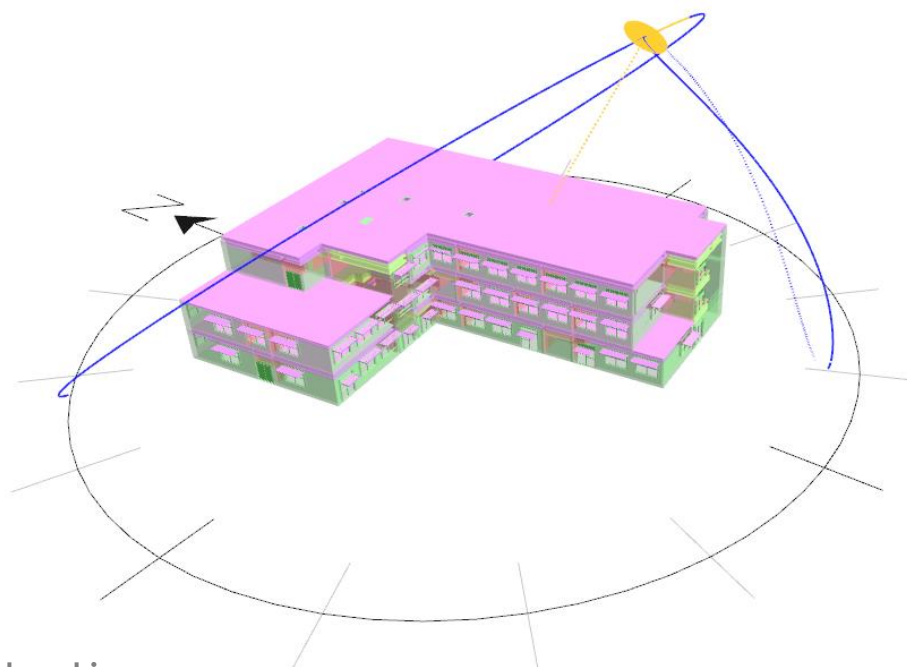


Hinckley School – Proposed New STEM Building Energy Strategy Report

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Executive Summary

This is the Energy Strategy Report proposed for a new school building at the Hinckley School, in Hinckley, Leicestershire.

Consideration has primarily been given to the Planning Policy context prior to establishing an Energy Strategy, with a priority given to efficiency. Low carbon and renewable technologies have also been considered in the context of their environmental feasibility and financial viability.

A Net Zero Carbon Operational Energy Building for the proposed STEM Building have been targeted in line with the Hinckley and Bosworth Borough Council aspirations and within the ethos of the National Planning Policy Framework (NPPF).

A Part L2 2021 Building Regulations compliant building has been calculated to produce a Baseline building from which carbon dioxide emission reductions can be determined. Further to this, additional calculations have been produced utilising Passive measures such as improvements to Building Fabric and Active measures such as high efficiency Building Services.

It is proposed that Heat Pump systems will be installed to generate Heating and Domestic Hot Water and a Photovoltaic system that can generate 236,979 kWh/annum have been proposed for this development to meet the Net Zero Carbon Operational Energy Target proposed by Hinckley and Bosworth Borough Council.

The calculated energy consumption and carbon dioxide figures in this report are to be utilised only for the compliance of Planning Policy and for the determination of which Low Zero Carbon technologies may be the most suitable for this project. Actual energy consumption of the proposed building may be different to that calculated in this report, due to the operational use of the building, such as occupancy levels and unregulated energy use.

1.0 Introduction

1.1 Energy Strategy

The Energy Strategy Report proposed for the new school building at the Hinckley School is set out in the following sections of this report.

1.2 The Proposed Development

A new secondary school STEM Building is to be constructed, inclusive of teaching spaces, laboratories, circulation, offices, stores and toilets. The project is a new build three storey STEM Building located in the eastern part of Hinckley on the B4668.

1.3 Report Objective

The objective of this Energy Strategy is to outline how energy efficiency, low carbon and renewable technologies have been considered as part of this project which are the requirements of the National Planning Policy Framework (NPPF) and Hinckley and Bosworth Borough Council Core Strategy.

1.4 Methodology

Consideration has primarily been given to the Planning Policy context which is detailed in Section 2.0. Other considerations are addressed in Section 3.0.

The subsequent sections aim to present how energy reduction been implemented for the proposed scheme. Passive and Active design and energy efficiency are discussed in Section 4.0, and the feasibility of Low and Zero Carbon and Renewable Technologies are addressed in Section 5.0.

Section 6.0 provides Additional Sustainability Considerations, Section 7.0 provides a summary of Energy and Carbon Dioxide savings, Section 8.0 provides Running Cost information and Section 9.0 provides conclusions of the preferred options for the proposed new STEM Building.

1.5 Modelling Base Drawings

The Main Building has been modelled based upon the latest Architects drawings provided by Sense of Space, models and documents as of 27th January 2023.

1.6 Building Geometry

Based on the architects' drawings provided, a three-dimensional model has been constructed using the building designer integrated in the EDSL TAS software suite. The model images are as follows:

