIC PERFORMANCE & INSULATION

High levels of insulation are proposed as summarised later in this section. The thermal performance of all exposed elements equals or exceeds the minimum requirements for Building Regulations 2021. This will significantly reduce energy consumption and ensure optimum occupant comfort all year round by retaining heat in the winter and reducing heat gains in the summer.

This is particularly relevant for glazed surfaces that can be a cause of overheating in summer or overcooling and condensation formation in winter. High-performance glazing will also improve occupant comfort by reducing radiant temperature asymmetry which can be a comfort issue especially during the winter months.

4.4 AIR TIGHTNESS AND INFILTRATION

A high target air-permeability rate has been selected for the new-build areas. The key to achieving high levels of airtightness is the build quality of construction.

NATURAL VENTILATION & THERMAL MASS

Daytime natural ventilation can assist in removing excess heat during the mid-season and summer months and enables the provision of high air quality. When used in combination with exposed thermal mass, natural ventilation will reduce high internal daily temperature fluctuations and minimise the overheating risk in the summer. Therefore, occupant comfort can be maintained with reduced reliance on mechanical cooling systems.

The summer overheating strategy includes openable windows, solar control glazing (g-value 0.4) for key sections of south and west-facing glazing and for non-North-facing rooflights, and shading in the form of deep window reveals, floor overhangs and vertical pillars to reduce direct solar gains, as well as heavyweight thermally massive structure including floor/ceiling slabs.

4.5 SOLAR EXPOSURE & DAYLIGHT

Maximising exposure to solar energy and daylight is essential to reducing reliance on artificial lighting, reducing winter daytime heating requirements, and contributing to the general wellbeing of occupants.

The site has good access to solar energy, which makes the development suitable for solar energy harvesting.

Fenestration on the facades maximises natural daylight to reduce artificial lighting energy use. Internal shading can be incorporated to minimise the risk of overheating and glare without compromising daylight availability during the rest of the year.

4.6 ACTIVE BUILDING SERVICES SYSTEMS

Space heating and domestic hot water (DHW) in the new-build areas, as well as hot water in the existing areas, will be provided by a heat pump system. In the existing areas, space heating will be provided by a boiler system. Energy use associated with DHW will be minimised by the use of water efficient fittings.

High-efficiency mechanical ventilation with heat recovery will be used in the new-build areas. The systems will have a summer bypass to support night-time free cooling of thermal mass.

Low-energy fixed lighting, generally comprising of high-efficiency LED fittings, will be installed throughout the development with timer, daylight dimming, and motion-sensor control as appropriate.

All building services systems will be in accordance with and exceed the relevant efficiency requirements outlined in the Building Service Compliance Guide.

4.7 COOLING & OVERHEATING

The cooling and overheating strategies are summarised in the table below using the cooling hierarchy which has been applied to the design.

Hierarchy Measure	Application to proposed development
1. Minimise Internal Heat Gains	- Low energy LED lighting. - High insulation on hot water distribution.
2. Minimise External Heat Gains	- High levels of fabric insulation. - Low g-value windows 0.4 for key sections of south and west-facing glazing and for non-North-facing rooflights - Deep window reveals, floor overhangs and vertical pillars providing external shading.
3 & 4 Heat Management and Passive Ventilation	- Openable windows. -Night-time ventilation strategy where feasible.
5. Mechanical Ventilation	- Mechanical Ventilation with Heat Recovery (MVHR) is specified in the new-build areas. Systems will have "heat recovery bypass" mode in order to be operable in summer night-cooling mode.
6. Active Cooling	- None.

Table 3: Cooling hierarchy

5 Carbon Emissions – New-Build Extension

5.1 BASELINE (NEW-BUILD EXTENSION)

Energy demand and annual carbon emissions are calculated using the BRE accredited energy compliance software SBEM for the new-build areas.

The amount of carbon emission reductions achieved by the proposed scheme is compared to the notional Target Emission Rate (TER) which forms the baseline comparison target. The notional building is produced by the energy model and intends to replicate the actual building in terms of area, form, orientation and usage. The fabric parameters and system efficiencies for this notional building meet, and in some parts exceed, the minimum requirements for compliance with Part L of the Building Regulations, as summarised in the table below.

