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A REPORT BY

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PLANNING ENERGY ASSESSMENT REPORT

YPB-WGC-ZZ-XX-RP-ME-80002

MEP DESIGN & BIM

Validation. Completion. Construction.

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Document History

Date	Rev	Comments
24.05.22	P01	First Issue
01.09.22	P02	Updated in line with Cassidy & Ashton Comments
12.09.22	P03	Updated in line with Cassidy & Ashton Comments

Executive Summary

The project is the proposed construction is of a new 2-story school in Denbighshire.

The design team have considered available options and opportunities associated with the scheme and site constraints and believe they have a robust approach which will meet the requirements within the Planning Policy Wales (PPW) – Edition 11 (Feb 2021) and Technical Advice Notes (TANs) including TAN12 Design 2016 which includes:
'*The Welsh Government's aspiration that in the future all new buildings achieve a zero carbon and nearly zero energy standard for regulated emissions (i.e. heating, cooling, lighting and ventilation).*

This supports The Denbighshire County Council Local Development Plan vision (Chapter 3) that:
'New development sites will demonstrate high levels of sustainable development and seek to achieve low, or even zero, carbon status…. Denbighshire will be making a significant contribution to managing climate change through the promotion of renewable energy technologies and innovative design, the requirement for high levels of sustainable construction and development and through directing new development away from areas of flood risk'

The proposed design is supportive of the guidance within the PPW and associated TANs to achieve the commitment standard as the proposed scheme exceeds current Building Regulations Energy Efficiency Standards and achieves regulatory net zero carbon by 141.21% (183.12 tonnes CO2 per annum) of Carbon reduction in emissions based on an ADL2A Baseline model approach.

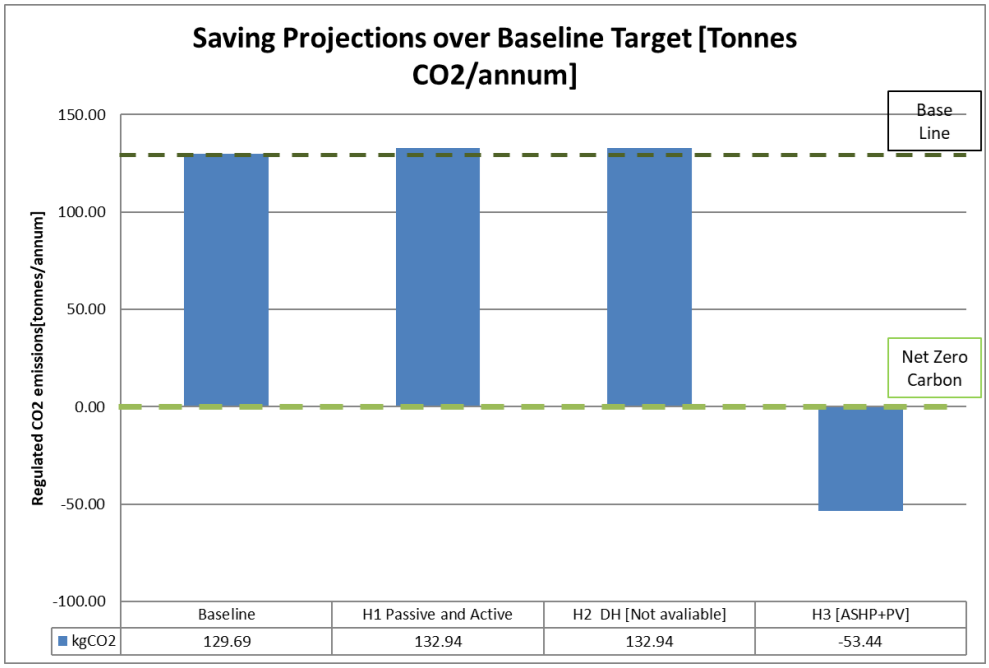
The analysis predicts that the use of renewable technologies and systems proposed contributes 92.15% (105.71kWh/m2 per annum) Energy saving compared to the Baseline analysis.