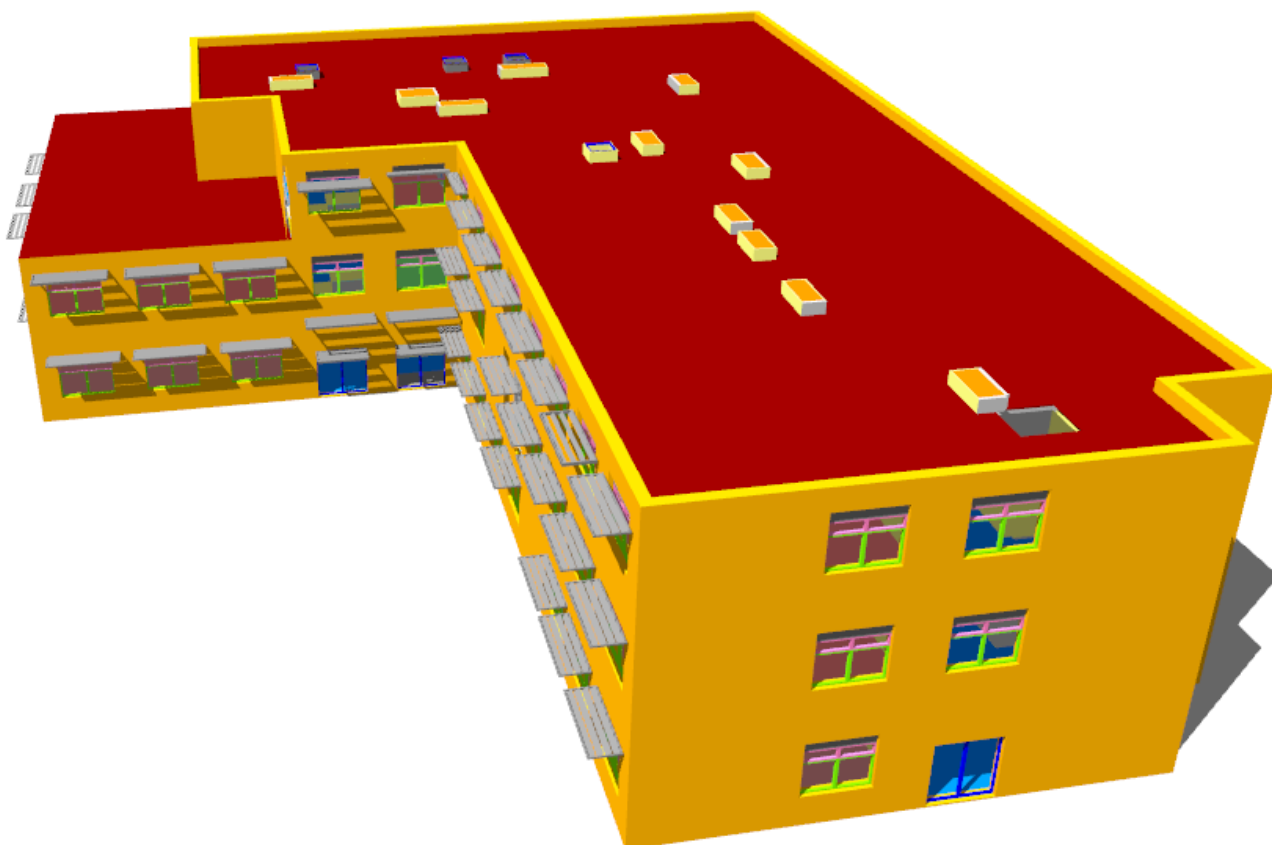


Figure 1.1 – South Elevation View

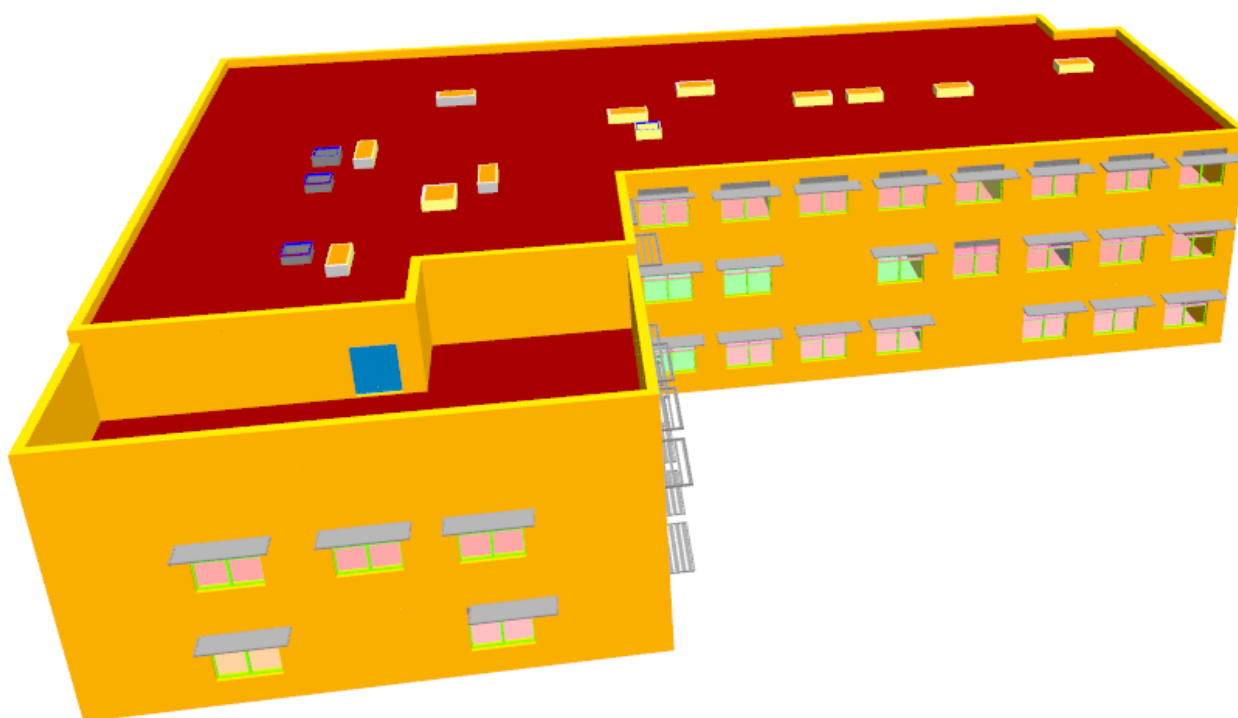


Figure 1.2 – West Elevation View

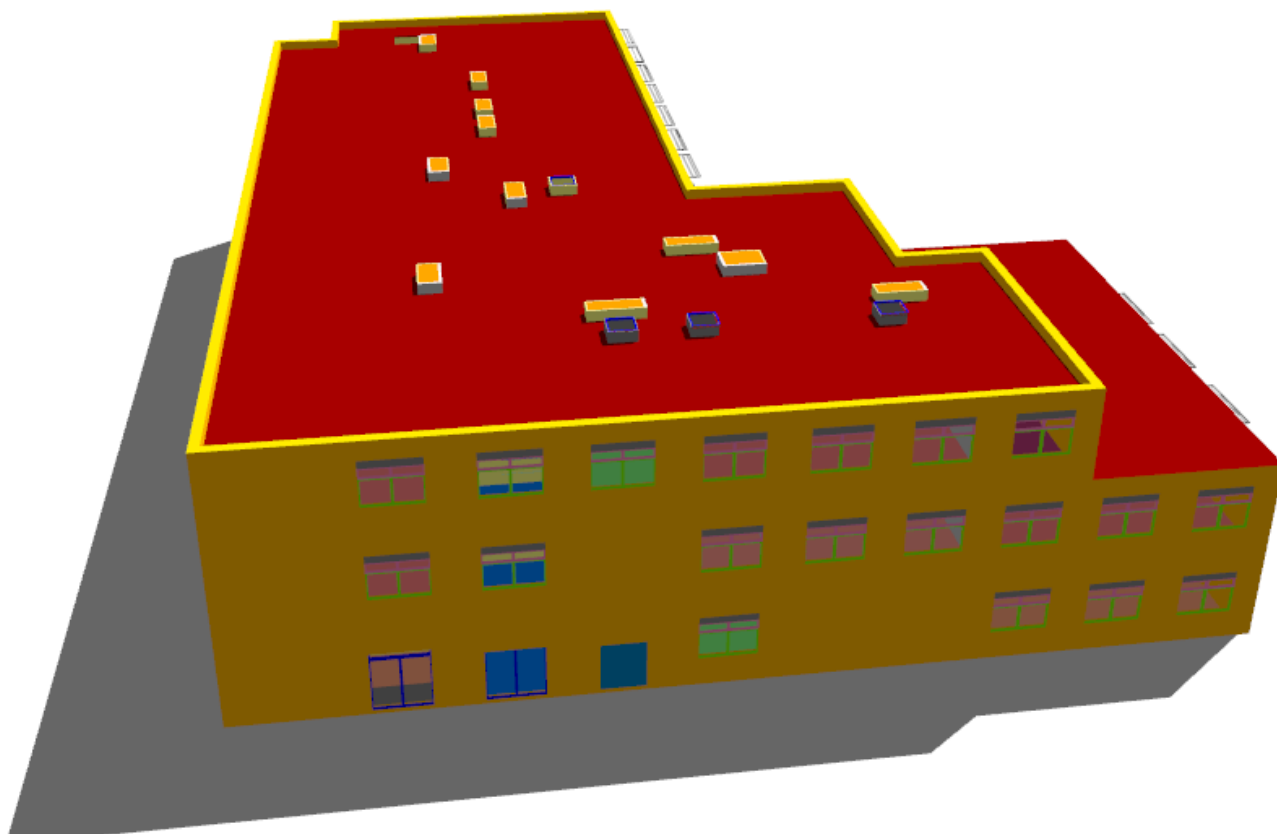


Figure 1.3 – North Elevation View

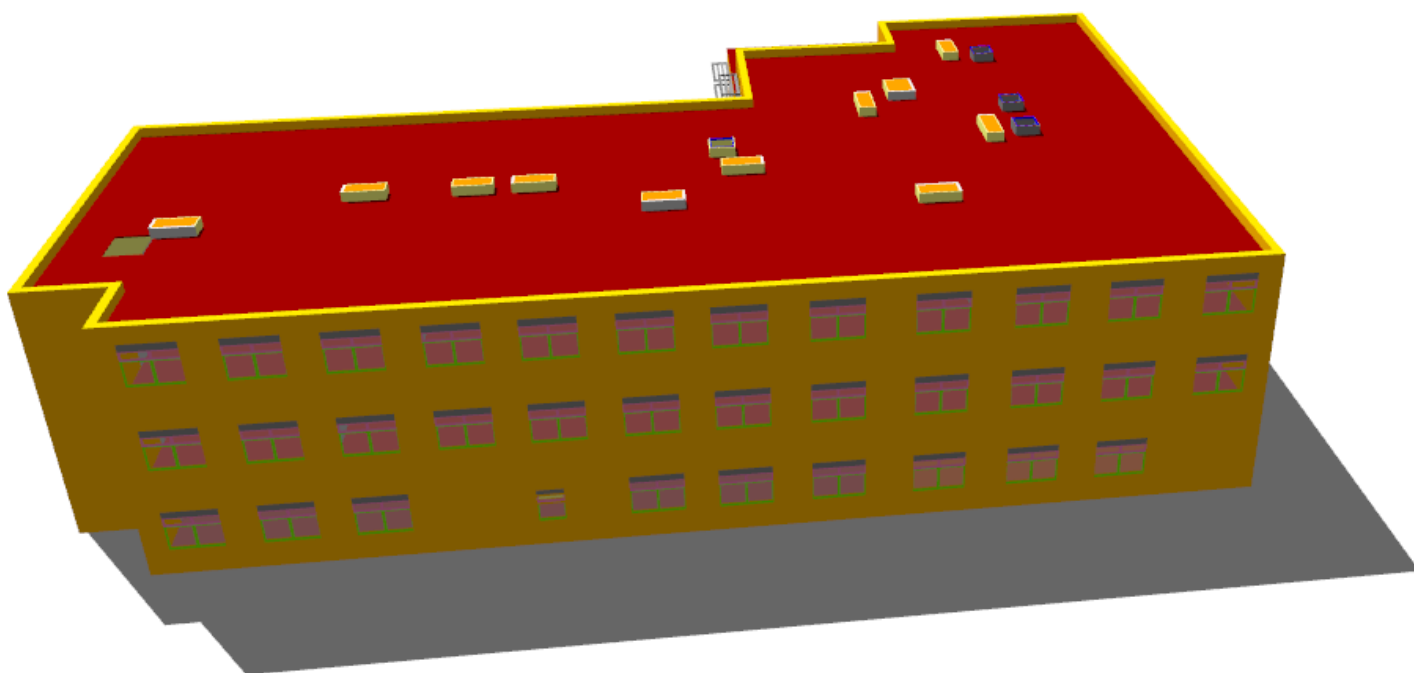


Figure 1.4 – East Elevation View

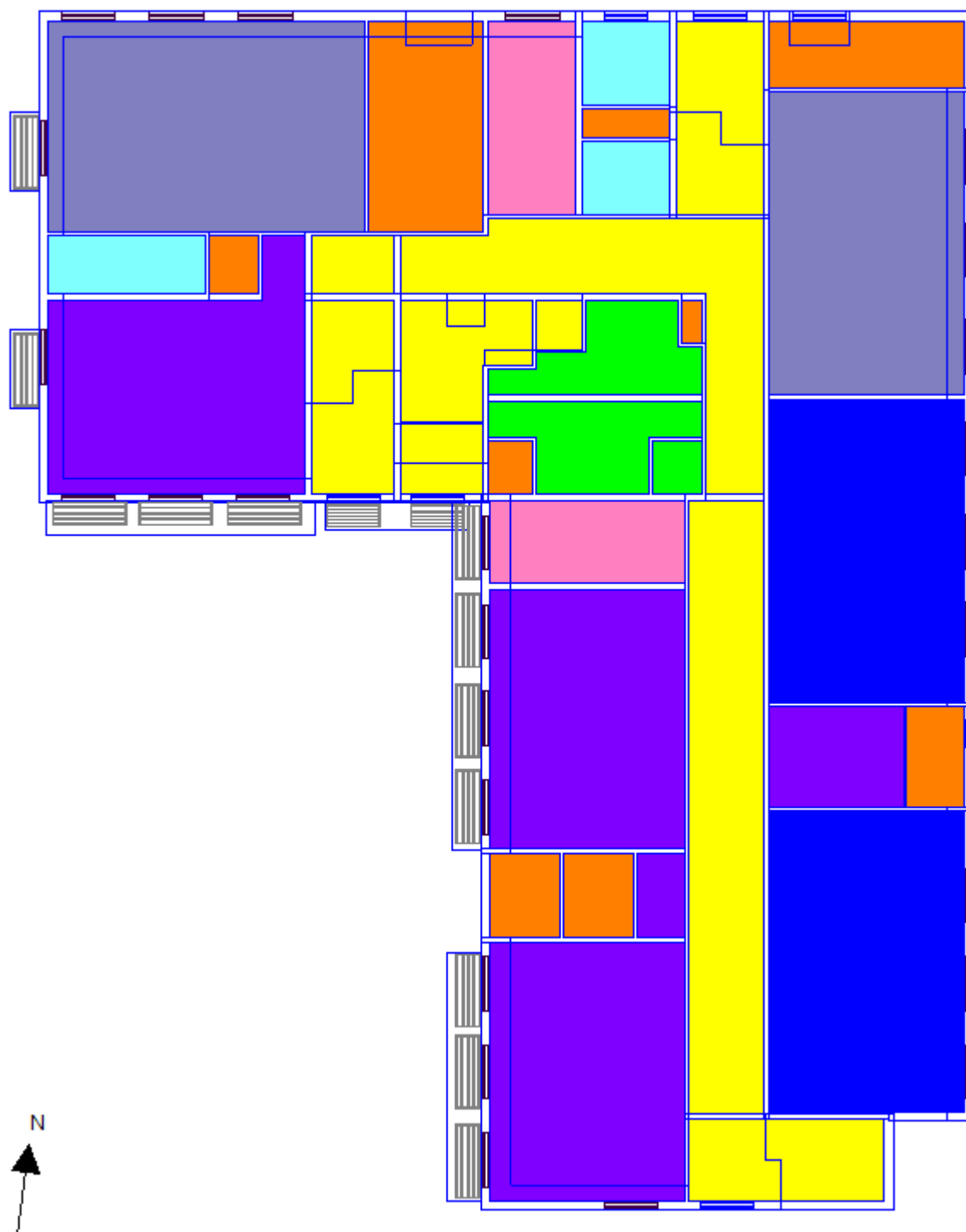


Figure 1.5 – Ground floor plan



Figure 1.6 – First floor plan

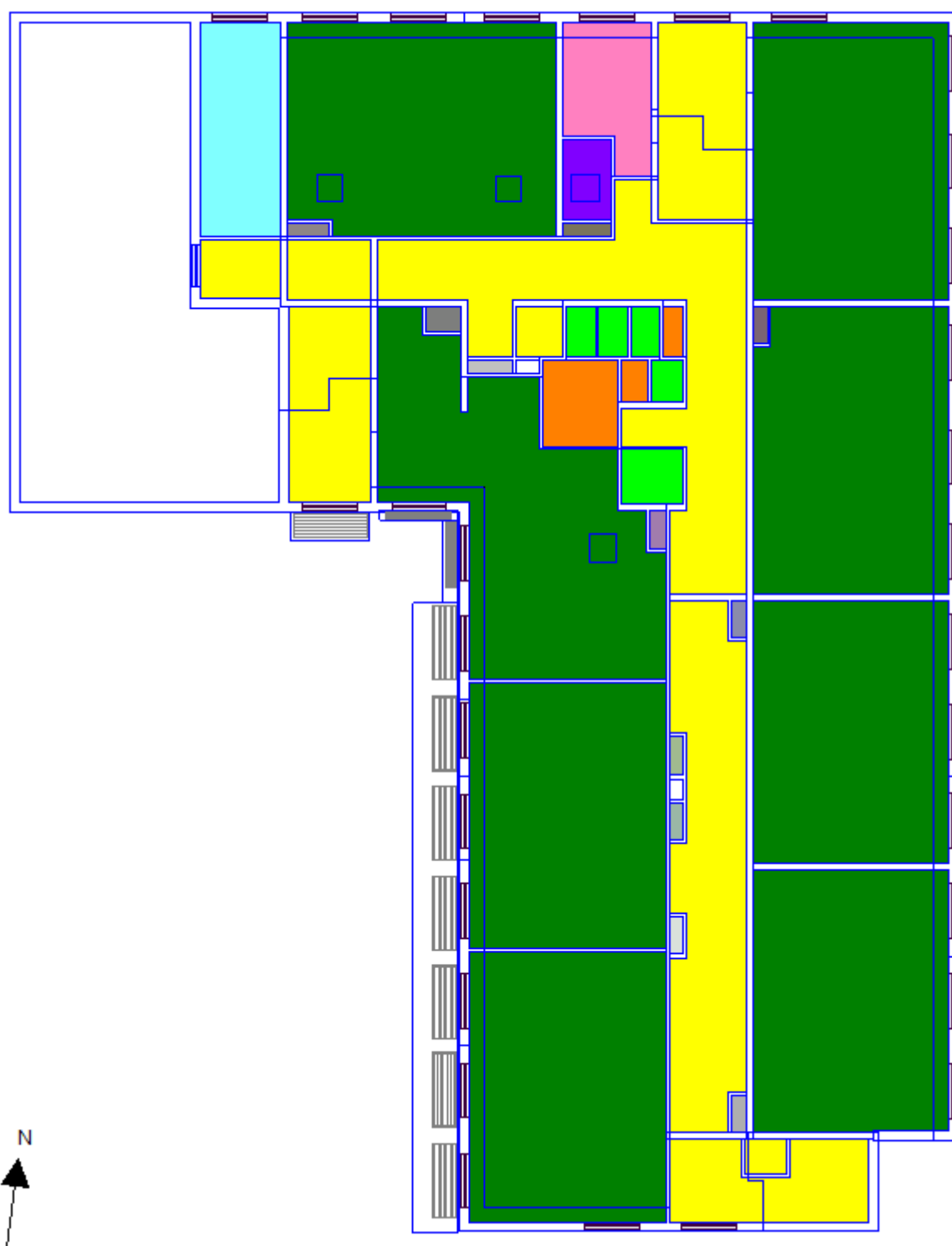


Figure 1.7 – Second floor plan

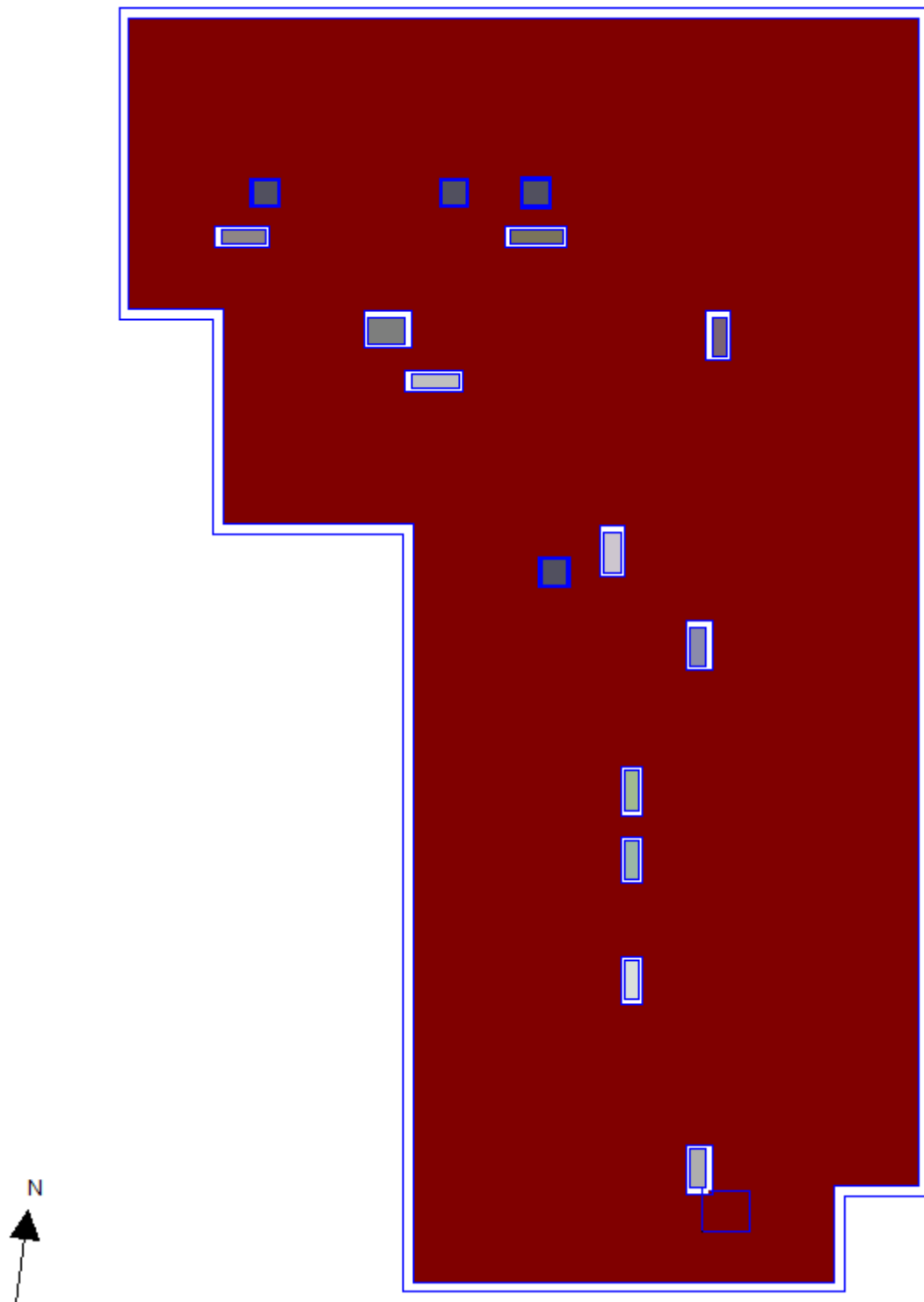


Figure 1.8 – Roof plan

The louvres and windows shown in these images are shown for illustration only. For accurate window sizes and opening elements refer to Sense of Space Architects drawings and details.

1.7 Environmental Conditions

The following information provides details of how the proposed new development has been dynamically modelled.

- Weather File: CIBSE Test Reference Year (TRY) for Nottingham (Nearest suitable location)
- Calendar Type: NCM Schools 2010/2013
- Internal Conditions: D1 Education NCM Activity V6.1
- Terrain Type: Rural
- Number of Preconditioning Days: 15
- Shading Calculation Steps: 15 Days
- Ground Solar Reflectance: 20%

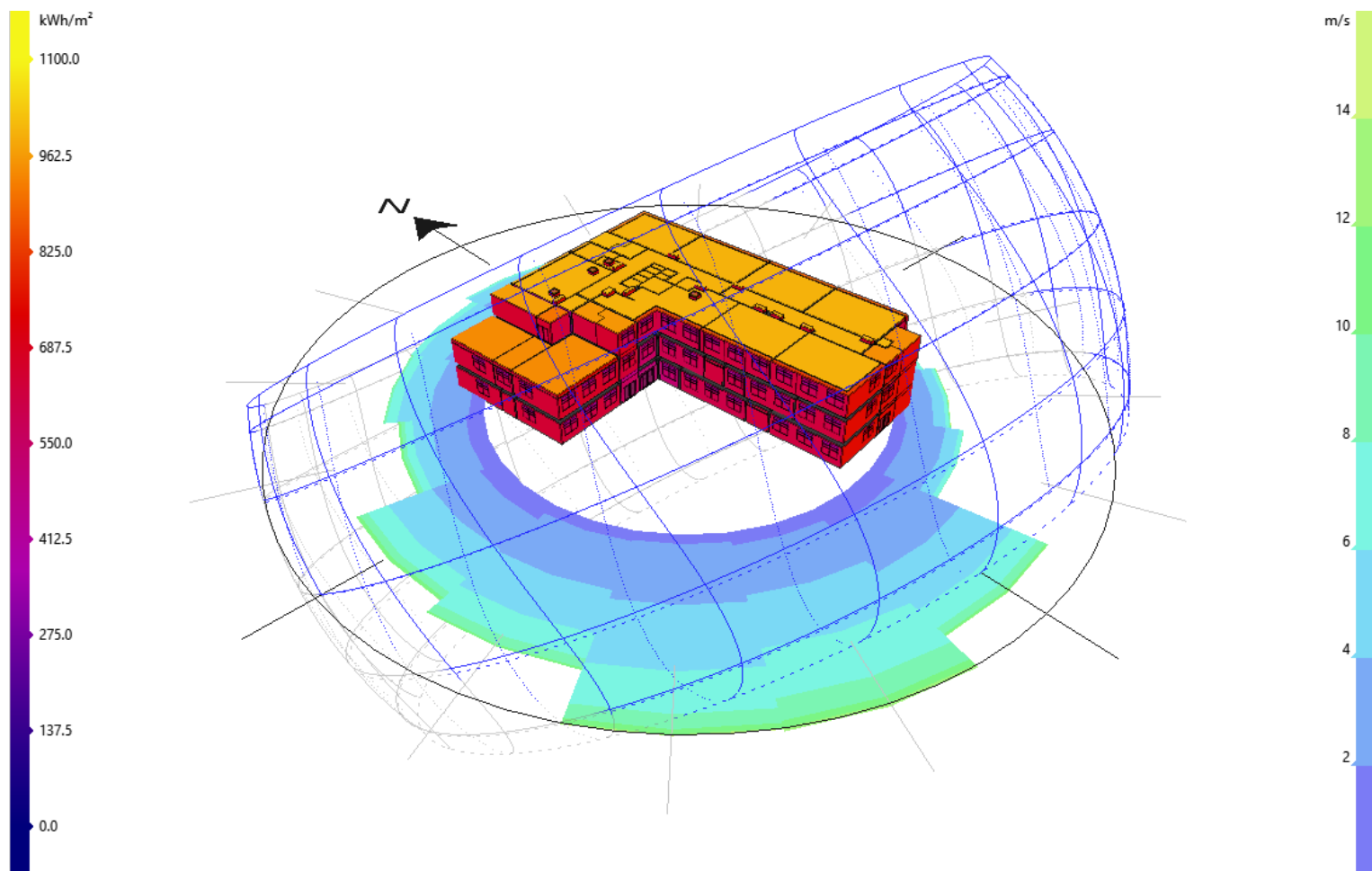


Figure 1.9 – Wind rose, sun insolation and analemmas for the proposed new building at the Hinckley School

2.0 Planning Context

Planning Policy relevant to sustainability considerations, energy and emissions of carbon dioxide is considered in detail in the following sections:

2.1 National Planning Policy Framework

The Ministry of Housing, Communities and Local Government determines national policies on different aspects of planning and the rules that govern the operation of the system. The National Planning Policy Framework (NPPF), at the time of planning for this development, was published in July 2021: setting out the Government's planning policies for England and replacing the previous series of Planning Policy Statements (PPS).