The notional values for the new build non-domestic areas are:

Element	Notional Building (New-Build)
External walls U-value	0.18 W/m ² /°C
Floor U-value	0.15 W/m ² /°C
Roof U-value	0.15 W/m ² /°C
Windows U-value (g-value)	1.4 W/m ² /°C (0.29)
Rooflights U-value (g-value)	2.1 W/m ² /°C (0.40)
External doors (including glazed) U-value	High usage entrance and pedestrian doors: 1.9 W/m ² /°C
Air tightness	3.0 m ³ /m ² /h @50Pa
Ventilation type	Same as actual building (if mechanical, heat recovery efficiency of 76%)
Heating	Electric heat pump (system SCOP 2.64)
Hot water	Electric heat pump (generator SCOP 2.86)
Wastewater heat recovery (WWHR)	None
Hot water storage	For high HW demand NCM activities only
Lighting	100% low energy lighting (95 lm/W)
Air-conditioning	Same as actual building (if air-conditioning present, SSEER of 4.4 or 2.7 in mixed-mode)
Photovoltaic (PV) system	None

Table 4: Notional Building Specification for New-Build Non-Domestic (NCM modelling guide 2021)

5.2 “BE LEAN” (NEW-BUILD EXTENSION)

As part of the “Be Lean” approach seeking to minimise energy demand, the building fabric has been specified to meet or exceed the minimum fabric parameters outlined in Part L of the Building Regulations 2021, as per the table below.

Element	Proposed new-build areas
External walls U-value	0.15 W/m ² /°C
Floor U-value	0.14 W/m ² /°C
Roof U-value	0.14 W/m ² /°C
Windows U-value (g-value)	1.4 W/m ² /°C (g=0.4 – 0.63)
Rooflights U-value (g-value)	1.4 W/m ² /°C (g=0.4 – 0.63)
External doors (including glazed) U-value	High usage entrance and pedestrian doors: 1.4 W/m ² /°C (g=0.4 – 0.63)
Air tightness	3.0 m ³ /m ² /h @50Pa
Ventilation type	Mechanical ventilation with heat recovery to key rooms (80% efficiency, SFP 1.5 W/l/s, demand-led speed control based on gas sensors)
Wastewater heat recovery (WWHR)	None
Hot water storage	600 litres, 0.005kWh/l/day storage losses
Lighting	100 lm/W (occupancy sensing in ensembles and corridors)

Table 5: Proposed new-build development (Be Lean)

5.3 “BE CLEAN” (NEW-BUILD EXTENSION)

Policy DP39 of the Adopted Mid Sussex District Plan 2014-2031 states that proposed developments should “*explore opportunities for efficient energy supply through the use of communal heating networks where viable and feasible*”. As this is a small scheme, connection to any existing or future third-party heat networks is not considered viable for this development.

With the decarbonisation of the electricity grid, it is also preferential from a carbon emissions point of view to use an all-electric energy strategy rather than CHP.

Efficient energy provision for space heating and hot water is proposed for the new-build areas, avoiding fossil fuels on site and using electricity for 100% of energy requirements, as shown in the table below.

No cooling is provided.

Element	Proposed new-build areas
Heating	Air source heat pump (generator SCOP 3.0)
Hot water	Air source heat pump (generator SCOP 3.0)
Air-conditioning	None

Table 6: Proposed new-build development (Be Clean)

5.4 “BE GREEN” (NEW-BUILD EXTENSION)

A renewable energy feasibility exercise has been carried out in order to determine the most viable option(s) for the new-build areas of the development (see the appendix). The viable technology options are air source heat pumps (ASHPs) and solar photovoltaic (PV), which are presented below.

Air Source Heat Pumps

Air source heat pumps (ASHPs) extract heat energy from the air which is naturally replenished by renewable solar energy. An ASHP can create around 3kW of renewable energy for every 1kW of electrical power it consumes, which makes it one of the lowest carbon reliable heating technologies available.

Air source heat pumps are proposed for all space heating and hot water in the new-build areas, and for all hot water in the existing areas.