Following the energy hierarchy, passive design, energy efficient measures and renewable energy measures have been considered and the design will incorporate the following with a fabric first approach:

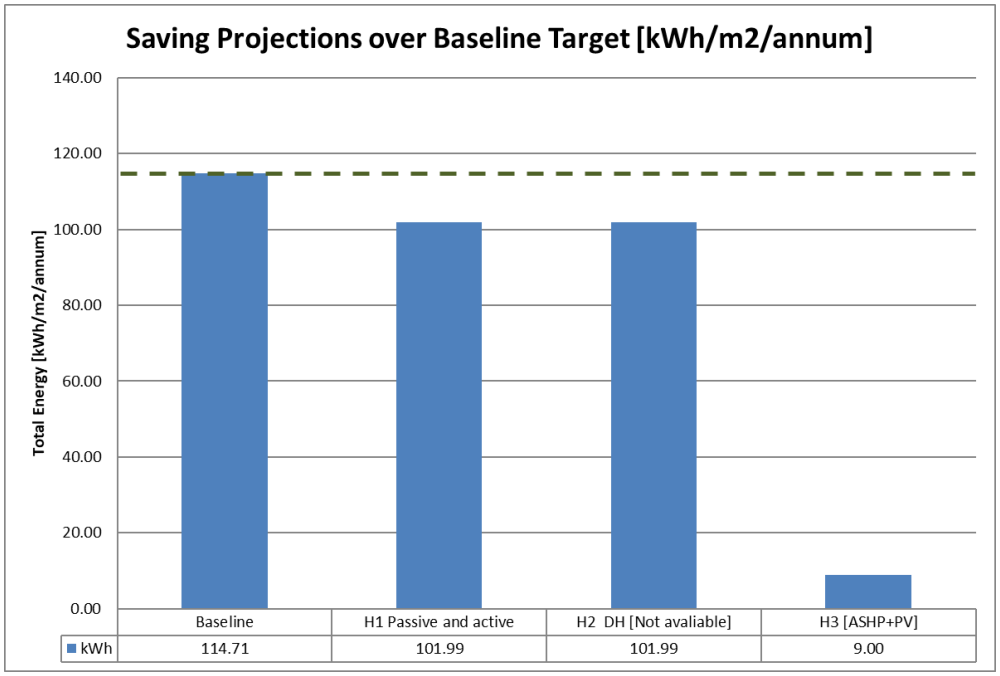
- Improved U values
- Improved glazing performance
- Design to maximise natural daylight
- LED Lighting
- Adaptive lighting controls
- High efficiency Air Sourced Heat Pumps
- Solar PV Cells

The following graphs shows the Baseline and savings for the Hierarchy actions H1 to H3 to be implemented:

Graph 1.0



Graph 2.0



It is demonstrated that the H3 measures will exceed baseline Building Regulations ADL2A 2014 compliance with savings in regulated CO2 emissions when compared to the baseline Building Regulations ADL2A 2014 compliance and exceed the 0% target through the use of on-site renewable energy and low carbon technologies.

Technical data and supporting BRUKL documents are included in the Appendix sections.

The following tables detail the overall Carbon and Energy analysis and reduction for the Baseline and H1 to H3 analysis reported in Table formats:

Table 1.0: Carbon Dioxide Emissions After Each Stage of the Energy Hierarchy

	Carbon Dioxide emissions for non-domestic buildings [Tonnes CO2 per annum]	
Baseline: ADL2A 2014 of the Building Regulations Compliant Building	129.69	
After energy demand reduction (Be Lean H1)	132.94	
After heat network / CHP (Be Clean H2)	132.94	
After renewable energy (Be Green H3)	-53.44	

Table 2.0: Carbon Dioxide Savings from Each Stage of the Energy Hierarchy

	Regulated non-domestic Carbon Dioxide Savings	
	[Tonnes CO2 per annum]	[%]
Savings from energy demand reduction (Be Lean H1)	-3.26	-2.51%
Savings from heat network / CHP (Be Clean H2)	0.00	0.00%
Savings from renewable energy (Be Green H3)	186.38	143.72%
Total Cumulative Savings	183.12	141.21%

Table 3.0 Total Energy After Each Stage of the Energy Hierarchy

	Total Energy [kWh/m2 per annum]		
	Regulated	Unregulated	Total
Baseline	89.76	24.95	114.71
Be Lean H1	77.04	24.95	101.99
Be Clean H2	77.04	24.95	101.99
Be Green H3	29.28	24.95	9.00