The following parts of the NPPF are considered most relevant to sustainability considerations, energy and emissions of carbon dioxide in the context of the proposed scheme:

National Planning policy Framework (Section 2)

NPPF Paragraph 8. (extract)

Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

...

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

National Planning policy Framework (Section 14)

NPPF Paragraph 152.

The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk 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.

NPPF Paragraph 153.

Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

NPPF Paragraph 154.

New development should be planned for in ways that:

- a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

- b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

NPPF Paragraph 155.

To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

NPPF Paragraph 157.

In determining planning applications, local planning authorities should expect new development to:

- a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

NPPF Paragraph 158.

When determining planning applications for renewable and low carbon development, local planning authorities should:

- a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and
- b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

2.2 Local Planning Policies

The proposed new STEM building will be made under the remit of Hinckley and Bosworth Borough Council Core Strategy (Adopted December 2009) and will be assessed against government guidance on land use planning and development plan policies.

The proposed site sits within the remit of Hinckley and Bosworth Borough Council.

This report seeks to respond to the requirements of this Local Development Framework. The Spatial Objective that applies to this development is **Spatial Objective 12: Climate Change and Resource Efficiency**. The section which applies to this development is Climate Change and Sustainable Design, **Policy 24: Sustainable Design and Technology**.

Spatial Objective 12: Climate Change and Resource Efficiency

To minimise the impacts of climate change by promoting the prudent use of resources through sustainable patterns of development, investment in green infrastructure, minimising the use of resources and energy, increasing reuse and recycling of natural resources, increasing the use of renewable energy technologies and minimising pollution, including greenhouse gas emissions.

Policy 24: Sustainable Design and Technology

The main purpose of forming this policy is to reduce carbon emissions and ensure that the opportunities are maximised for Sustainable Energy. After the 2006 report of East Midlands Carbon Footprint was released, it demonstrated that Hinckley & Bosworth consumed high levels of energy commercially as well.

Developments such as schools are expected to meet the minimum BREEAM (or equivalent) assessment rating of 'excellent'.

2.3 BREEAM Requirements

The proposed replacement block at Hinckley School will be designed and constructed in accordance with the Department for Education's Output Specification 2021 (OS2021). This document, which includes Technical Annex 2J (Sustainability), has been recently updated to mandate the highlight standards in sustainable design. The full document is freely available to download from the gov.uk website, but please see below for a summary of how OS2021 meets or exceeds the minimum requirements of BREEAM 'Excellent' (New Construction, Version 6 – 2022):

Man03 Responsible construction practices: Reds10 always registers sites with Considerate Constructors Scheme and are currently targeting a score of 40. Reds10 most recent sites have achieved a score of 39.

Man04 Commissioning and handover: OS2021 requires a detailed schedule of commissioning/testing and a building user guide to be produced.

Man05 Aftercare: Part A (General Conditions) and Technical Annex 2F (Mechanical Services) of the OS2021 set out the commissioning and aftercare procedures Reds10 are required to undertake in the 12 months following completion. These align with the requirements of the commissioning-implementation credit.

Ene01 Reduction of energy use and carbon emissions: OS2021 requires Operational Energy and Carbon to be calculated to demonstrate that Net Zero Carbon in Operation (at handover) is achieved. BREEAM only requires this level of performance when an Outstanding rating is targeted. With reference to Thermal Comfort, the DfE Output Specification 2021 requires the building to be assessed utilising a 2080 weather file however BREEAM New Construction only requires weather files up to 2050 to be assessed for naturally ventilated buildings and 2020 for mechanically ventilated buildings. It can therefore be seen that the DfE Output Specification is mandating a higher level of performance for the building than BREEAM New Construction.

Ene02 Energy monitoring: The sub-metering of end-use categories credit here is covered by the requirements of OS2021 Technical Annex 2H(Energy).

Wat01 Water consumption: OS2021 Technical Annex 2A (sanitaryware) sets requirements such as effective flush volume of toilets, and litres/min flow rate for wash hand taps, which will satisfy the improvements over baseline performance as required for these credits.

Wat 02 Water monitoring: To satisfy Criterion 1 a water meter is provided in accordance with BS EN 14154-1

Mat 03 Responsible sourcing of construction products: 100% of the timber and timber based products used on the project will be 'Legal' and 'Sustainable' as per the UK Government's Timber Procurement Policy in line with Criterion 1.

Wst 03 Operational Waste: As this is replacement block project, the waste management strategy of the existing school will remain unchanged and is outside the scope of this project.

The above are the minimum credit requirements for BREEAM Excellent, in addition to this an overall score of 70% in other credits will be required. From BREEAM Assessor input on previous Reds10 projects, it is highly likely that this will be achieved via compliance with the full DfE Output Specification and Technical Annexes, along with Reds10 other certifications such as Considerate Constructors Scheme and ISO 140001. Reds10 also engage the services of a BREEAM AP to assist with this process. On all of Reds10's Department for Education projects, a detailed embodied carbon assessment is undertaken at design stage as part of Reds10's ongoing PAS 8020 strategy.

3.0 Other Considerations

3.1 Other Considerations Introduction

This section comprises an overview of other considerations relevant to the Sustainability Statement and Energy Strategy.

3.2 Building Regulations (Part L2 Volume 2 Conservation of Fuel & Power)

The new STEM building and its building services shall meet and improve upon the requirements of Part L2 Volume 2 2021 – The Conservation of Fuel and Power in New Buildings other than Dwellings.

3.3 DfE Output Specification

The Department for Education Output Specification – Generic Design Brief (November 2021) requires the proposed new school building to meet the Energy Efficiency Hierarchy, as per Section 4.1 of this report.

There is also the aspiration for the proposed new STEM building to be a carbon neutral building in response to the declared climate emergency.

It is therefore proposed that the new school building shall be **Net Zero Carbon Enabled for Operational Energy** and can be operated to zero carbon if operated correctly.

4.0 Baseline & Residual Regulated Energy and Carbon Dioxide Calculations

4.1 Energy Consumption Reduction

Before the introduction of new Low Zero Carbon (LZC) Technologies, first ways in which the energy consumption of the new STEM building can be reduced shall be discussed.

To reduce the energy consumption and operational cost of the development, the school shall be designed in line with the Energy Efficiency Hierarchy, as follows:

The principles of Be Lean, Be Clean, Be Green and Be Seen shall be fully implemented in the design of the new building.

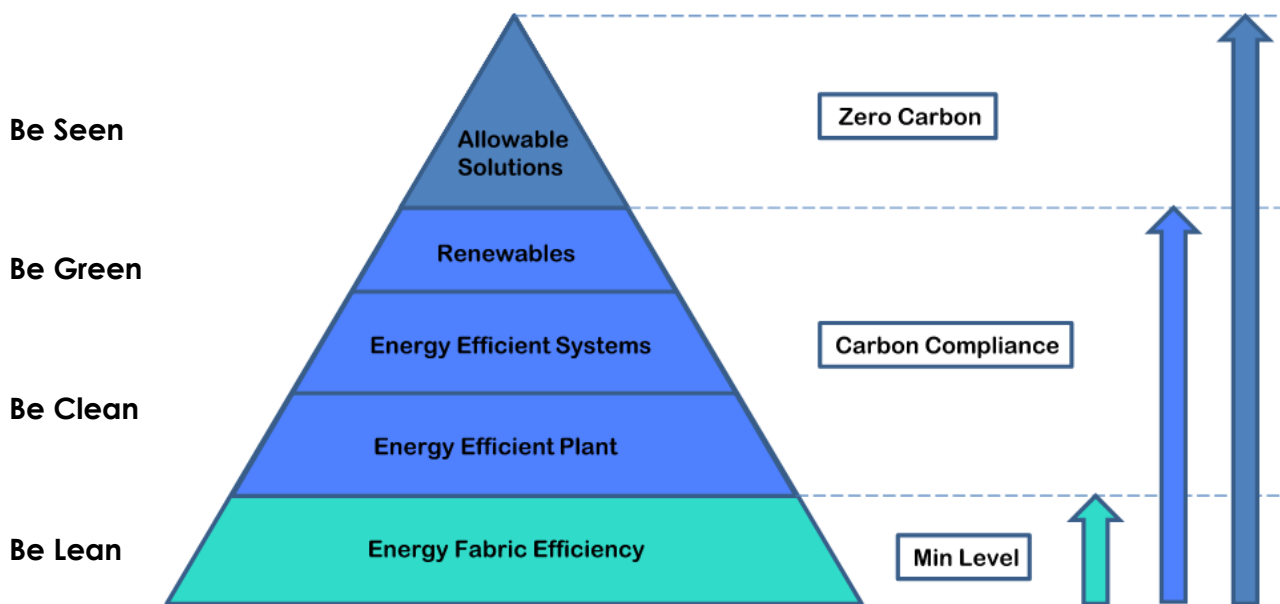


Figure 4.1 – Energy Efficiency Hierarchy

4.2 Baseline Carbon Dioxide Emissions

The Baseline carbon dioxide emissions for this development shall be determined by the requirements of Building Regulations Part L2 Volume 2 2021. The BRUKL calculations provide a Building Emission Rate (BER) that can be used to calculate reductions in Carbon Dioxide emissions due to Passive and Active measures.

The Baseline calculation has included the following Passive Measures in section 4.3.

4.3 Be Lean – Passive Measures

A Passive Design Analysis has been undertaken for the proposed new STEM Building and has covered the following considerations:

1. Site location
2. Site weather
3. Microclimate
4. Building layout
5. Building orientation
6. Building form

7. Building fabric
8. Thermal mass or other fabric thermal storage
9. Building occupancy type
10. Daylighting strategy
11. Ventilation strategy
12. Adaptation to Climate Change

4.3.1 Site Location, Weather & Microclimate

The proposed STEM building is located in Hinckley, Leicestershire. The proposed site is located in eastern part of Hinckley off road B4668 and is in a semi-rural location.

The weather file utilised for the Part L2 Volume 2 2021 calculations is the Nottingham TRY (Test Reference Year) which is the most suitable for the site.

The new STEM building is somewhat restricted by the site layout, however there is some scope to utilise Passive measures to reduce the annual energy consumption.

4.3.2 Building Layout & Orientation

The building has been orientated so that beneficial solar gains in winter months are provided to several Teaching Spaces.

4.3.3 Building Form, Fabric & Thermal Mass

The proposed fabric constructions shall be a Passive measure however and shall improve upon the requirements of Part L2 Volume 2 2021 of the Building Regulations, as per table 4.1:

Building Elements	U _a -Calc (W/m ² K)	Solar Transmittance (g-value)	Construction
Ground Floor	0.12	-	As per architects' details
External Walls	0.15	-	As per architects' details
Roof	0.12	-	As per architects' details
High Usage (powered) Doors	3.0	0.565	To window manufacturer details
Pedestrian Doors	1.6	0.46	To window manufacturer details
Windows	1.1	0.285	To window manufacturer details
Rooflights	2.2	0.345	To window manufacturer details

*U_a-Calc – Calculated area-weighted average U-value maximum value (pane and frame)

Table 4.1 – Proposed new development fabric standards. The required U-values for the building are highlighted in bold.

The designed building is assumed to achieve an average air permeability of **3.0 m³/(h.m²) @ 50 Pa**, which is better than the minimum acceptable air permeability of 8.0 m³/(h.m²) @ 50 Pa required by ADL2 2021. The notional value for the building which is used in the calculation varies depending upon whether the area of the building is side-lit or top-lit and whether the area includes cooling.

Area	Air Permeability Required (m ³ /h.m ² at 50 Pa)	Notional Building	Worst Acceptable Standard (Reference Building)
All zones	3.0	3.0	8.0

Table 4.2 – Air permeability values for the new development

The building shall not be utilising Thermal Mass to supplement the conditioning of the spaces.

4.3.4 Building Occupancy Type

The proposed STEM Building is to serve children of Secondary School age. The building shall be thermally modelled in accordance with CIBSE Guide AM11 - Building Performance Modelling and be appropriate for the occupant type.

4.3.5 Daylighting Strategy

Climate Based Daylight Modelling (CBDM) will be undertaken to inform the façade design, providing optimum levels of daylight for occupant comfort and energy efficiency. Spaces will be provided that avoid excess glare and negate the need for supplementary artificial lighting.

Suitable Light Reflectance Values for the building fabric will be determined as well as appropriate Light Transmission Values for the glazing.

External shading will be integrated in the building form to avoid excessive glare, which will also provide the benefit of reducing solar gains to minimise overheating risk.

4.3.6 Sun Path Analysis

A sun path analysis has been undertaken which has helped inform the early design of the external shading and façade design.

4.3.7 Ventilation Strategy

It is proposed that the STEM Building shall be naturally ventilated where possible utilising hybrid ventilation units and allowing provision for cross/stack ventilation via roof turrets. The building shall be thermally modelled to ascertain the openable free areas of windows and size/number of Natural Ventilation Heat Recovery (NVHR) units required to meet the requirements of Building Bulletin 101 - Ventilation, thermal comfort and indoor air quality (2018). Additional mechanical ventilation shall be provided dependant on room type requirements.

4.3.8 Adaptation to Climate Change

Building services requirements include a number of measures to adapt to the consequences of climate change.

Optimal levels of thermal insulation shall provide improvements over Building Regulations Part L2 Volume 2 2021 for the fabric elements. This will aid in the reduction of temperature variations within the building. Optimum solar transmission (g-values) for windows will manage solar gains to reduce the risk of overheating within the building, in conjunction with external shading from Brise Soleil.

Dynamic thermal modelling utilising CIBSE TM52 methodology will be undertaken using future climate change scenarios, with 2080 weather files being considered. The thermal model will inform the sizing of the HVAC equipment to ensure oversizing doesn't occur which create inefficiencies.

As well as the potential for increased temperatures from climate change, there is the potential for milder and wetter winters to be experienced. Hybrid ventilation systems shall be designed to provide suitably conditioned and fresh external air to provide a good air quality within the building.

Mechanical and Electrical services shall be installed with appropriate levels of insulation to account for colder weather events. Electrical services shall be installed at appropriate locations and heights to negate the impacts from any flooding events. Domestic Services design will include simple water economy measures such as presence detection for isolation of supplies when not in use, flow restrictors on all outlets and low flush WC's. This will help to negate the impacts of drought and any reduced summer rainfall.

4.4 Be Lean – Active Measures

The following Building Services assumptions have been made in the Be-Lean calculations.

4.4.1 Heating & Domestic Hot Water Plant

For the Baseline and Be-Lean regulated energy calculations the heating shall be provided to all areas of the buildings via a LTHW gas fired boiler.

Domestic hot water shall be provided via a direct gas fired water heater system.

The following efficiencies shall be utilised:

Building Service	Source	Efficiency	Distribution efficiency
Heating	LTHW gas fired boiler	95%	95%
Domestic Hot Water	Gas fired water heater	91%	95%

Table 4.3 – Heating and Domestic Hot Water efficiencies for the proposed new STEM building Baseline and Be-Lean calculations.

4.4.2 Pumps

All LTHW heating circuits will be provided with twin headed variable speed inverter driven pump sets to provide energy efficient pumping. Variable speed pumps with differential pressure sensors across the pump shall be used.

4.4.3 Fans

Fan efficiency is represented by the Specific Fan Power (SFP) value, defined as the sum of the design total circuit-watts, including all losses through switchgear and controls such as inverters, of the fans in the system that supply air and exhaust it back to outdoors. In this study, the designed ventilation systems have been categorized and assumed to achieve the minimum SFP values as required in ADL2 2021. These values are subject to the results of final commissioning data.

System Type	SFP (W/(litre/s))	Maximum allowed SFP (W/(litre/s))	Heat Recovery Efficiency (%)	Applicable Areas
Extract Only	0.5	0.5	-	Acc, WC, Chemical Store, Cleaners, Server Room
Hybrid Ventilation*	Wintertime normal operation 0.21, Normal	-	42	Art/DT, ICT, Photography, Resistant Materials, Science, Textiles

	operation daytime 0.053, Night-time 0.13.			
Zonal Supply and Extract Ventilation Units, such as ceiling void or roof units serving single room or zone with heating and heat recovery	1.1	1.9	82	DT Prep, Food, Intervention Rooms, Offices, Pupil WCs, Science Prep, Workrooms, Year Bases

*Calculation produced determines that 0.3 kWh/m²/year Ancillary Fan Load, included in the L2 assessment.