Photovoltaic (PV) panels

A ground-mounted photovoltaic array is proposed. Local shading is considered to be low.

Total installed capacity of the system:	35.4 kWp
Panel inclination:	15 degrees
Panel orientation:	Southerly
Energy generation:	27,774 kWh/a
Carbon emission reduction:	3.8 tonnes CO ₂ /a

“Be Green” Carbon Emissions

The “Be Green” CO₂ emissions associated with regulated energy consumption (Building Emission Rates, BER) are given below for the new-build areas in relation to the baseline Target Emission Rates (TER).

The total Be Green saving for the new-build areas is 72%.

Area (m ²)	TER (kg.CO ₂ /m ² /yr)	BER (kg.CO ₂ /m ² /yr)
865.5	6.15	1.70

Table 7: Be Green regulated emissions for new-build areas

6 Carbon Emissions – Existing Building

6.1 PROPOSED STRATEGY (EXISTING BUILDINGS)

Where fabric is being upgraded in the existing buildings this will meet, and in some parts exceed, the minimum requirements for compliance with Part L of the Building Regulations. The proposed refurbishment strategy for the existing manor includes where feasible:

- Roof: 300mm insulation in the loft.
- External Walls: 50 – 80mm internal solid wall insulation to first and second floor.
- Floors: Insulation to ground floor from undercroft (depending on accessibility).
- Glazing: secondary glazing to all the first and second floor windows.

7 Summary

7.1 CARBON EMISSIONS SUMMARY

The proposed new-build areas of the development are shown to achieve:

- 72% improvement in regulated CO₂ emissions compared to the standard set out by Part L 2021.

The proposed design achieves this via high-performance building fabric, passive low energy design and low energy building services systems such as mechanical ventilation with heat recovery (MVHR) and LED lighting.

Following a Low and Zero Carbon (LZC) technology feasibility study, it is proposed to provide 35.4 kW_{peak} of ground-mounted solar photovoltaic (PV) modules and 100% of heating and hot water to the new-build areas via heat pumps.

The table below shows the regulated and unregulated energy use for the new-build areas for the proposed design compared to the Part L baseline.

Carbon dioxide emissions (Tonnes CO ₂ per annum)	Regulated	Unregulated
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Proposed Design	1.5	3.6
Savings from Baseline	3.8 (72%)	-

Table 8: New-build regulated and unregulated CO₂ emissions for proposed design compared to Part L baseline

7.2 SUSTAINABILITY SUMMARY

In addition to the low carbon performance set out above, the scheme benefits from several sustainability aspects, including the use of water saving devices to achieve the equivalent of a BREEAM Good standard for the 'Wat 01' water category in the new-build areas. Health and wellbeing are supported by aspects such as high levels of fresh air provided by mechanical ventilation with heat recovery.

The site has links to low energy public transportation, e.g. it is a half an hour walk to the Station Road bus stop or a 20-minute taxi ride to the Balcombe train station which is on the Thameslink line.

The scheme is also demand-side response (DSR) enabled through the provision of an electric-powered heat pump system with buffer vessel energy stores in order to work with National Grid signalling / time of use tariffs. This supports the transition to low carbon electricity and reduces energy costs.

7.3 COST OF ENERGY SUMMARY

The scheme aims to protect the consumer from high energy prices by:

- Reducing energy demands.
- Generating energy onsite via solar PV.
- Promoting the use of smart energy tariffs to provide cheaper electricity during non-peak times. This means the buffer vessel energy stores can be charged at night by the heat pump when electricity costs are much lower.

Appendix A: Technology Feasibility Study Summary

The overall summary of the feasibility exercise is presented below.