Table 4.0 Total Energy Savings after each stage of the energy Hierarchy

	Total Energy Savings	
	[kWh/m2 per annum]	[%] over baseline
Be Lean H1	12.72	11.09%
Be Clean H2	0.00	0.00%
Be Green H3	92.99	81.07%
Total Cumulative Savings	105.71	92.15%

The estimated savings anticipated from implementing this energy strategy on the Baseline ADL2A 2014 energy demand for the development can be seen in Tables 1 - 4. It is anticipated that these measures in combination would achieve 141.21% (183.12 tonnes CO2 per annum) Carbon reduction and 92.15% (105.71 kWh/m2 per annum) Energy saving compared to the Baseline analysis with the use of renewable technologies and systems proposed.

1.0 Introduction

1.1 Site Description

Erection of a new Ysgol Plas Brondyffryn Special Educational Needs (SEN) School for ages 3-19, including formation of Multi Use Games Areas (2no.), external plant / services area, new 118 space car parking area (including 14 electric charging bays), minibus parking (4no.), cycle parking (60no.), designated drop off area, new vehicular access off Ystrad Road, extension / improvements to existing active travel route, community café, landscaping works and all other associated works.

Fig 1.1 Proposed Development

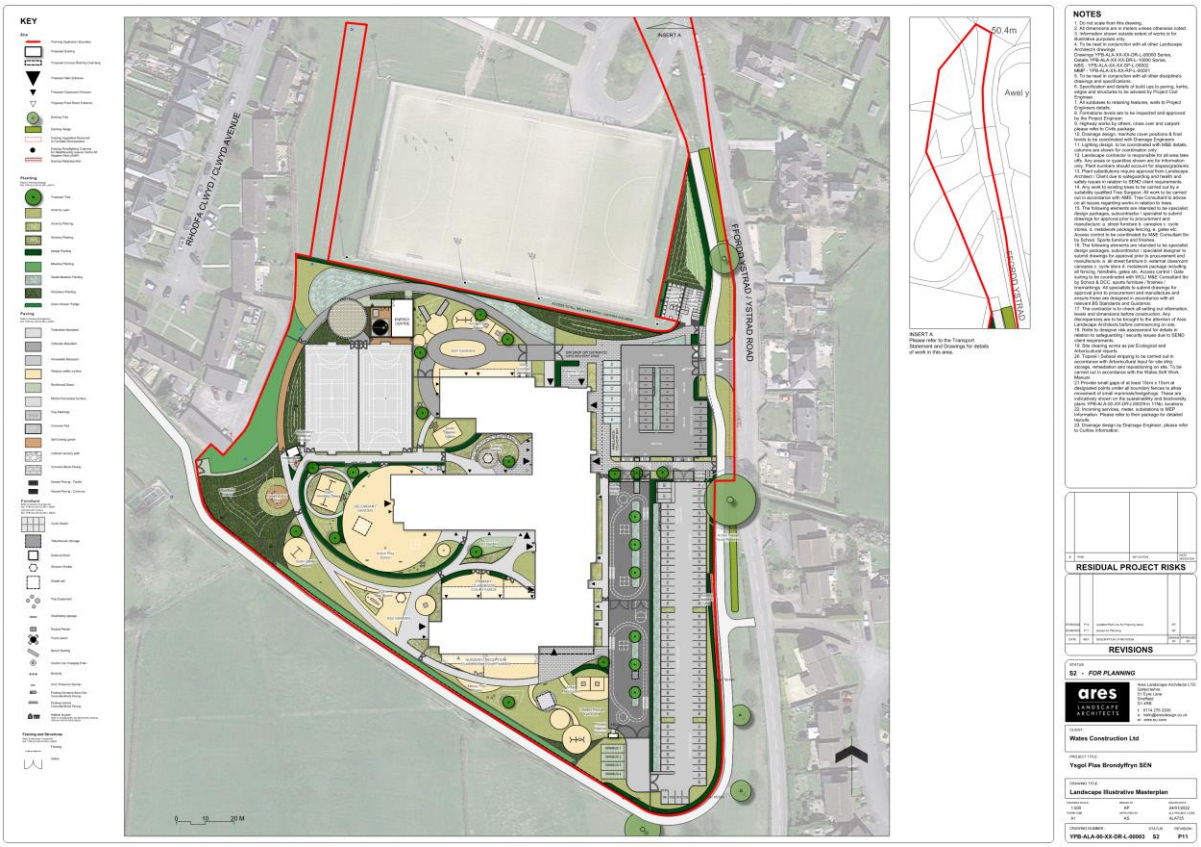


Fig 1.2 Dynamic Analysis Model

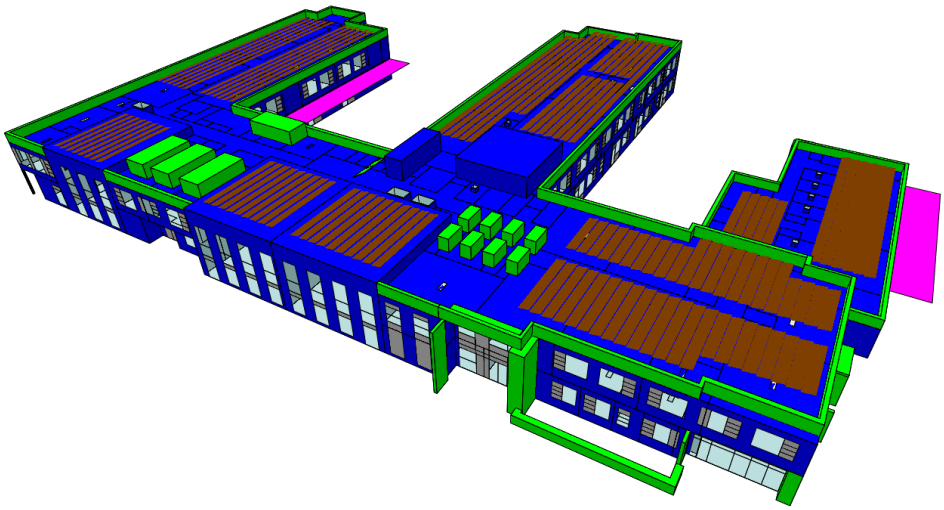


Fig 1.3 Site location

1.3 Purpose of Report

The purpose of this energy assessment is to demonstrate that the design and proposed solutions have addressed climate change mitigation opportunities and details the measures necessary to meet the requirements of policies including Planning Policy Wales and Denbighshire County Council Local Development Plan and including the use of energy hierarchy approaches as TAN12: Design and are integral to the proposed development's design and development.

1.4 Planning Policies

Several regional and local policies exist which promote energy efficiency and the use of renewable technologies where appropriate to minimise carbon dioxide emissions including:

The Planning Policy Wales which sets out the Welsh Government's land use planning policies in respect of planning for sustainable buildings in development plans and development including section 5.8 which presents a policy that:
'is to secure zero carbon buildings while continuing to promote a range of low and zero carbon technologies as a means to achieve this.' And outlines how 'sustainable building design principles should be integral to the design of new development.'

Guidance provided in TAN12: Design and practice Guidance for sustainable buildings of which this report specifically incorporates.

The report demonstrates the design supports the Denbighshire County Council Local Development Plan vision (Chapter 3) that:
'New development sites will demonstrate high levels of sustainable development and seek to achieve low, or even zero, carbon status….'

Other guidance considered in this assessment but not limited to includes:

- The Planning Policy Wales (PPW) Edition 11 2021
- Technical Advice Note (TAN) 12 Design (Mar 2016)
- Denbighshire County Council Local Development Plan 2006-21 Adopted 4th June 2013
- Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015
- Approved Document ADL2A 2014
- The National Planning Policy Framework (NPPF 2012)
- NCM (National Calculation Methodology) Modelling Guide for buildings other than dwellings in Wales (2014 Edition)
- CIBSE TM52 The Limits of Thermal Comfort: Avoiding Overheating in European Buildings
- CIBSE Guide F, Energy efficiency in buildings
- The non-domestic building services compliance guide, 2013
- CIBSE TM37 'Design for improved solar shading control
- CIBSE AM12:2103 Combined heat and power for buildings

This assessment outlines how these policy and guidance are incorporated into the design approach to reduce the energy use and CO2 emissions and achieve the targets where required.