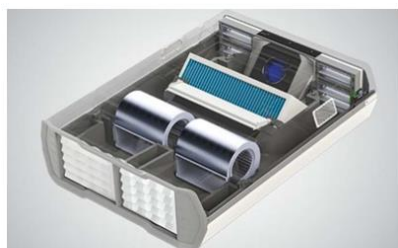
Table 4.4 – Specific Fan Powers for the ventilation systems at the new development

Hybrid Ventilation (NVHR)

Where located on an outside wall, teaching spaces will generally be ventilated and heated via high level hybrid ventilation units. These units will provide fresh air supply to various rooms and utilise mixed air heat recycling additionally the units will be fitted with heater batteries to temper the air.

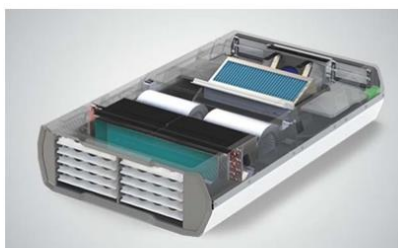
The hybrid units will have temperature and CO₂ sensors within the rooms served to control the Hybrid ventilation unit fan speeds. The fans utilised within the units will have very low Specific Fan Powers (SFPs).

The NVHR units will be very quiet in operation and may have Zero Embodied Carbon and use fully recyclable materials.



HVR Zero X

It provides natural ventilation, hybrid mixing ventilation and low energy mechanical heat recovery ventilation in one compact unit.



HVR Zero X+

The X+ model includes a heating coil that can provide the primary heating needed for a room, using the lower water flow temperatures provided through renewable heat pump solutions.



HVR Zero XC+

The system lowers the overall power consumption of buildings by combining ventilation, heat recovery, primary heating and cooling in a highly efficient, integrated solution with a harmonious control...

Figure 4.2 – Typical NVHR units

Mechanical Ventilation Heat Recovery Units (MVHR)

MVHR units will provide fresh air supply and extract ventilation to various internal rooms including some toilet areas. The units will include filtration, heat recovery via high efficiency plate heat exchangers and attenuators if required to meet the project acoustic requirements.

For internal occupied spaces temperature and CO₂ sensors located within the rooms served will control the MVHR unit fan speeds. For toilet areas, the control will be via PIR with trickle and boost operation. The MVHR units will be enabled according to an adjustable time schedule and will operate automatically according to room temperature and carbon dioxide sensors.

Fans within the units will be inclusive of low Specific Fan Powers and intelligent controls will also limit energy consumption.

Natural Ventilation – Cross/Stack Ventilation

Teaching Spaces will be ventilated via high level roof ventilators. These will provide a regulated flow of air into the space at high level.

These will be provided with the manufacturers integral control system complete with the following functions:

- External temperature sensor
- Room occupant interface with open/close override
- Room temperature & CO₂ sensor

4.4.4 Lighting

Artificial illumination will be provided throughout the school with due consideration to energy conservation and daylight provision. The lighting installation will be designed in strict accordance with latest CIBSE guidance recommendations, Building Bulletins, DfE requirements and with due regard to Approved Document L2 to increase efficacy of the installation, to reduce energy consumption.

Where luminaires are located within areas benefiting from natural daylight, they will be provided with DALI dimmable ballasts to allow regulation by means of daylight/occupancy sensors, thus reducing energy consumption.

The control of the lighting throughout will be through the use of manual switching and automatic daylight/occupancy sensors capable of being programmed to regulate the output of luminaires based upon the available natural daylight.

The operation of the lighting in the majority of occupied rooms will be arranged such that on entrance to the room the lights automatically turn on via the room sensor then automatically regulates the output (dims) the luminaires based upon the available natural daylight. Once the space has been vacated the luminaires will switch off after a pre-determined time. A manual switch will be provided at the entrance to space and teaching wall to allow manual override of the teachers' row of lighting and the remaining fittings in the space separately. Conventional switching of the lighting will be provided in certain areas such as plant rooms where automatic switching is not appropriate.

Lighting design modelling will be required for the building, with data for the proposed lighting design provided in luminaire lumens per circuit-watt or general power density. The lighting systems have automatic lighting controls throughout the building.

4.4.5 Enhanced Management and Control Features

- Electricity Power Factor: **>0.95** (Photographic evidence from site or calculations must be obtained to use this value otherwise a default of <0.9 shall be used).
- Whole building lighting automatic monitoring and targeting with alarms for out-of-range values: **Yes**
- HVAC Monitoring and targeting with alarms for out-of-range values: **Yes**

A Building Energy Management System (BEMS) will be provided to operate, regulate, and provide information about the building services systems.

Energy use will be controlled and monitored by the BEMS, with energy metering provided for electricity, separately arranged for lighting and power use and heating and DHW energy consumption.

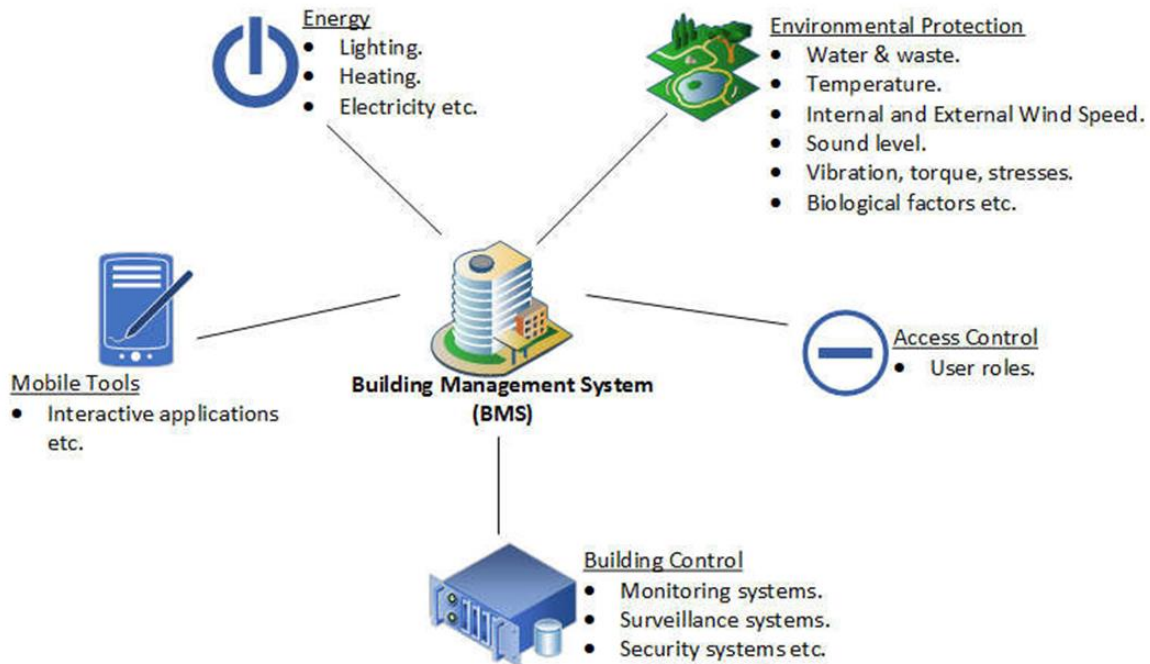


Figure 4.3 – Schematic of a typical Building Energy Management System (BEMS)

In general, the controls system will be designed to minimise energy consumption. The controls will also prioritise selected plant to ensure maximum performance is achieved.

All time scheduling and operational requirements will be controlled via the BEMS system to allow close control and monitoring of the performance and efficiency of all energy consuming systems. This system will incorporate provision to allow the control strategies to be developed into a “learning resource facility”. The BEMS system will be able to amend and adjust plant and equipment operations on an individual basis.

Metering

As part of the ‘**Be Seen**’ policy, metering, monitoring, analysing and reporting of energy consumption will be inherent to the building design to ensure that the Net Zero Operational Carbon requirement can be demonstrated in practice.

Sub-metering will be provided to meet CIBSE TM39 recommendations and energy conservation measures will include control optimisation.

Heating and Domestic Hot Water plant shall have their heat energy consumption monitored through the installation of Heat Meters. Lighting and Power installations will be provided with Automatic Monitoring and Targeting of energy consumption with alarms for out-of-range values.

The new water supply to the school building will comprise of a metered incoming service to the school. The water system will be provided with secondary meters to monitor the usage in the hot water system. Metering of water consumption will provide the user with data that can be analysed to be able to reduce water usage.

4.5 Baseline Calculations

The following calculation demonstrates the Baseline carbon dioxide emissions. The reduction of carbon dioxide emissions shall be determined with passive and active measures being taken into consideration, as per the assumptions in Section 4.4. The additional percentage reduction of carbon emissions through from Low or Zero Carbon technologies can then be determined. This is demonstrated in section 5.0 of this report.

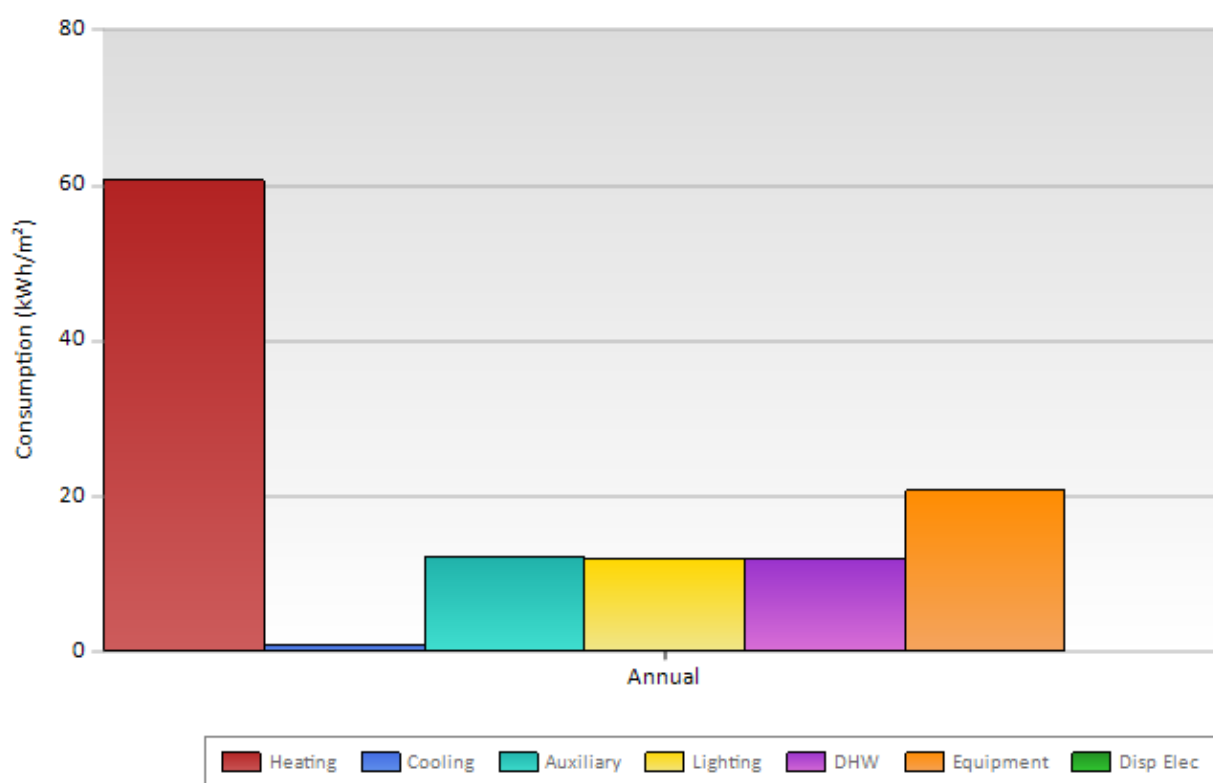
The reduction in carbon dioxide emissions for the new STEM Building were determined after Passive and Active measures had been taken into consideration.

From the calculated annual regulated energy consumption of the proposed new STEM Building the following gas and electricity figures are determined:

- Annual electricity consumption = 83,542 kWh/annum
- Annual gas consumption = 255,661 kWh/annum

The total annual regulated energy consumption is therefore calculated at **339,203 kWh**.

Tas Tas UK Building Regulations Studio Actual Annual Consumption



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
Consumption (kWh/m²)	60.56	0.78	12.03	11.89	11.85	20.82	0.00

Figure 4.1 – Calculated annual energy consumption for the new STEM Building - Baseline

4.6 Be Lean Calculations

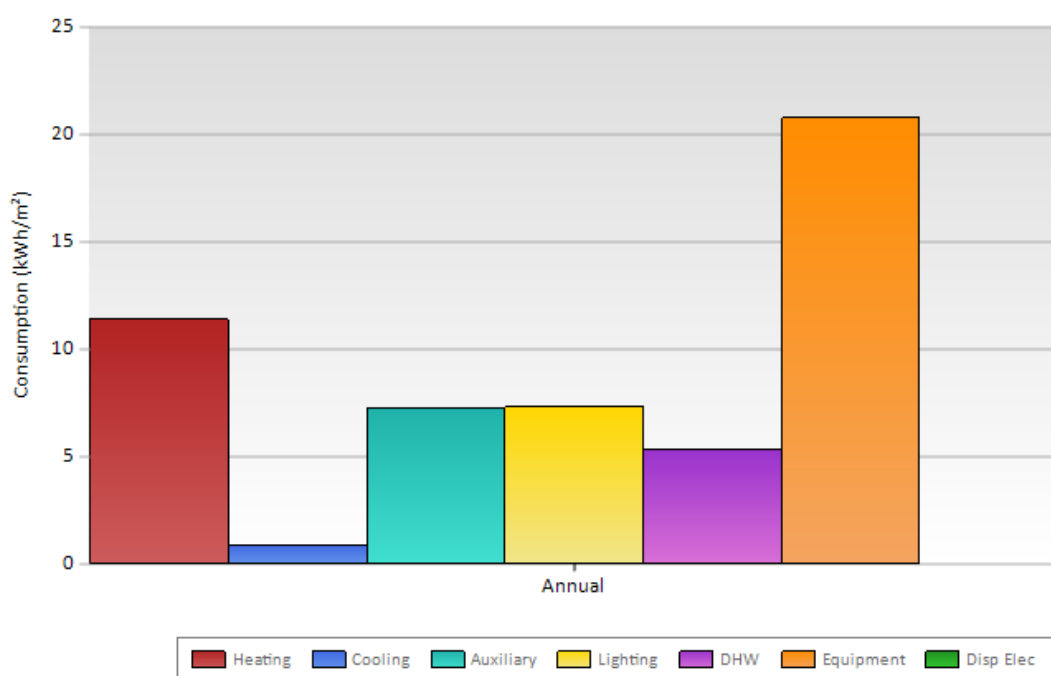
From the calculated annual regulated energy consumption of the proposed new STEM Building after Passive measure reductions the following electricity and gas figures are determined for the **Be Lean** calculation:

- Annual electricity consumption = 50,872 kWh/annum
- Annual gas consumption = 61,455 kWh/annum

The total annual regulated energy consumption is therefore calculated at **112,327 kWh**.

Compared to the Baseline energy consumption figure, determined from the Building Emission Rate (BER), of **339,203 kWh/annum**, this is equivalent to a saving in the reduction in energy consumption of **66.8%**

Tas Tas UK Building Regulations Studio Actual Annual Consumption



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
Consumption (kWh/m²)	11.41	0.84	7.23	7.33	5.34	20.82	0.00

Figure 4.2 – Calculated annual carbon dioxide emissions for the new STEM Building after Passive measure reductions – **Be Lean**

The Building Emission Rate (BER) for the Baseline STEM Building has been calculated as **18.64 kgCO₂/m²/annum**. This equates to **65,115 kgCO₂/annum**.

The Building Emission Rate (BER) after Passive measures have been provided is **5.69 kgCO₂/m²/annum**. This equates to **19,877 kgCO₂/annum** for the **Be Lean** Building.

This equates to a reduction in carbon dioxide emissions of **45,238 kgCO₂/annum** and a percentage reduction of carbon dioxide of **69.5%** due to Passive measures.

4.7 Be Clean Stage

The energy demand of the proposed building has been reduced, as per the Be Lean stage.

The proposed building services will be fossil fuel free. The proposed new building is located within a residential area and adjacent to a golf course, with limited provision for the creation of a District Heating Network.

It is understood that a local District Heating/Energy Network is not within the vicinity of the proposed new school building. Referring to the Heat Networks Planning Database the nearest proposed Heat Networks are in postcodes LE1, LE2 and LE4.

5.0 Low and Zero Carbon Technology Options – Be Green

5.1 Initial exclusion of unsuitable technologies

The LZC options considered most likely to be unsuitable for the development are identified as:

- Tidal power
- Wave power
- Water Source Heat Pump (WSHP) } No local resource
- Biomass – Regular maintenance and deliveries as well as fuel store provisions deem biomass unsuitable for this project.
- Combined Heat & Power (natural gas) – Thermal baseload not deemed to be sufficient and building to be fossil fuel free.
- Ground Source Heat Pump (GSHP) – Site restrictions makes this unfeasible.
- Solar Hot Water system – A meaningful contribution to the energy reduction would not be made.
- Wind Turbines – The British Wind Energy Association (BWEA) suggests that a site with an average wind speed of 4-5 meters per second is generally sufficient to make installing a small wind turbine worthwhile. For this site the average wind speed is 5.2m/s at 10m above the ground. The size of turbine required to make any meaningful contributions to the energy reduction for this development would be prohibitive.