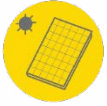
Technology	Assessment/Viability		
 Wind Power	Wind turbine installed on the roof of the development.	Due to the high cost per kW for smaller building-mounted turbines and the impacts in terms of visual, noise and shadow flicker, wind turbines are not considered a viable technology for the development.	CONCLUSION: NOT CONSIDERED FEASIBLE
 Ground Source Heat Pumps	Open or closed loop GSHP system requiring extraction of ground water and / or deep boreholes.	Ground-source heat pumps are one of the lowest carbon methods of providing reliable low-carbon heat and require low maintenance. However, they have high installation costs.	CONCLUSION: NOT CONSIDERED FEASIBLE
 Air Source Heat Pumps	Electric powered external plant serving each unit providing heating and hot water	Air source heat pumps are one of the lowest carbon methods of providing reliable low-carbon heat. They require low maintenance. External visual or noise impacts can be suitably mitigated by an acoustic enclosure.	CONCLUSION: CONSIDERED FEASIBLE
 Solar Thermal Collectors	Solar thermal panels providing hot water heating	Roof areas have some potential for solar thermal energy collection. However, the integration with a heat pump would result in a complex system. Therefore, solar PV is preferred over solar thermal technology.	CONCLUSION: NOT CONSIDERED FEASIBLE
 Solar Photovoltaic Panels	Photovoltaic panels (PV) provide electricity directly to the scheme, exporting any surplus production to the grid.	The development has potential for ground-mounted solar PV. This technology also supports air source heat pumps	CONCLUSION: CONSIDERED FEASIBLE
 Combined Heat & Power (CHP)	Gas powered turbine generating electricity on site. Waste heat is also made available for on-site use	Carbon offsetting potential of CHP is significantly reduced now that the UK's electricity grid is much cleaner after the increase in renewable energy deployment and decrease in coal generation.	CONCLUSION: NOT CONSIDERED FEASIBLE
 Energy Storage	Stand-alone battery storage	Battery scheme is not considered beneficial as there are limited carbon saving benefits due to the significant daytime energy use on site relative to the amount of PV installed. In addition, batteries have high embodied carbon emissions and initial capital costs.	CONCLUSION: NOT CONSIDERED FEASIBLE
 Biomass Heating	Biomass-fired community heating system.	Biomass heating is an established technology but has high maintenance requirements, fuel storage and delivery issues and is a source of increased pollution, notably particulates (PM10), SO ₂ and NO _x emissions.	CONCLUSION: NOT CONSIDERED FEASIBLE

Table A1: Summary of Low and Zero Carbon Study Analysis Results

Appendix B: SBEM BRUKL

This appendix contains the SBEM BRUKL document.

BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Wickenden Manor Extension

As designed

Date: Wed Aug 27 11:44:36 2025

Administrative information

Building Details

Address: Address 1, Address 2, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.27

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

Foundation area [m²]: 294.15

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	6.15
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	1.7
Target primary energy rate (TPER), kWh _{PE} /m ² annum	65.92
Building primary energy rate (BPER), kWh _{PE} /m ² annum	15.27
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	SP000007_W-1
Floors	0.18	0.11	0.14	SP00000A_F
Pitched roofs	0.16	0.14	0.14	L0000009_C
Flat roofs	0.18	0.14	0.14	L0000009_C
Windows** and roof windows	1.6	1.4	1.4	SP00000C_W-1_O0
Rooflights***	2.2	1.4	1.4	L0000010_C_O0
Personnel doors^	1.6	1.4	1.4	SP000007_W0_O0
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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/m ² K 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	>0.95

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- SYST0000-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3	0.001
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