2.0 The Energy Assessment Methodology

All development proposals should take the most appropriate action to minimising Carbon emissions in accordance with the Energy Hierarchy: Be Lean- Be Clean- Be Green as well as consider the need to reduce cooling demand and assess impact of overheating.

The energy assessment is structured around the Energy Hierarchy which is generally accepted as the most effective way of reducing building Carbon emissions. The three stage strategy targets energy use by consideration of the following actions:

Be Lean [Passive]	Energy demand reduction building fabric
Be Lean [Active]	Energy demand reduction building services
Be Clean	Consideration of heating infrastructure including CHP
Be Green	Supply energy from renewable sources

The approach detailed in this document is based on and around the CIBSE methodology for energy reports and follows 4 primary steps:

Step 1	Identifying the targets
Step 2	Assessing the Baseline
Step 3	Applying energy efficiency
Step 4	Applicability of renewable and LZC's

2.1 Identifying the Targets

The scheme and the targets have been assessed based around applying the Energy Hierarchy in relation to Part ADL2A of the 2014 Building Regulations in accordance with the energy strategy Methodology and the setting of a Baseline energy target based around the building fabric and building services.

The current target for new build schemes is 10% beyond Part ADL2A 2014 following a defined methodology.

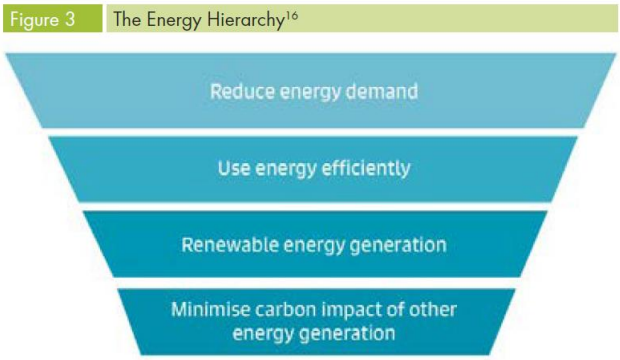
This is the target adopted in this report and used as the basis of comparison.

The requirements of planning policies have been targeted in the design approach and the scheme considered guidance including but not limited to:

TAN12 Section 5.4 Climate Responsive Development and Sustainable Buildings:

> *5.4.3 To effectively **mitigate** the causes of climate change in the design of a development a clear approach to reducing carbon and other greenhouse gas emissions associated with the development should be taken. Good practice in mitigating the causes of climate change is to apply the energy hierarchy (see Figure 3), which details a series of steps that should be taken to minimise the carbon emissions associated with a new development in the most efficient and cost-effective way.*

5.4.4 It is the Welsh Government's aspiration that in the future all new buildings achieve a zero carbon and nearly zero energy standard for regulated emissions (i.e. heating, cooling, lighting and ventilation). A broad hierarchy is used to prioritise design solutions, based on the need to reduce demand first. In taking forward an energy hierarchy, an approach to 'carbon reduction' can be prepared for developments, where appropriate, and included or summarised in a design and access statement to illustrate how the design of the development has sought to reduce the carbon emissions associated with the development - including opportunities to move towards zero carbon.



TAN12 Section 5.10 Public Buildings

5.10.1 The public sector has a responsibility and an opportunity to set high standards in achieving good design in its own buildings and achieving low carbon targets or zero carbon where possible. In the design of schools, hospitals and other buildings and infrastructure intended for use by the local community the aim should be to achieve fitness for purpose, value for money over the whole life of the building, and a positive impact on the lives of those who use it and, on its surroundings,

The analysis required a Baseline building to be generated within approved regulatory software made up generally as the 2014 notional building performance. A summary of the Part L 2014 elemental specification of these notional buildings is published at Appendix B in the Approved Document ADL2A.

This has been selected to set the Target Value as detailed in Fig 2.2 which is the extracted table out of the approved document.

Fig 2.2 ADL2A 2014 extract

Appendix B – L2A
Elemental Specification for the TER calculation

1. The elemental specifications which must be used to calculate the *TPEC* and *TER* of a new building are given in the NCM Modelling Guide[22]. A summary is given in the table below for different categories of building.