5.2 Suitable technologies

The LZC options considered most likely to be suitable for the development and that can meet the requirements of the Hinckley and Bosworth County Council Core Strategy are identified as:

- Air Source Heat Pump (ASHP)
- Solar Photovoltaic panels (PV)

Both the proposed Air Source Heat Pump system and Photovoltaic system shall be included in the carbon dioxide emission reduction calculations.

5.3 Air Source Heat Pump (ASHP)

An Air Source Heat Pump is a device that can transfer low temperature heat from a renewable source such as ambient air, water or the ground and raise it to a higher, more useful temperature using a refrigerant cycle. The relatively small amount of energy needed to transfer this heat is used to drive the refrigerant compressor. Typically, for every kWh of energy used to operate an electrically-driven heat pump, the resulting useful heat output is between 3kWh and 4.5kWh. The following diagram shows the typical workings of an Air Source Heat Pump system.

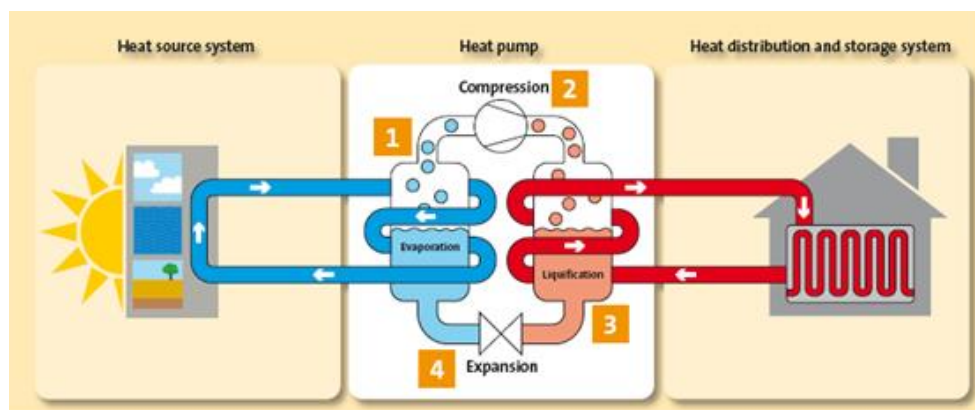


Figure 5.1 – Schematic of a typical Heat Pump system

Design Considerations

Air Source Heat Pumps are best suited where there is a need for low grade heat as they provide the greatest co-efficient of performance (CoP). CO₂ or propane versions are also available that generate high water temperatures suitable for Domestic Hot Water use.

Air Source Heat Pump systems could be considered to be viable for this scheme.

The following issues should be carefully considered:

- The system may be considered visually intrusive. A suitable location will be required for the condenser units.
- Noise emanating from the outdoor condensing units will need to be taken into consideration, especially during night-time hours.
- The available electrical capacity to run the system(s) should be analysed to determine suitability.

Calculations

An Air Source Heat Pump system with a Seasonal Coefficient of Performance (SCoP) of 3.99 to provide Heating and an Air Source Heat Pump for Domestic Hot Water is proposed with a Coefficient of Performance (CoP) of 2.0 to be installed.

The following energy and carbon dioxide savings could be made.

The following graph shows an estimate of the annual energy consumption of the new STEM Building utilising Air Source Heat Pump systems:

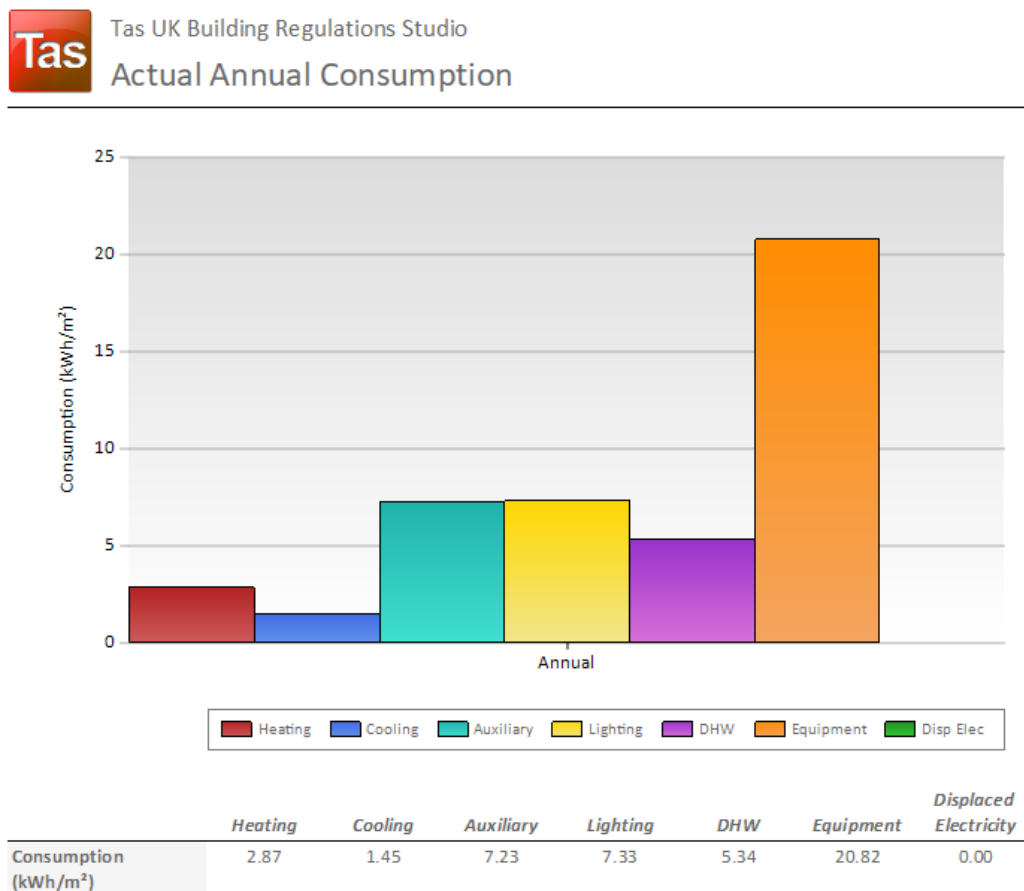


Figure 5.2 – Calculated annual energy consumption for the new STEM Building incorporating an ASHP system for Heating and Domestic Hot Water generation.

From the calculated annual regulated energy consumption of the proposed new STEM Building the following electricity figures are determined:

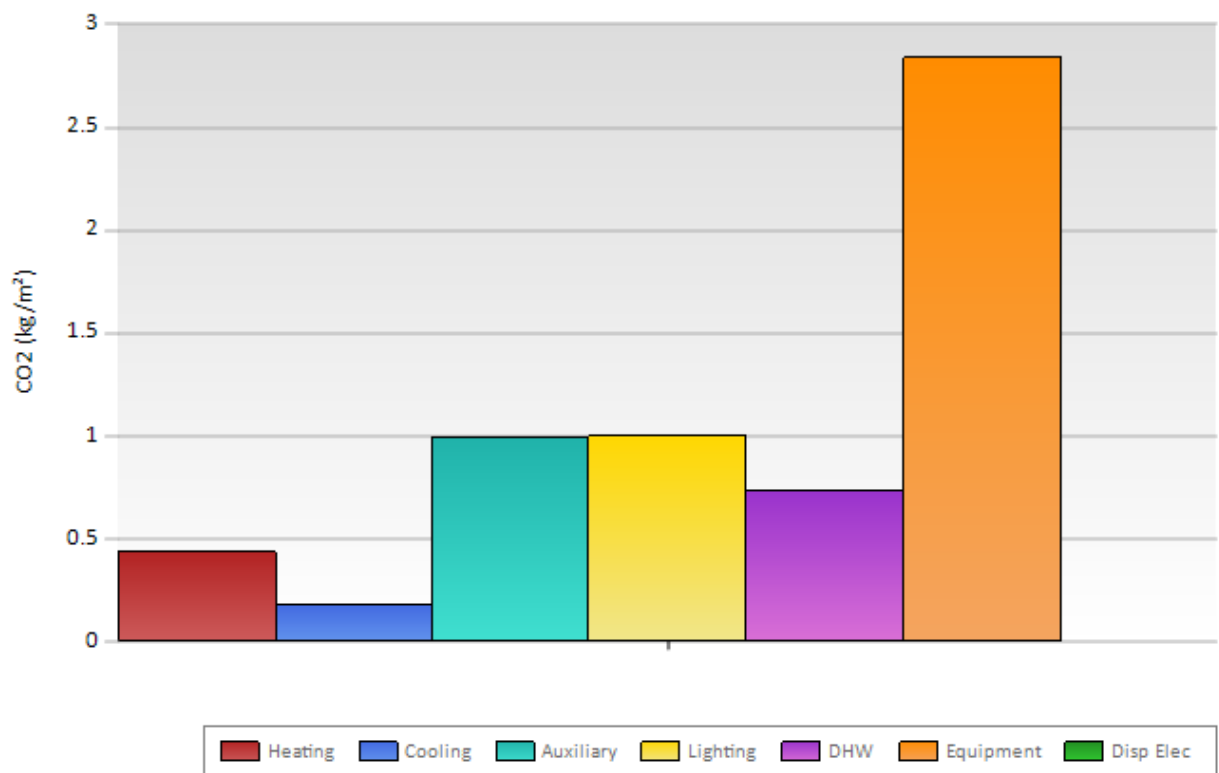
- Annual electricity consumption = 84,635 kWh/annum

The total annual regulated energy consumption is therefore calculated at **84,635 kWh**.

Compared to the Be Lean figure of **112,327 kWh/annum**, this is equivalent to a saving in the reduction in regulated energy consumption of **24.6%**

The annual carbon dioxide emissions are:

Tas Tas UK Building Regulations Studio
Actual Annual CO2 Emissions



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
CO2 (kg/m²)	0.43	0.18	0.99	1.00	0.73	2.84	-8.70

Figure 5.3 – Calculated annual carbon dioxide consumption for the new STEM Building incorporating ASHP systems for Heating & Domestic Hot Water generation.

The Building Emission Rate (BER) inclusive of Air Source Heat Pumps is **3.33 kgCO₂/m²/annum**. This equates to **11,633 kgCO₂/annum**.

This equates to a reduction in carbon dioxide emissions of **8,244 kgCO₂/annum** and a percentage reduction of **41.4%** against the Be- Lean building calculations.

5.4 Photovoltaic Panels

A plan view of the building shows the proposed roofs are clear from adjacent buildings and trees and their potential to utilise the direct solar exposure. The use therefore of some form of photovoltaic panels will be considered further in this section.

A solar voltaic system directly converts sunlight to electricity via a semi-conductor device known as a photovoltaic (PV) cell and is considered ecologically beneficial since it is non-polluting and produces no harmful residues.

PV cells are manufactured and sold as photovoltaic panels. There are currently three types of photovoltaic panel available, namely mono-crystalline (~17-21% efficient), polycrystalline (~13-16% efficient), and amorphous thin film, (~7-13% efficient).



Figure 5.4 – A typical polycrystalline panel.

Positioning of photovoltaic panels (PV cells) is critical, ideally angled from the horizontal in an unshaded south facing orientation for maximum electrical output.

A solar voltaic system can be grid connected to enable the import / export of electricity when demand is not matched by the solar energy output. The system generally consists of an array of serially connected solar modules, and an inverter to convert the generated DC electricity to AC, or a number of batteries. Alternatively, the system can be stand alone and the electrical energy used for a specific purpose e.g. powering car park lighting, water pumps etc.

The anticipated life span of a PV cell is 30 years. Studies have shown that PV systems in the UK will generate an amount of energy equal to that used in their manufacture (energy payback) within approximately 4-5 years, depending on PV cell type.

Design Issues

A solar voltaic system may be a suitable solution for the proposed new STEM building. The following issues should be carefully considered:

- To maximize the benefits of an installation, solar modules (PV cells) should be south or east/west facing and installed at 10-40° pitch and must not be over shaded.
- The system may be considered visually intrusive. Planning permission will be required for the solar modules (PV cells).

Calculations

An assessment of the available roof areas that could be suitable for the installation of Photovoltaics indicates that the flat roofs would be suitable. An additional canopy will be provided to install additional panels on.

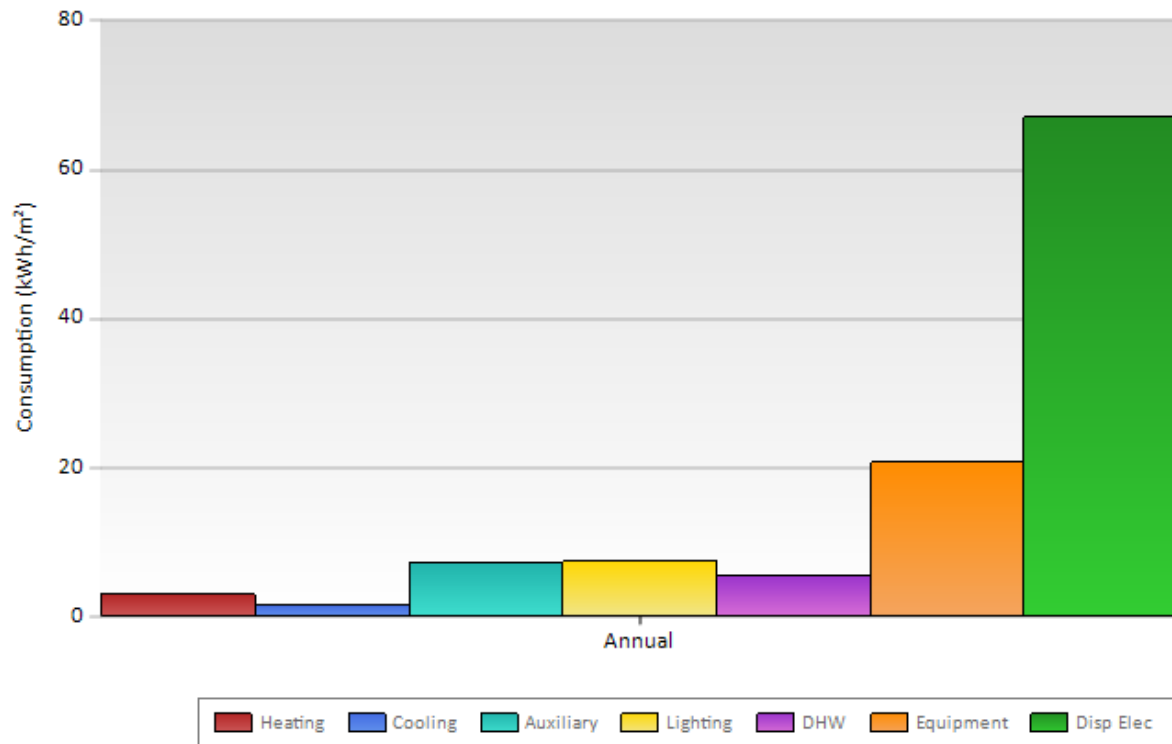
A Photovoltaic system size of 236,979 kWh/annum has been determined from the Operational Energy Assessment.