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
BS Circulation	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Circulation/Stairs	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Priest Bedroom 1 - Ensuite	0.3	-	-	-	-	-	-	-	-		-	N/A
BS Priest Bedroom 2 - Ensuite	0.3	-	-	-	-	-	-	-	-		-	N/A
BS Priest DDA Bedroom - Ensuite	0.3	-	-	-	-	-	-	-	-		-	N/A
BS Priest Dining/Kitchen	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Priest Dining/Kitchen - WC	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Priest Lounge	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Priest Oratory	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Rainwater Harvest	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Staff Facilities - Bathroom	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Staff Facilities - Dining/Kitchen	-	-	-	-	1.5	-	-	-	-		0.8	N/A
BS Staff Facilities - Lounge	-	-	-	-	1.5	-	-	-	-		0.8	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
L00 Ante Dining Room		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L00 Changing/WCs		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L00 Circulation/Stairs		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L00 Dining Room (36P)		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L00 Kitchen		-	-	-	-	-	-	-	-	1	-	N/A
L00 Laundry		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L00 Office		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L00 Servery		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L00 Staff Oratory (4P)		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L01 Circulation/Stairs S		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L01 Sitting Room		-	-	-	-	1.5	-	-	-	-	0.8	N/A
L01 Staff Bathroom		0.3	-	-	-	-	-	-	-	-	-	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
BS Circulation		100	-	-
BS Circulation/Stairs		100	-	-
BS Confession Rooms		100	-	-
BS Priest Bedroom 1		100	-	-
BS Priest Bedroom 1 - Ensuite		100	-	-
BS Priest Bedroom 2		100	-	-
BS Priest Bedroom 2 - Ensuite		100	-	-
BS Priest DDA Bedroom		100	-	-
BS Priest DDA Bedroom - Ensuite		100	-	-
BS Priest Dining/Kitchen		100	-	-
BS Priest Dining/Kitchen - WC		100	-	-
BS Priest Lounge		100	-	-
BS Priest Oratory		100	-	-
BS Rainwater Harvest		100	-	-
BS Staff Facilities - Bathroom		100	-	-
BS Staff Facilities - Dining/Kitchen		100	-	-
BS Staff Facilities - Lounge		100	-	-
L00 Ante Dining Room		100	-	-
L00 Changing/WCs		100	-	-
L00 Circulation/Stairs		100	-	-
L00 Confession Rooms		100	-	-
L00 Dining Room (36P)		100	-	-
L00 Food Storage		100	-	-
L00 Kitchen		100	-	-
L00 Laundry		100	-	-
L00 Office		100	-	-
L00 Public Oratory (40P)		100	-	-

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
L00 Served		100	-	-
L00 Staff Oratory (4P)		100	-	-
L01 Circulation/Stairs N		100	-	-
L01 Circulation/Stairs S		100	-	-
L01 Lift		100	-	-
L01 Roof Plant		100	-	-
L01 Sitting Room		100	-	-
L01 Staff Bathroom		100	-	-
L01 Staff Bedroom E		100	-	-
L01 Staff Bedroom W		100	-	-
L01 Storage		100	-	-
L01 Storage		100	-	-
L02 Circulation/Stairs S		100	-	-
L02 Lift		100	-	-

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?
BS Confession Rooms	N/A	N/A
BS Priest Bedroom 1	NO (-4%)	NO
BS Priest Bedroom 2	NO (-3.2%)	NO
BS Priest DDA Bedroom	NO (-16.5%)	NO
BS Priest Dining/Kitchen	NO (-51%)	NO
BS Priest Lounge	NO (-51.3%)	NO
BS Priest Oratory	NO (-75%)	NO
BS Staff Facilities - Dining/Kitchen	NO (-75.2%)	NO
BS Staff Facilities - Lounge	NO (-78.7%)	NO
L00 Ante Dining Room	N/A	N/A
L00 Confession Rooms	NO (-69.9%)	NO
L00 Dining Room (36P)	NO (-54%)	NO
L00 Office	NO (-70.3%)	NO
L00 Public Oratory (40P)	NO (-63.7%)	NO
L00 Staff Oratory (4P)	YES (+226.3%)	NO
L01 Sitting Room	N/A	N/A
L01 Staff Bedroom E	N/A	N/A
L01 Staff Bedroom W	YES (+41.5%)	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?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	865.5	865.5
External area [m ²]	1766	1766
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	391.32	564.92
Average U-value [W/m ² K]	0.22	0.32
Alpha value* [%]	36.84	25.57

* 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
4	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
27	Residential Spaces
69	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.1	9.05
Cooling	0	0
Auxiliary	6.16	4.21
Lighting	7.38	5.83
Hot water	22.36	25.2
Equipment*	30.33	30.33
TOTAL **	42	44.29

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	32.09	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>32.09</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	139.46	151.87
Primary energy [kWh _{PE} /m ²]	15.27	65.92
Total emissions [kg/m ²]	1.7	6.15

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	61.8	77.6	6.1	0	6.2	2.82	0	3	0
Notional	86	65.8	9.1	0	3	2.64	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