Element	Side lit or unlit (When HVAC specification is heating only)	Side lit or unlit (Where HVAC specification includes cooling)	Toplit
Roof U-value ($W/m^2.K$)	0.18	0.18	0.18
Wall U-value ($W/m^2.K$)	0.26	0.26	0.26
Floor U-value ($W/m^2.K$)	0.22	0.22	0.22
Window U-value ($W/m^2.K$)	1.6 (10% FF)	1.8 (10% FF)	N/A
G-Value (%)	40%	40%	N/A
Light Transmittance (%)	71%	71%	N/A
Roof light U-value ($W/m^2.K$)	N/A	N/A	1.8 (15% FF)
G-Value (%)	N/A	N/A	52%
Light Transmittance (%)	N/A	N/A	57%
Air-permeability (m3/m2/hour), note: GIA = Gross Internal Area			
GIA ≤ $250m^2$	5	5	7
$250m^2$ < GIA ≤ $3,500m^2$	3	5	7
$3,500m^2$ < GIA ≤ $10,000m^2$	3	5	5
$10,000m^2$ < GIA	3	5	3
Lighting Efficacy (lm / circuit watt)	65	65	65
Occupancy control (Yes/No)	Yes	Yes	Yes
Daylight control (Yes/No)	Yes	Yes	Yes
Maintenance Factor	0.8	0.8	0.8
Constant illuminance control	No	No	No
Heating efficiency	91%	91%	91%
Central SFP (W/l/s)	1.8	1.8	1.8

Element	Side lit or unlit (When HVAC specification is heating only)	Side lit or unlit (Where HVAC specification includes cooling)	Toplit
Terminal Unit SFP (W/l/s)	0.3	0.3	0.3
Cooling (SEER / SSEER)	N/A	4.5 / 3.6	4.5 / 3.6
Cooling (mixed mode)[1] (SSEER)	N/A	2.7	2.7
Heat recovery efficiency (%)	70%	70%	70%
Variable speed control	Yes	Yes	Yes
Demand control ventilation	Yes	Yes	Yes
Renewable Energy Contribution:			
Monocrystalline PV with an efficiency of 15%. Active area of south facing panels (120kWh/m^2/year output) equivalent to stated % of gross floor area but limited to 50% of roof area.	5.3% of gross internal area		

3.0 Assessing Baseline Emissions

Using Building Regulations approved compliance software and assuming that the heating is provided by gas boilers and any active cooling is provided by electrically powered equipment, the 'Baseline' building represents a development which meets the minimum standards of CO2 emissions reduction and for the analysis the Target Emissions Rate (TER) as defined by Part L of the Building Regulations 2014 is used as the Baseline Carbon emission in kgCO2/m2/annum.

Assessing the Carbon emissions of the proposed development and notional buildings was undertaken using computer-based simulation techniques and based on the standardised National Calculation Methodology (the 'NCM').

The TER is calculated using (IES-VE 2021.4.0.0) software approved for use by the Department for Communities and Local Government (DCLG) as a Dynamic Building Simulation Modelling package (DSM) software which models the Carbon Dioxide emission rates produced by a building in accordance with Part L2A of the Building Regulations (2014).

Table 3.1 below provides the TER data for the Baseline, the BRUKL document for the Baseline has been attached in Appendix A.

Table 3.1 TER for the baseline

Performance	TER [BER from 'H' models]	19.9	kgCO2/m2 annum
	Model Floor Area	6516.9	m2
	Regulated Energy	89.76	Kwh/m2
	Total Energy	114.71	Kwh/m2
	Total Carbon	129.69	TCO2 annum

3.1 Unregulated Emissions

Part L 2014 limits certain Carbon emissions relating to the provision of heat and light to buildings.

Small power loads, i.e., electrical energy for appliances and equipment within the building, are not considered within the regulations. This type of energy use is defined as 'unregulated emissions' as they occur within the building but are not taken into consideration within compliance calculation software.

The unregulated emissions have been extracted out of the BRUKL energy by end use and based on NCM templates and casual load allowances and is included in Table 3.1 above as the difference between total and regulated energy.