The following graph shows an estimate of the annual energy consumption of the new STEM Building incorporating the improvements from Passive and Active measures and Photovoltaics:



Tas UK Building Regulations Studio

Actual Annual Consumption



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
Consumption (kWh/m²)	2.87	1.45	7.23	7.33	5.34	20.82	67.00

Figure 5.6 – Calculated annual energy consumption for the new STEM Building incorporating Passive and Active measures and Photovoltaics – **Be Green**

From the calculated annual regulated energy consumption of the proposed new STEM Building the following electricity and gas figures are determined:

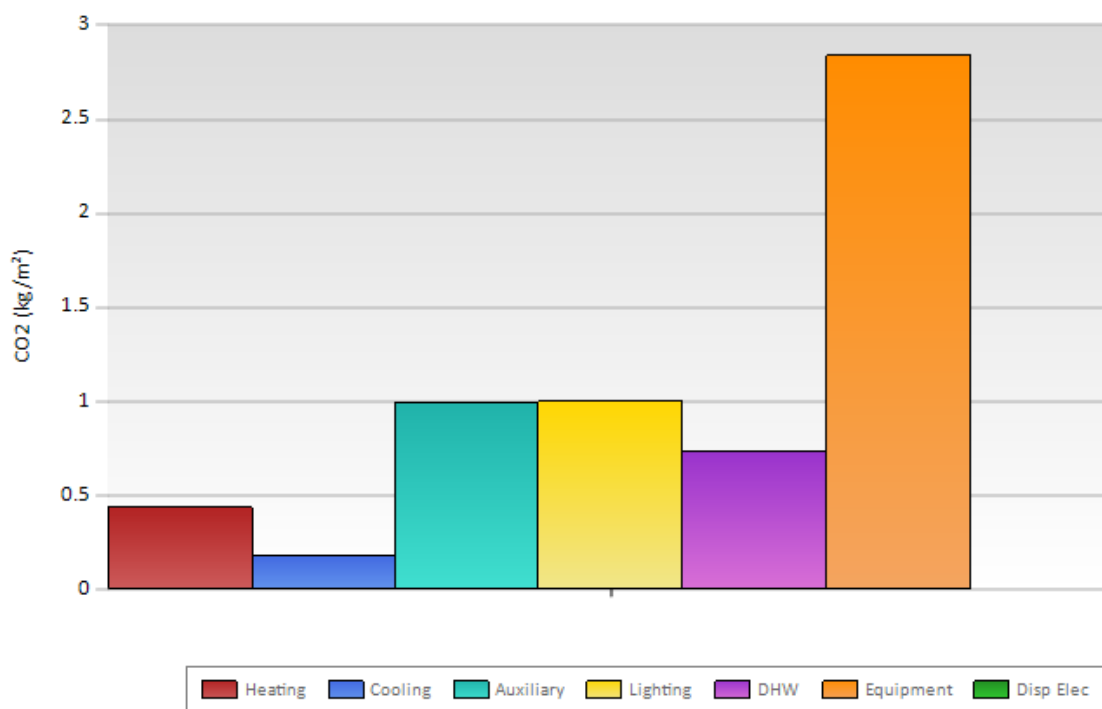
- Annual electricity consumption = 84,635 kWh/annum
- Annual displaced grid electricity = -236,979 kWh/annum
- Annual gas consumption = 0 kWh/annum

The total annual regulated energy consumption is therefore calculated at **-152,344 kWh**.

Compared to the to the Be Lean figure of 112,327 kWh/annum, this is equivalent to a saving in the reduction in energy consumption of **135.6%**



Tas UK Building Regulations Studio Actual Annual CO2 Emissions



	Heating	Cooling	Auxiliary	Lighting	DHW	Equipment	Displaced Electricity
CO2 (kg/m²)	0.43	0.18	0.99	1.00	0.73	2.84	-8.70

Figure 5.7 – Calculated annual carbon dioxide emissions for the new STEM Building incorporating Passive and Active measures and Photovoltaics – **Be Green**

The Building Emission Rate (BER) inclusive of Photovoltaics is **-5.37 kgCO₂/m²/annum**. This equates to **-18,759 kgCO₂/annum**.

This equates to a reduction in carbon dioxide emissions of **38,636 kgCO₂/annum** and a percentage reduction of **194%** against the Be Lean figure of 19,877 kgCO₂/annum building calculations.

5.5 Operational Energy Carbon Dioxide Emissions Requirements

To meet the aspiration of achieving a Net Zero Carbon Enabled building for Operational Energy, that can be operated to zero carbon if operated correctly, both regulated and unregulated energy, i.e., small power, shall be assessed.

Sections 5.3 and 5.4 above set out how much carbon dioxide savings are apparent through the use of Air Source Heat Pump systems or Photovoltaics alone and make an assessment against regulated energy.

Calculations for carbon dioxide emissions from unregulated energy consumption are made in the Operational Energy Assessment.

6.0 Other Sustainability Considerations

6.1 Water Use

Domestic Services design will include simple water economy measures to conserve water, such as presence detection for isolation of supplies when not in use, leak detection, flow restrictors on all outlets and low flush WC's.

6.2 Materials

Material selection and their use will be made giving full consideration to ensure they have a low environmental impact.

Material specified will where possible be from a certified responsible sourced supplier or be recycled or reclaimed.

6.3 Waste

Construction site waste will be minimised by the Principal Contractor with the building being constructed off-site with modular construction.

The use of materials that generate hazardous waste will be avoided or minimised where unavoidable.

6.4 Pollution

Any blowing agent within insulation materials will have a Global Warming Potential (GWP) of less than 5.

6.5 Energy Storage

An initial study has been undertaken for the inclusion of Energy Storage for the school building. The following Energy Storage technologies have been considered:

- *Batteries* – Initial load analysis of the building indicates that any electricity generated from a Photovoltaic system would be able to be used by auxiliary, lighting or small power. Heat pump systems would also provide a suitable load. This form of energy storage is therefore discounted for this building.
- *Building fabric thermal storage* – exposed, dense building structure not being considered therefore this form of energy storage is discounted.
- *Hot Water Storage* - The STEM building incorporates Science and Ancillary Areas. There will therefore be a requirement for a reasonable supply of domestic hot water and hot water storage shall be considered further.

6.6 Hot Water Storage

A hot water thermal store shall therefore be considered which shall have the benefit of flattening out any demand fluctuations. Heat energy will be generated from decentralised heat pump systems and therefore hot water storage would not be suitable.

7.0 Summary of Energy & Carbon Dioxide Saving Options

7.1 Energy Strategy

The total calculated carbon dioxide emissions for regulated and unregulated energy for the Be Lean building is **5.69 kgCO₂/m²/annum**. A Net Zero Operational Energy Carbon Emissions target has been proposed which equates to **-5.37 kgCO₂/m²/annum**, based on Part L methodology. A separate Operational Energy and Carbon analysis will be undertaken for the building to achieve Net Zero Carbon in Operation.

The following table provides a summary of the renewable energy and low carbon technologies for the proposed new STEM Building development.

Technology	Annual energy saved/generated (kWh)	CO ₂ saving, per annum (tonnes)	Noise	Heat or power Export	Planning considerations
Air Source Heat Pump	27,692	3,766	~55 dB(A)	N/A	Supported by the NPPF, generally accepted. Visual & noise considerations
Solar Power (PV)	236,979	32,703	N/A	Unlikely to be cost effective at current rates	Supported by the NPPF, generally accepted when mounted on roof plane, relatively low visual impact at roof level.

Figure 7.1 – Summary of Low and Zero Carbon technology considerations

7.2 Proposed Net Zero Operational Energy Carbon Emissions Solution

To meet the Net Zero Operational Energy Carbon Emissions target both the Air Source Heat Pump systems for Heating and Domestic Hot Water as well as the Photovoltaic system would be installed.

8.0 Running Costs Evaluation

8.1 Baseline Building Running Costs

The regulated and unregulated energy running costs for the proposed new STEM building can be calculated based upon the Part L2 calculations within this report.

The Baseline building energy consumption has been calculated as follows:

- Annual regulated electricity consumption = 83,542 kWh/annum
- Annual unregulated electricity consumption = 72,730 kWh/annum
- Annual gas consumption = 255,661 kWh/annum

Gas and electricity prices in the non-domestic sector for the 4th quarter of 2022, provided by the Department for Business, Energy & Industrial Strategy, are as follows:

- 24.65 p/kWh for grid electricity
- 10.28 p/kWh for natural gas

Fuel costs for the Baseline building are therefore:

- Annual electricity cost = 156,272 kWh/annum x 24.65 p/kWh = £38,521.05
- Annual gas consumption = 255,661 kWh/annum x 10.28 p/kWh = £26,281.95

Total Baseline building regulated energy fuel cost = £64,803/annum

8.2 Net Zero Operational Energy Carbon Dioxide Emissions Building Running Costs

The Reduced Carbon Dioxide Emissions building energy consumption has been calculated as follows:

- Annual electricity consumption = 84,635 kWh/annum
- Annual unregulated electricity consumption = 72,730 kWh/annum
- Annual displaced grid electricity = -236,979 kWh/annum

Fuel costs for the Reduced Carbon Dioxide Emissions building are therefore:

- Annual electricity cost = 157,365 kWh/annum x 24.65 p/kWh = £38,970.47
- Annual electricity offset by Photovoltaics = 157,365 kWh/annum x 24.65 p/kWh = £38,970.47
- Annual electricity export from Photovoltaics = 79,614 kWh/annum x assumed export tariff @5p/kWh = £3,980.70

Total Reduced Carbon Dioxide Emissions building regulated energy fuel cost = £-3,980.70/annum

The savings in annual running costs compared to the Baseline Building equates to **£68,783.70** at current fuel costs.

Cost savings are indicative, calculated against an indicative baseline building, and are based upon Part L2 energy calculations. A separate report calculating energy and carbon consumption will be undertaken in the Operational Energy and Carbon Analysis.

9.0 Conclusions

Having reviewed a number of sustainable options the following conclusions have been determined with a summary of the findings as follows:

To achieve the requirements of the Hinckley and Bosworth Borough Council Core Strategy, Heat Pump systems and Photovoltaic systems shall be installed to serve this development.

This option would provide a Net Zero Carbon Enabled building for Operational Energy for the development and provides a good combination of energy savings and carbon dioxide emission reductions.

Heating and Domestic Hot Water will be generated through the use of Air Source Heat Pumps. A Photovoltaic system that can generate 236,979 kWh/annum for the STEM Building is proposed. This figure has been determined based upon an Energy Use Intensity (EUI) figure of 67 kWh/m², which is based upon the benchmark figure in the DfE Output Specification. The final generation required from Photovoltaics will be determined by the Operational Energy calculations at the detailed design stage and is subject to change.

Appendix A – Baseline BRUKL Calculation

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hinckley Academy

As designed

Date: Tue Feb 21 13:45:30 2023

Administrative information

Building Details

Address: Hinckley Academy, Butt Lane, Hinckley, LE10 1LE

Certifier details

Name: James Richard Manton

Telephone number: 0117 922 1681

Address: Eden Office Park, Bristol, BS20 0DD

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.4"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.4

BRUKL compliance check version: v6.1.b.0

Foundation area [m²]: 1164.43

The CO₂ 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	3.91
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	18.64
Target primary energy rate (TPER), kWh/m ² .annum	28.13
Building primary energy rate (BPER), kWh/m ² .annum	117.83
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	0.26	0.26	External Wall
Floors	0.18	0.18	0.18	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	0.18	0.18	Roof
Windows** and roof windows	1.6	1.6	1.84	New Window 2 low
Rooflights***	2.2	2.17	2.17	Rooflight
Personnel doors^	1.6	-	-	No personnel doors in project
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	1.7	1.7	D01-Glazed External Door south
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 N.B.: 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	8

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	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- NV & LTHW Radiators

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

2- MVHR via LTHW Coil Htg (13 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	0.8
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- NVHR & LTHW & CHW Coil (24 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

4- NVHR & Htg/Clg via FCU (1101 ICT 02 FF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

5- MVHR & Htg/Clg via FCU (5 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	0.8
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

6- MVHR & LTHW Radiators (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	0.8
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

7- MVHR (4 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	0.8
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

8- Local Extract (4 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

9- DX Cooling/Local Extract (6211 Server Room GF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

10- NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

1- ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.92	0
Standard value	0.91	N/A

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	Zone	Standard
1120 Textiles GF		-	-	-	-	-	1	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
1114 Art 02 GF		-	-	-	-	-	1	-	-	-	-	N/A
1001 Classroom 01 FF		-	-	-	-	-	1	-	-	-	-	N/A
1002 Classroom 02 FF		-	-	-	-	-	1	-	-	-	-	N/A
1117 Resistant Materials Workshop 01-GF		-	-	-	-	-	1	-	-	-	-	N/A
1116 Resistant Materials Workshop 02-GF		-	-	-	-	-	1	-	-	-	-	N/A
5101 Cleaners 01 GF		-	-	-	2.3	-	-	-	-	-	-	N/A
5011 Food Store/Prep		-	-	-	2.3	-	-	-	-	-	-	N/A
5010 DT Prep+Store GF		-	-	-	2.3	-	-	-	-	-	-	N/A
6001 Pupil WC 01 GF		-	-	-	2.3	-	-	-	-	-	-	N/A
6002 Pupil WC 02 GF		-	-	-	2.3	-	-	-	-	-	-	N/A
6004 Pupil WC 04 FF		-	-	-	2.3	-	-	-	-	-	-	N/A
4002 DT Staff Workroom GF		-	-	-	2.3	-	-	-	0.3	-	-	N/A
1118 Food 01 GF		-	-	-	2.3	-	-	-	0.3	-	-	N/A
1119 Food 02 GF		-	-	-	2.3	-	-	-	0.3	-	-	N/A
6211 Server Room GF		-	-	0.5	-	-	-	-	-	-	-	N/A
5102 Cleaners 02		-	-	-	2.3	-	-	-	-	-	-	N/A
6006 Acc WC 02 FF		-	-	-	2.3	-	-	-	-	-	-	N/A
6007 Acc WC 03 SF		0.3	-	-	-	-	-	-	-	-	-	N/A
1004 Classroom 04 FF		-	-	-	-	-	1	-	-	-	-	N/A
1005 Classroom 05 FF		-	-	-	-	-	1	-	-	-	-	N/A
1006 Classroom 06 FF		-	-	-	-	-	1	-	-	-	-	N/A
4004 Maths Staff Workroom FF		-	-	-	2.3	-	-	-	0.3	-	-	N/A
4001 Science Staff Workroom SF		-	-	-	2.3	-	-	-	0.3	-	-	N/A
1115 Photography/ICT 01 FF		-	-	-	-	-	1	-	-	-	-	N/A
1101 ICT 02 FF		-	-	-	-	-	0.2	-	0.3	-	-	N/A
5001a Science Prep 01 FF		-	-	-	2.3	-	-	-	-	-	-	N/A
1102 Science 01 FF		-	-	-	-	-	1	-	-	-	-	N/A
1104 Science 03 FF		-	-	-	-	-	1	-	-	-	-	N/A
1105 Science 04 FF		-	-	-	-	-	1	-	-	-	-	N/A
1107 Science 06 SF		-	-	-	-	-	1	-	-	-	-	N/A
1108 Science 07 SF		-	-	-	-	-	1	-	-	-	-	N/A
1109 Science 08 SF		-	-	-	-	-	1	-	-	-	-	N/A
1110 Science 09 SF		-	-	-	-	-	1	-	-	-	-	N/A
1111 Specialist Science 01 SF		-	-	-	-	-	1	-	-	-	-	N/A
5001 Science Prep 02 SF		-	-	-	-	-	1	-	-	-	-	N/A
5103 Cleaners 03 SF		0.3	-	-	-	-	-	-	-	-	-	N/A
1106 Science 05 SF		-	-	-	-	-	1	-	-	-	-	N/A
1112 Specialist Science 02 SF		-	-	-	-	-	1	-	-	-	-	N/A
1103 Science 02 FF		-	-	-	-	-	1	-	-	-	-	N/A
4011 Year Base 01 FF		-	-	-	2.3	-	-	-	-	-	-	N/A
3001 Intervention Room 1 FF		-	-	-	2.3	-	-	-	-	-	-	N/A
3002 Intervention Room 2 SF		-	-	-	2.3	-	-	-	-	-	-	N/A
3004 Intervention Room 3 GF		-	-	-	2.3	-	-	-	-	-	-	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
1003 Classroom 03 FF	-	-	-	-	-	1	-	-	-	-	N/A
6003 Pupil WC 03 FF	-	-	-	2.3	-	-	-	-	-	-	N/A
5002 Chemical Store SF	0.3	-	-	-	-	-	-	-	-	-	N/A
1113 Art 01 GF	-	-	-	-	-	1	-	-	-	-	N/A
4005 Office GF	-	-	-	2.3	-	-	-	-	-	-	N/A
6005 Acc WC 01 GF	0.3	-	-	-	-	-	-	-	-	-	N/A
Pupil WC 03	-	-	-	2.3	-	-	-	-	-	-	N/A
Pupil WC 01	-	-	-	2.3	-	-	-	-	-	-	N/A
Pupil WC 02	-	-	-	2.3	-	-	-	-	-	-	N/A
Pupil WC 04	-	-	-	2.3	-	-	-	-	-	-	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
6302 Stair 02		-	-	-
6301 Stair 01		-	-	-
6303 Stair 03		-	-	-
6311 Lift 01		-	-	-
1120 Textiles GF		95	-	-
1114 Art 02 GF		95	-	-
1001 Classroom 01 FF		95	-	-
1002 Classroom 02 FF		95	-	-
1117 Resistant Materials Workshop 01 GF		95	-	-
1116 Resistant Materials Workshop 02 GF		95	-	-
5101 Cleaners 01 GF		95	-	-
5012 Store 01		95	-	-
5003 Art Store 01		95	-	-
5004 Art Store 02		95	-	-
5013 Store 02 GF		95	-	-
5011 Food Store/Prep		95	-	-
5010 DT Prep+Store GF		95	-	-
6001 Pupil WC 01 GF		-	-	-
6002 Pupil WC 02 GF		-	-	-
6004 Pupil WC 04 FF		-	-	-
4002 DT Staff Workroom GF		95	-	-
1118 Food 01 GF		95	-	-
1119 Food 02 GF		95	-	-
6101 Cold Water Plant GF		95	-	-
6102 Switch Room GF		95	-	-
6211 Server Room GF		95	-	-
5008 Darkroom		95	-	-
5009 Store 04		95	-	-
5102 Cleaners 02		95	-	-

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
6006 Acc WC 02 FF		-	-	-
6007 Acc WC 03 SF		-	-	-
6312 Lift 02		-	-	-
6313 Lift 03		-	-	-
1004 Classroom 04 FF		95	-	-
1005 Classroom 05 FF		95	-	-
1006 Classroom 06 FF		95	-	-
4004 Maths Staff Workroom FF		95	-	-
4001 Science Staff Workroom SF		95	-	-
1115 Photography/ICT 01 FF		95	-	-
1101 ICT 02 FF		95	-	-
5001a Science Prep 01 FF		95	-	-
1102 Science 01 FF		95	-	-
1104 Science 03 FF		95	-	-
1105 Science 04 FF		95	-	-
1107 Science 06 SF		95	-	-
1108 Science 07 SF		95	-	-
1109 Science 08 SF		95	-	-
1110 Science 09 SF		95	-	-
1111 Specialist Science 01 SF		95	-	-
5001 Science Prep 02 SF		95	-	-
5103 Cleaners 03 SF		95	-	-
6104 Board 1		95	-	-
6105 Board 2		95	-	-
6106 Board 3 SF		95	-	-
6321 Circulation		-	-	-
6320 Circulation		-	-	-
6324 Circulation		-	-	-
6323 Circulation		-	-	-
6326 Circulation		-	-	-
6325 Circulation		-	-	-
6327 Plant Lobby		-	-	-
1106 Science 05 SF		95	-	-
1112 Specialist Science 02 SF		95	-	-
6103 Plant Room SF		95	-	-
1103 Science 02 FF		95	-	-
6304 Stair 01		-	-	-
6305 Stair 02		-	-	-
6306 Stair 03		-	-	-
6307 Stair 01		-	-	-
6308 Stair 02		-	-	-
6309 Stair 03		-	-	-
4011 Year Base 01 FF		95	-	-

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
5014 DT Staff Store		95		-	-
3001 Intervention Room 1 FF		95		-	-
3002 Intervention Room 2 SF		95		-	-
3004 Intervention Room 3 GF		95		-	-
1003 Classroom 03 FF		95		-	-
6003 Pupil WC 03 FF		-		-	-
5002 Chemical Store SF		95		-	-
1113 Art 01 GF		95		-	-
6322 Circulation		-		-	-
4005 Office GF		180		-	-
6005 Acc WC 01 GF		-		-	-
Pupil WC 03		-		-	-
Pupil WC 01		-		-	-
6329 Circulation		-		-	-
6330 Circulation		-		-	-
6331 Circulation		-		-	-
6328 Roof Escape		-		-	-
6332 Circulation		-		-	-
6333 Circulation		-		-	-
Pupil WC 02		-		-	-
Pupil WC 04		-		-	-

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?
1120 Textiles GF	NO (-51%)	NO
1114 Art 02 GF	NO (-44%)	NO
1001 Classroom 01 FF	NO (-52%)	NO
1002 Classroom 02 FF	NO (-77%)	NO
1117 Resistant Materials Workshop 01 GF	NO (-65%)	NO
1116 Resistant Materials Workshop 02 GF	NO (-34%)	NO
4002 DT Staff Workroom GF	NO (-53%)	NO
1118 Food 01 GF	NO (-34%)	NO
1119 Food 02 GF	NO (-47%)	NO
1004 Classroom 04 FF	NO (-77%)	NO
1005 Classroom 05 FF	NO (-69%)	NO
1006 Classroom 06 FF	NO (-33%)	NO
4004 Maths Staff Workroom FF	NO (-34%)	NO
4001 Science Staff Workroom SF	NO (-53%)	NO
1115 Photography/ICT 01 FF	NO (-35%)	NO
1101 ICT 02 FF	NO (-30%)	NO
5001a Science Prep 01 FF	NO (-17%)	NO
1102 Science 01 FF	NO (-55%)	NO
1104 Science 03 FF	NO (-35%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1105 Science 04 FF	NO (-54%)	NO
1107 Science 06 SF	NO (-34%)	NO
1108 Science 07 SF	NO (-23%)	NO
1109 Science 08 SF	NO (-48%)	NO
1110 Science 09 SF	NO (-40%)	NO
1111 Specialist Science 01 SF	NO (-69%)	NO
5001 Science Prep 02 SF	NO (-27%)	NO
1106 Science 05 SF	NO (-49%)	NO
1112 Specialist Science 02 SF	NO (-29%)	NO
1103 Science 02 FF	NO (-49%)	NO
4011 Year Base 01 FF	NO (-18%)	NO
3001 Intervention Room 1 FF	N/A	N/A
3002 Intervention Room 2 SF	NO (-76%)	NO
3004 Intervention Room 3 GF	N/A	N/A
1003 Classroom 03 FF	NO (-77%)	NO
1113 Art 01 GF	NO (-28%)	NO
4005 Office GF	NO (-35%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	3493	3493
External area [m ²]	4030	4030
Weather	NOT	NOT
Infiltration [m ³ /hm ² @ 50Pa]	8	3
Average conductance [W/K]	1959	1393
Average U-value [W/m ² K]	0.49	0.35
Alpha value* [%]	26.36	11.36

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
100	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	60.56	3.65
Cooling	0.78	2.6
Auxiliary	12.03	6.83
Lighting	11.89	7.28
Hot water	11.85	12.45
Equipment*	20.82	20.82
TOTAL**	97.1	32.82

* 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	0	10.91
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	10.91

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	213.59	39.92
Primary energy [kWh/m ²]	117.83	28.13
Total emissions [kg/m ²]	18.64	3.91

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: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	45.2	0	13.5	0	2.2	0.93	0	0.95	0
Notional	13	0	4.2	0	1.3	0.86	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	59.2	0	17.7	0	16.1	0.93	0	0.95	0
Notional	12.6	0	4.1	0	5.7	0.86	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Natural Gas									
Actual	300.6	15.7	89.7	1.2	14.1	0.93	3.6	0.95	3.6
Notional	8.7	44.6	2.8	4.6	9.1	0.86	2.7	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Natural Gas									
Actual	116.8	19	34.8	1.5	10.9	0.93	3.6	0.95	3.6
Notional	7.3	61.5	2.4	3.9	16.2	0.86	4.4	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Natural Gas									
Actual	134.4	15	40.1	1.2	32	0.93	3.6	0.95	3.6
Notional	16.5	33.6	5.3	2.1	13.3	0.86	4.4	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	184.6	0	55.1	0	11.9	0.93	0	0.95	0
Notional	45.7	0	14.8	0	6	0.86	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	112.9	0	33.7	0	7.6	0.93	0	0.95	0
Notional	35	0	11.3	0	2.4	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	66.6	0	19.9	0	2	0.93	0	0.95	0
Notional	30.5	0	9.9	0	1.4	0.86	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	0	0	0	11.3	0	0	0	0
Notional	0	0	0	0	9	0	0	----	----
[ST] No Heating or Cooling									
Actual	74.6	0	22.3	0	0	0.93	0	0.95	0
Notional	22.3	0	7.2	0	0	0.86	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 B – Be Lean Calculation

BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Hinckley Academy

As designed

Date: Thu Mar 09 09:38:04 2023

Administrative information

Building Details

Address: Hinckley Academy, Butt Lane, Hinckley, LE10 1LE

Certifier details

Name: James Richard Manton

Telephone number: 0117 922 1681

Address: Eden Office Park, Bristol, BS20 0DD

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.4"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.4

BRUKL compliance check version: v6.1.b.0

Foundation area [m²]: 1164.43

The CO₂ 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 /m²annum	4.48
Building CO ₂ emission rate (BER), kgCO ₂ /m²annum	5.69
Target primary energy rate (TPER), kWh/m²annum	36.29
Building primary energy rate (BPER), kWh/m²annum	41.37
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	External Wall
Floors	0.18	0.12	0.12	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	0.12	0.12	Roof
Windows** and roof windows	1.6	1.07	1.33	New Window 2 low
Rooflights***	2.2	1.7	1.7	Rooflight
Personnel doors^	1.6	-	-	No personnel doors in project
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	1.7	1.7	D01-Glazed External Door south
U _a -Limit = Limiting area-weighted average U-values [W/(m²K)] U _a -Calc = Calculated area-weighted average U-values [W/(m²K)] U _i -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 N.B.: 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	YES
Whole building electric power factor achieved by power factor correction	>0.95

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value		0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
6002 Pupil WC 02 GF		-	-	-	1.6	-	-	-	-	-	-	N/A
6004 Pupil WC 04 FF		-	-	-	1.6	-	-	-	-	-	-	N/A
4002 DT Staff Workroom GF		-	-	-	1.6	-	-	-	0.3	-	-	N/A
1118 Food 01 GF		-	-	-	1.6	-	-	-	0.3	-	-	N/A
1119 Food 02 GF		-	-	-	1.6	-	-	-	0.3	-	-	N/A
6211 Server Room GF		-	-	0.5	-	-	-	-	-	-	-	N/A
5102 Cleaners 02		-	-	-	1.6	-	-	-	-	-	-	N/A
6006 Acc WC 02 FF		-	-	-	1.6	-	-	-	-	-	-	N/A
6007 Acc WC 03 SF		0.3	-	-	-	-	-	-	-	-	-	N/A
1004 Classroom 04 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
1005 Classroom 05 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
1006 Classroom 06 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
4004 Maths Staff Workroom FF		-	-	-	1.6	-	-	-	0.3	-	-	N/A
4001 Science Staff Workroom SF		-	-	-	1.6	-	-	-	0.3	-	-	N/A
1115 Photography/ICT 01 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
1101 ICT 02 FF		-	-	-	-	-	0.2	-	0.3	-	-	N/A
5001a Science Prep 01 FF		-	-	-	1.6	-	-	-	-	-	-	N/A
1102 Science 01 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
1104 Science 03 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
1105 Science 04 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
1107 Science 06 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
1108 Science 07 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
1109 Science 08 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
1110 Science 09 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
1111 Specialist Science 01 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
5001 Science Prep 02 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
5103 Cleaners 03 SF		0.3	-	-	-	-	-	-	-	-	-	N/A
1106 Science 05 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
1112 Specialist Science 02 SF		-	-	-	-	-	0.2	-	-	-	-	N/A
1103 Science 02 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
4011 Year Base 01 FF		-	-	-	1.6	-	-	-	-	-	-	N/A
3001 Intervention Room 1 FF		-	-	-	1.6	-	-	-	-	-	-	N/A
3002 Intervention Room 2 SF		-	-	-	1.6	-	-	-	-	-	-	N/A
3004 Intervention Room 3 GF		-	-	-	1.6	-	-	-	-	-	-	N/A
1003 Classroom 03 FF		-	-	-	-	-	0.2	-	-	-	-	N/A
6003 Pupil WC 03 FF		-	-	-	1.6	-	-	-	-	-	-	N/A
5002 Chemical Store SF		0.3	-	-	-	-	-	-	-	-	-	N/A
1113 Art 01 GF		-	-	-	-	-	0.2	-	-	-	-	N/A
4005 Office GF		-	-	-	1.6	-	-	-	0.3	-	-	N/A
6005 Acc WC 01 GF		0.3	-	-	-	-	-	-	-	-	-	N/A
Pupil WC 03		-	-	-	1.6	-	-	-	-	-	-	N/A
Pupil WC 01		-	-	-	1.6	-	-	-	-	-	-	N/A
Pupil WC 02		-	-	-	1.6	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
Pupil WC 04		-	-	-	1.6	-	-	-	-	-	-	N/A

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
6302 Stair 02		-	-	-
6301 Stair 01		-	-	-
6303 Stair 03		-	-	-
6311 Lift 01		-	-	-
1120 Textiles GF		180	-	-
1114 Art 02 GF		180	-	-
1001 Classroom 01 FF		180	-	-
1002 Classroom 02 FF		180	-	-
1117 Resistant Materials Workshop 01 GF		180	-	-
1116 Resistant Materials Workshop 02 GF		180	-	-
5101 Cleaners 01 GF		147	-	-
5012 Store 01		147	-	-
5003 Art Store 01		147	-	-
5004 Art Store 02		147	-	-
5013 Store 02 GF		147	-	-
5011 Food Store/Prep		147	-	-
5010 DT Prep+Store GF		147	-	-
6001 Pupil WC 01 GF		-	-	-
6002 Pupil WC 02 GF		-	-	-
6004 Pupil WC 04 FF		-	-	-
4002 DT Staff Workroom GF		95	-	-
1118 Food 01 GF		180	-	-
1119 Food 02 GF		180	-	-
6101 Cold Water Plant GF		147	-	-
6102 Switch Room GF		95	-	-
6211 Server Room GF		147	-	-
5008 Darkroom		147	-	-
5009 Store 04		147	-	-
5102 Cleaners 02		147	-	-
6006 Acc WC 02 FF		-	-	-
6007 Acc WC 03 SF		-	-	-
6312 Lift 02		-	-	-
6313 Lift 03		-	-	-
1004 Classroom 04 FF		180	-	-
1005 Classroom 05 FF		180	-	-
1006 Classroom 06 FF		180	-	-
4004 Maths Staff Workroom FF		180	-	-
4001 Science Staff Workroom SF		180	-	-

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	
1115 Photography/ICT 01 FF		180	-	-	
1101 ICT 02 FF		180	-	-	
5001a Science Prep 01 FF		180	-	-	
1102 Science 01 FF		180	-	-	
1104 Science 03 FF		180	-	-	
1105 Science 04 FF		180	-	-	
1107 Science 06 SF		180	-	-	
1108 Science 07 SF		180	-	-	
1109 Science 08 SF		180	-	-	
1110 Science 09 SF		180	-	-	
1111 Specialist Science 01 SF		180	-	-	
5001 Science Prep 02 SF		180	-	-	
5103 Cleaners 03 SF		147	-	-	
6104 Board 1		147	-	-	
6105 Board 2		147	-	-	
6106 Board 3 SF		147	-	-	
6321 Circulation		-	-	-	
6320 Circulation		-	-	-	
6324 Circulation		-	-	-	
6323 Circulation		-	-	-	
6326 Circulation		-	-	-	
6325 Circulation		-	-	-	
6327 Plant Lobby		-	-	-	
1106 Science 05 SF		180	-	-	
1112 Specialist Science 02 SF		180	-	-	
6103 Plant Room SF		147	-	-	
1103 Science 02 FF		180	-	-	
6304 Stair 01		-	-	-	
6305 Stair 02		-	-	-	
6306 Stair 03		-	-	-	
6307 Stair 01		-	-	-	
6308 Stair 02		-	-	-	
6309 Stair 03		-	-	-	
4011 Year Base 01 FF		180	-	-	
5014 DT Staff Store		147	-	-	
3001 Intervention Room 1 FF		180	-	-	
3002 Intervention Room 2 SF		180	-	-	
3004 Intervention Room 3 GF		95	-	-	
1003 Classroom 03 FF		180	-	-	
6003 Pupil WC 03 FF		-	-	-	
5002 Chemical Store SF		147	-	-	
1113 Art 01 GF		180	-	-	
6322 Circulation		-	-	-	

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
4005 Office GF		180		-	-
6005 Acc WC 01 GF		-		-	-
Pupil WC 03		-		-	-
Pupil WC 01		-		-	-
6329 Circulation		-		-	-
6330 Circulation		-		-	-
6331 Circulation		-		-	-
6328 Roof Escape		-		-	-
6332 Circulation		-		-	-
6333 Circulation		-		-	-
Pupil WC 02		-		-	-
Pupil WC 04		-		-	-

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?
1120 Textiles GF	NO (-62%)	YES
1114 Art 02 GF	NO (-57%)	YES
1001 Classroom 01 FF	NO (-62%)	YES
1002 Classroom 02 FF	N/A	N/A
1117 Resistant Materials Workshop 01 GF	NO (-72%)	YES
1116 Resistant Materials Workshop 02 GF	NO (-50%)	YES
4002 DT Staff Workroom GF	NO (-63%)	YES
1118 Food 01 GF	NO (-49%)	YES
1119 Food 02 GF	NO (-59%)	YES
1004 Classroom 04 FF	N/A	N/A
1005 Classroom 05 FF	N/A	N/A
1006 Classroom 06 FF	N/A	N/A
4004 Maths Staff Workroom FF	NO (-48%)	YES
4001 Science Staff Workroom SF	NO (-63%)	YES
1115 Photography/ICT 01 FF	NO (-50%)	YES
1101 ICT 02 FF	NO (-47%)	YES
5001a Science Prep 01 FF	NO (-37%)	YES
1102 Science 01 FF	NO (-60%)	YES
1104 Science 03 FF	NO (-44%)	YES
1105 Science 04 FF	NO (-60%)	YES
1107 Science 06 SF	NO (-50%)	YES
1108 Science 07 SF	NO (-41%)	YES
1109 Science 08 SF	NO (-60%)	YES
1110 Science 09 SF	NO (-54%)	YES
1111 Specialist Science 01 SF	NO (-78%)	YES
5001 Science Prep 02 SF	NO (-46%)	YES
1106 Science 05 SF	NO (-56%)	YES
1112 Specialist Science 02 SF	NO (-46%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1103 Science 02 FF	NO (-60%)	YES
4011 Year Base 01 FF	NO (-38%)	YES
3001 Intervention Room 1 FF	N/A	N/A
3002 Intervention Room 2 SF	N/A	N/A
3004 Intervention Room 3 GF	N/A	N/A
1003 Classroom 03 FF	NO (-82%)	YES
1113 Art 01 GF	NO (-46%)	YES
4005 Office GF	NO (-50%)	YES