3.2 Baseline Summary

Using DSM modelling, Baseline energy consumption for the proposed development including for the notional building fabric and services specification detailed in general planning guidance, has been assessed using a primary DSM model [Baseline] taking account Baseline data. Results are as follows with the supporting BRUKL in Appendix A:

Table 3.2: Baseline Emissions

TER [BER from 'H' models]	19.9	kgCO2/m2 annum
Model Floor Area	6516.9	m2
Regulated Energy	89.76	Kwh/m2
Total Energy	114.71	Kwh/m2
Total Carbon	129.69	TCO2 annum

Heating	27.12	Kwh/m2
Cooling	0.47	Kwh/m2
Auxiliary	2.84	Kwh/m2
Lighting	10.63	Kwh/m2
Hot Water	48.70	Kwh/m2
Equipment	24.95	Kwh/m2
Regulated Energy	89.76	Kwh/m2
Total Energy	114.71	Kwh/m2

Building Regulations take account of energy used to heat, cool, light, provide hot water and ventilate the building. This is detailed as the 'regulated' energy use. Unregulated small power (other equipment etc.) is not considered in the calculation of energy consumption and associated emissions.

The Baseline analysis sets a baseline Carbon emission of 129.69 (Tonnes CO2/annum) and total energy value 114.71 (kWh/m2 per annum) based on the data used.

Table 3.3: Baseline Carbon Dioxide Emissions

	Carbon Dioxide emissions for non-domestic buildings [Tonnes CO2 per annum]	
Baseline: ADL2A 2014 of the Building Regulations Compliant Building	129.69	

Table 3.4: Baseline Total Energy

	Total Energy [kWh/m2 per annum]		
	Regulated	Unregulated	Total
Baseline	89.76	24.95	114.71

The Baseline emissions are based on the building specification before the application of energy efficiency measures. The following assumptions have been made in the calculations and generally based on the notional building performance:

Table 3.5: Baseline Building Input Data

Summary		**Baseline rev 0** ADL2A Notional Building [2014]	
Drawings Provided	Ground floor Plan	Planning	
	First Floor Plan	Planning	
	Sections	Planning	
	Elevations	Planning	
New Build U Values	Walls	0.26	W/m2K
	Ground Floor	0.22	W/m2K
	Exposed Floor	0.22	W/m2K
	Windows	1.60	W/m2K
	Roof Lights	1.80	
	Roof	0.18	W/m2K
Air Permeability	New Build	3.00	m3/hr/m2 @ 50Pa
	Photovoltaic Systems	Yes as Per Modelling Guide	
	CHP Generators	None	
	Solar Thermal Systems	None	
	Air Source Heat Pumps	None	
Power Factor Correction	Not Installed	< 0.9	
Lighting	Lighting Metering	Yes	
	Out of Range Values	No	
	Lamp Type	LED	
	Luminaire Efficacy	65 ll/cW	
	Heating Efficiency	81.9% [Nat Gas]	
	Control	PIR and Daylight Control	
	Heat Recovery	70%	
	Cooling SEER	3.6	
	Cooling EER	2.5	
	Other	Summary Table ADL2A Appendix B	

4.0 Demand Reduction [Be lean] H1

4.1 Passive Measures H1

A number of passive design measures have been considered and where applicable incorporated into the proposed scheme in order to reduce total energy demand.

The proposed development is a new building design on a green field site. There was no opportunity to orientate the building to benefit from passive solar design as the site layout was fixed due to physical constraints and access requirements.

The internal layout has been designed to maximise the use of natural light and borrowed light between spaces.

A Natural Ventilation Heat recovery [NVHR] design and approach is the primary ventilation solution.

User controlled blinds will be provided to all windows serving occupied spaces to control glare and reduce overheating, automated blinds to the roof lights will be provided to these high-level windows.

All external building elements, floors, walls, roof and openings, are better than the notional U Values detailed in Table 5 beyond those required by Part ADL2A adopting a fabric first approach. New glazing units (improved solar g values to solar exposed windows where necessary) will reduce the energy required to heat the building during the heating season while also reducing overheating in the summer and addressing potential future climate change impacts.

Building air tightness has been reviewed by the team and the designers feel a target air permeability rate of 3.0 m3/(h.m2)at 50Pa for the new build shall be targeted if not reduced further during detailed design and building junction detailing.