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
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			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m ²]	3493	3493		Retail/Financial and Professional Services
External area [m ²]	4030	4030		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	NOT	NOT		Offices and Workshop Businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	1522	1393		Storage or Distribution
Average U-value [W/m ² K]	0.38	0.35		Hotels
Alpha value* [%]	26.36	11.36		Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				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
			100	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	11.41	2.25
Cooling	0.84	2.26
Auxiliary	7.23	6.85
Lighting	7.33	7.28
Hot water	5.34	8.48
Equipment*	20.82	20.82
TOTAL**	32.16	27.12

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	172.08	35.21
Primary energy [kWh/m ²]	41.37	36.29
Total emissions [kg/m ²]	5.69	4.48

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: radiators, [HS] Direct gas firing, [HFT] Natural Gas, [CFT] Electricity									
Actual	23.2	0	1.7	0	2.2	3.91	0	4	0
Notional	12.2	0	2.7	0	1.3	1.26	0	----	----
[ST] Split or multi-split system, [HS] Direct gas firing, [HFT] Natural Gas, [CFT] Electricity									
Actual	30.5	0	2.2	0	11.2	3.91	0	4	0
Notional	10.4	0	2.3	0	5.6	1.26	0	----	----
[ST] Split or multi-split system, [HS] Direct gas firing, [HFT] Natural Gas, [CFT] Natural Gas									
Actual	249.9	16.5	17.8	1.3	7	3.91	3.6	4	3.6
Notional	7.6	38.4	1.7	4	9.1	1.26	2.7	----	----
[ST] Fan coil systems, [HS] Direct gas firing, [HFT] Natural Gas, [CFT] Natural Gas									
Actual	89.5	20.6	6.4	1.6	10.4	3.91	3.6	4	3.6
Notional	5.9	60	1.3	3.8	16.2	1.26	4.4	----	----
[ST] Fan coil systems, [HS] Direct gas firing, [HFT] Natural Gas, [CFT] Natural Gas									
Actual	71.9	18	5.1	1.4	23.1	3.91	3.6	4	3.6
Notional	16.3	28.5	3.6	1.8	12.7	1.26	4.4	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	210.5	0	15	0	22.9	3.91	0	4	0
Notional	79.7	0	17.6	0	14.6	1.26	0	----	----
[ST] Split or multi-split system, [HS] Direct gas firing, [HFT] Natural Gas, [CFT] Electricity									
Actual	69.4	0	4.9	0	5.3	3.91	0	4	0
Notional	34.8	0	7.7	0	2.4	1.26	0	----	----
[ST] Central heating using water: radiators, [HS] Direct gas firing, [HFT] Natural Gas, [CFT] Electricity									
Actual	47.9	0	3.4	0	2	3.91	0	4	0
Notional	29.7	0	6.6	0	1.4	1.26	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	0	0	0	11.3	0	0	0	0
Notional	0	0	0	0	9	0	0	----	----
[ST] No Heating or Cooling									
Actual	51.5	0	3.7	0	0	3.91	0	4	0
Notional	22.4	0	5	0	0	1.26	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 C – Be Green - Net Zero Carbon Operational Energy BRUKL Calculation

BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Hinckley Academy

As designed

Date: Thu Mar 09 12:10:02 2023

Administrative information

Building Details

Address: Hinckley Academy, Butt Lane, Hinckley, LE10 1LE

Certifier details

Name: James Richard Manton
Telephone number: 0117 922 1681
Address: Eden Office Park, Bristol, BS20 0DD

Certification tool

Calculation engine: TAS
Calculation engine version: "v9.5.4"
Interface to calculation engine: TAS
Interface to calculation engine version: v9.5.4
BRUKL compliance check version: v6.1.b.0

Foundation area [m²]: 1164.43

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	3.02
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	-5.37
Target primary energy rate (TPER), kWh/m ² annum	32.7
Building primary energy rate (BPER), kWh/m ² annum	-63
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	External Wall
Floors	0.18	0.12	0.12	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	0.12	0.12	Roof
Windows** and roof windows	1.6	1.07	1.33	New Window 2 low
Rooflights***	2.2	1.7	1.7	Rooflight
Personnel doors^	1.6	-	-	No personnel doors in project
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	1.7	1.7	D01-Glazed External Door south
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 N.B.: 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	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- NV & LTHW Radiators

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- MVHR via LTHW Coil Htg (13 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	0.8
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- NVHR & LTHW & CHW Coil (24 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

4- NVHR & Htg/Clg via FCU (1101 ICT 02 FF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

5- MVHR & Htg/Clg via FCU (6 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	0.8
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

6- MVHR & LTHW Radiators (3002 Intervention Room 2 SF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	0.8
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

7- MVHR (4 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	0.83
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

8- Local Extract (4 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

9- DX Cooling/Local Extract (6211 Server Room GF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

10- NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
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					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.04	0
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		Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
1120 Textiles GF	-	-	-	-	-	0.2	-	-	-		-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
1114 Art 02 GF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1001 Classroom 01 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1002 Classroom 02 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1117 Resistant Materials Workshop 01-GF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1116 Resistant Materials Workshop 02-GF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
5101 Cleaners 01 GF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
5011 Food Store/Prep	-	-	-	1.6	-	-	-	-	-	-	-	N/A
5010 DT Prep+Store GF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
6001 Pupil WC 01 GF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
6002 Pupil WC 02 GF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
6004 Pupil WC 04 FF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
4002 DT Staff Workroom GF	-	-	-	1.6	-	-	-	-	0.3	-	-	N/A
1118 Food 01 GF	-	-	-	1.6	-	-	-	-	0.3	-	-	N/A
1119 Food 02 GF	-	-	-	1.6	-	-	-	-	0.3	-	-	N/A
6211 Server Room GF	-	-	0.5	-	-	-	-	-	-	-	-	N/A
5102 Cleaners 02	-	-	-	1.6	-	-	-	-	-	-	-	N/A
6006 Acc WC 02 FF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
6007 Acc WC 03 SF	0.3	-	-	-	-	-	-	-	-	-	-	N/A
1004 Classroom 04 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1005 Classroom 05 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1006 Classroom 06 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
4004 Maths Staff Workroom FF	-	-	-	1.6	-	-	-	-	0.3	-	-	N/A
4001 Science Staff Workroom SF	-	-	-	1.6	-	-	-	-	0.3	-	-	N/A
1115 Photography/ICT 01 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1101 ICT 02 FF	-	-	-	-	-	-	0.2	-	0.3	-	-	N/A
5001a Science Prep 01 FF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
1102 Science 01 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1104 Science 03 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1105 Science 04 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1107 Science 06 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1108 Science 07 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1109 Science 08 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1110 Science 09 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1111 Specialist Science 01 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
5001 Science Prep 02 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
5103 Cleaners 03 SF	0.3	-	-	-	-	-	-	-	-	-	-	N/A
1106 Science 05 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1112 Specialist Science 02 SF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
1103 Science 02 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
4011 Year Base 01 FF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3001 Intervention Room 1 FF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3002 Intervention Room 2 SF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3004 Intervention Room 3 GF	-	-	-	1.6	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
1003 Classroom 03 FF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
6003 Pupil WC 03 FF	-	-	-	1.6	-	-	-	-	-	-	-	N/A
5002 Chemical Store SF	0.3	-	-	-	-	-	-	-	-	-	-	N/A
1113 Art 01 GF	-	-	-	-	-	-	0.2	-	-	-	-	N/A
4005 Office GF	-	-	-	1.6	-	-	-	-	0.3	-	-	N/A
6005 Acc WC 01 GF	0.3	-	-	-	-	-	-	-	-	-	-	N/A
Pupil WC 03	-	-	-	1.6	-	-	-	-	-	-	-	N/A
Pupil WC 01	-	-	-	1.6	-	-	-	-	-	-	-	N/A
Pupil WC 02	-	-	-	1.6	-	-	-	-	-	-	-	N/A
Pupil WC 04	-	-	-	1.6	-	-	-	-	-	-	-	N/A

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
6302 Stair 02	-	-	-	-
6301 Stair 01	-	-	-	-
6303 Stair 03	-	-	-	-
6311 Lift 01	-	-	-	-
1120 Textiles GF	180	-	-	-
1114 Art 02 GF	180	-	-	-
1001 Classroom 01 FF	180	-	-	-
1002 Classroom 02 FF	180	-	-	-
1117 Resistant Materials Workshop 01 GF	180	-	-	-
1116 Resistant Materials Workshop 02 GF	180	-	-	-
5101 Cleaners 01 GF	147	-	-	-
5012 Store 01	147	-	-	-
5003 Art Store 01	147	-	-	-
5004 Art Store 02	147	-	-	-
5013 Store 02 GF	147	-	-	-
5011 Food Store/Prep	147	-	-	-
5010 DT Prep+Store GF	147	-	-	-
6001 Pupil WC 01 GF	-	-	-	-
6002 Pupil WC 02 GF	-	-	-	-
6004 Pupil WC 04 FF	-	-	-	-
4002 DT Staff Workroom GF	95	-	-	-
1118 Food 01 GF	180	-	-	-
1119 Food 02 GF	180	-	-	-
6101 Cold Water Plant GF	147	-	-	-
6102 Switch Room GF	95	-	-	-
6211 Server Room GF	147	-	-	-
5008 Darkroom	147	-	-	-
5009 Store 04	147	-	-	-
5102 Cleaners 02	147	-	-	-

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
6006 Acc WC 02 FF		-	-	-
6007 Acc WC 03 SF		-	-	-
6312 Lift 02		-	-	-
6313 Lift 03		-	-	-
1004 Classroom 04 FF		180	-	-
1005 Classroom 05 FF		180	-	-
1006 Classroom 06 FF		180	-	-
4004 Maths Staff Workroom FF		180	-	-
4001 Science Staff Workroom SF		180	-	-
1115 Photography/ICT 01 FF		180	-	-
1101 ICT 02 FF		180	-	-
5001a Science Prep 01 FF		180	-	-
1102 Science 01 FF		180	-	-
1104 Science 03 FF		180	-	-
1105 Science 04 FF		180	-	-
1107 Science 06 SF		180	-	-
1108 Science 07 SF		180	-	-
1109 Science 08 SF		180	-	-
1110 Science 09 SF		180	-	-
1111 Specialist Science 01 SF		180	-	-
5001 Science Prep 02 SF		180	-	-
5103 Cleaners 03 SF		147	-	-
6104 Board 1		147	-	-
6105 Board 2		147	-	-
6106 Board 3 SF		147	-	-
6321 Circulation		-	-	-
6320 Circulation		-	-	-
6324 Circulation		-	-	-
6323 Circulation		-	-	-
6326 Circulation		-	-	-
6325 Circulation		-	-	-
6327 Plant Lobby		-	-	-
1106 Science 05 SF		180	-	-
1112 Specialist Science 02 SF		180	-	-
6103 Plant Room SF		147	-	-
1103 Science 02 FF		180	-	-
6304 Stair 01		-	-	-
6305 Stair 02		-	-	-
6306 Stair 03		-	-	-
6307 Stair 01		-	-	-
6308 Stair 02		-	-	-
6309 Stair 03		-	-	-
4011 Year Base 01 FF		180	-	-

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	
5014 DT Staff Store		147	-	-	
3001 Intervention Room 1 FF		180	-	-	
3002 Intervention Room 2 SF		180	-	-	
3004 Intervention Room 3 GF		95	-	-	
1003 Classroom 03 FF		180	-	-	
6003 Pupil WC 03 FF		-	-	-	
5002 Chemical Store SF		147	-	-	
1113 Art 01 GF		180	-	-	
6322 Circulation		-	-	-	
4005 Office GF		180	-	-	
6005 Acc WC 01 GF		-	-	-	
Pupil WC 03		-	-	-	
Pupil WC 01		-	-	-	
6329 Circulation		-	-	-	
6330 Circulation		-	-	-	
6331 Circulation		-	-	-	
6328 Roof Escape		-	-	-	
6332 Circulation		-	-	-	
6333 Circulation		-	-	-	
Pupil WC 02		-	-	-	
Pupil WC 04		-	-	-	

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?
1120 Textiles GF	NO (-62%)	YES
1114 Art 02 GF	NO (-57%)	YES
1001 Classroom 01 FF	NO (-62%)	YES
1002 Classroom 02 FF	N/A	N/A
1117 Resistant Materials Workshop 01 GF	NO (-72%)	YES
1116 Resistant Materials Workshop 02 GF	NO (-50%)	YES
4002 DT Staff Workroom GF	NO (-63%)	YES
1118 Food 01 GF	NO (-49%)	YES
1119 Food 02 GF	NO (-59%)	YES
1004 Classroom 04 FF	N/A	N/A
1005 Classroom 05 FF	N/A	N/A
1006 Classroom 06 FF	N/A	N/A
4004 Maths Staff Workroom FF	NO (-48%)	YES
4001 Science Staff Workroom SF	NO (-63%)	YES
1115 Photography/ICT 01 FF	NO (-50%)	YES
1101 ICT 02 FF	NO (-47%)	YES
5001a Science Prep 01 FF	NO (-37%)	YES
1102 Science 01 FF	NO (-60%)	YES
1104 Science 03 FF	NO (-44%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1105 Science 04 FF	NO (-60%)	YES
1107 Science 06 SF	NO (-50%)	YES
1108 Science 07 SF	NO (-41%)	YES
1109 Science 08 SF	NO (-60%)	YES
1110 Science 09 SF	NO (-54%)	YES
1111 Specialist Science 01 SF	NO (-78%)	YES
5001 Science Prep 02 SF	NO (-46%)	YES
1106 Science 05 SF	NO (-56%)	YES
1112 Specialist Science 02 SF	NO (-46%)	YES
1103 Science 02 FF	NO (-60%)	YES
4011 Year Base 01 FF	NO (-38%)	YES
3001 Intervention Room 1 FF	N/A	N/A
3002 Intervention Room 2 SF	N/A	N/A
3004 Intervention Room 3 GF	N/A	N/A
1003 Classroom 03 FF	NO (-82%)	YES
1113 Art 01 GF	NO (-46%)	YES
4005 Office GF	NO (-50%)	YES

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			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m ²]	3493	3493		Retail/Financial and Professional Services
External area [m ²]	4030	4030		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	NOT	NOT		Offices and Workshop Businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	1522	1393		Storage or Distribution
Average U-value [W/m ² K]	0.38	0.35		Hotels
Alpha value* [%]	26.36	11.36		Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				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
			100	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	2.87	1.19
Cooling	1.45	2.6
Auxiliary	7.23	6.86
Lighting	7.33	7.28
Hot water	5.34	4.15
Equipment*	20.82	20.82
TOTAL**	24.23	22.08

* 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	67	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	67	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	59.26	40
Primary energy [kWh/m ²]	-63	32.7
Total emissions [kg/m ²]	-5.37	3.02

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: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	20.9	0	1.5	0	2.2	3.91	0	4	0
Notional	13	0	1.4	0	1.3	2.64	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	24.9	0	1.8	0	11.2	3.91	0	4	0
Notional	12.7	0	1.3	0	5.7	2.64	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	40.8	30.3	2.9	2.3	7	3.91	3.6	4	3.6
Notional	8.7	44.5	0.9	4.6	9.1	2.64	2.7	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	24.2	22.9	1.7	1.8	10.4	3.91	3.6	4	3.6
Notional	7.3	61.5	0.8	3.9	16.2	2.64	4.4	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	30.9	21.8	2.2	1.7	23.1	3.91	3.6	4	3.6
Notional	17.5	31.6	1.8	2	12.7	2.64	4.4	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity									
Actual	201.1	0	14.3	0	22.9	3.91	0	4	0
Notional	123.7	0	13	0	15.8	2.64	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	45.1	0	3.2	0	5.3	3.91	0	4	0
Notional	35.6	0	3.7	0	2.4	2.64	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	43.1	0	3.1	0	2	3.91	0	4	0
Notional	30.6	0	3.2	0	1.4	2.64	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	0	0	0	0	11.3	0	0	0	0
Notional	0	0	0	0	9	0	0	----	----
[ST] No Heating or Cooling									
Actual	42	0	3	0	0	3.91	0	4	0
Notional	22.4	0	2.4	0	0	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