The following Table details the improvements of the proposed U Value over regulatory limiting standards and the Notional regulatory building which has been used to set the baseline analysis.

Fig 4.1 U Value comparison

	Elemental U Values Minimum Standards ADL2A 2014		Proposed Elemental U Values		Proposed Elemental U Values Improvements over minimum standards
Walls	0.35	W/m2K	0.15	W/m2K	57%
Ground Floor	0.25	W/m2K	0.12	W/m2K	52%
Exposed Floor	0.25	W/m2K	0.12	W/m2K	52%
Windows	2.2	W/m2K	1.00	W/m2K	55%
Roof Lights	2.2	W/m2K	1.00	W/m2K	55%
Roof	0.25	W/m2K	0.09	W/m2K	64%

	Elemental U Values Notional Building ADL2A 2014		Proposed Elemental U Values		Proposed Elemental U Values Improvements over minimum standards
Walls	0.26	W/m2K	0.15	W/m2K	42%
Ground Floor	0.22	W/m2K	0.12	W/m2K	45%
Exposed Floor	0.22	W/m2K	0.12	W/m2K	45%
Windows	1.6	W/m2K	1.00	W/m2K	38%
Roof Lights	1.8	W/m2K	1.00	W/m2K	44%
Roof	0.18	W/m2K	0.09	W/m2K	50%

4.2 Active Measures H1

The new building will be fitted with a low energy, lighting scheme. Lighting to communal spaces, circulation will include adequate controls to maximise efficiency sensing, proximity control or timed control, whichever proves most suitable to a given area shall be reviewed and considered.

All areas have been designed to maximise available daylight and arranged so that natural light can be borrowed between occupied spaces through partially glazed partitions where applicable and natural opening in the building design.

The proposed HVAC system will utilise highly efficient systems to provide space heating. The system will be fully controlled by a Building Management System (BMS) to maximise efficiency and ensure adequate levels of environmental control to provide thermal comfort to building occupiers. Local control within the Occupied areas will be possible within limits set by the BMS and excess set point control will be managed by the systems mitigating heating demands and energy use.

Lighting design shall prioritise high Luminaries Efficacy LED fittings and low lighting control systems parasitic power with overriding control when spaces are unoccupied.

Because some of the internal occupied areas of the scheme are dependent on mechanical ventilation, these systems shall be designed to operate at automatic adjustable variable speed and be selected to that systems' specific fan powers [SFP] shall be lower than the limiting standards set by ADL2A.

All ventilation systems shall where practical, incorporate high efficiency heat recovery.

H1 Measures are summarised as follows:

Passive measures

- Improved U Values
- Improved glazing solar g and U Values
- Blinds

Active Measures

- LED Lighting
- MVHR Upgrades and reduction of SFP's zonal supply units
- Reduction of fan SFP's

A second DSM model has been created [H1] taking account of passive and active improvements to establish the emission reductions possible through these actions. The results and input data are shown in the following tables.

The results and details of the H1 (be lean) DSM modelling analysis are as follows:

Table 4.1: Hierarchy 1 Carbon Dioxide Emissions from each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide emissions for non-domestic buildings [Tonnes CO2 per annum]	
Baseline: ADL2A 2014 of the Building Regulations Compliant Building	129.69	
After energy demand reduction (Be Lean H1)	132.94	

Table 4.2: Hierarchy 1 Carbon dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic Carbon Dioxide Savings	
	[Tonnes CO2 per annum]	[%]
Savings from energy demand reduction (Be Lean H1)	-3.26	-2.51%

Table 4.3: Hierarchy 1 Total Energy from each stage of the Energy Hierarchy for non-domestic buildings

	Total Energy [kWh/m2 per annum]		
	Regulated	Unregulated	Total
Baseline	89.76	24.95	114.71
Be Lean H1	77.04	24.95	101.99

Table 4.4: Hierarchy 1 Total Energy savings from each stage of the Energy Hierarchy for non-domestic buildings

	Total Energy Savings	
	[kWh/m2 per annum]	[%] over baseline
Be Lean H1	12.72	11.09%

It can be seen from the analysis the H1 [Be Lean] actions provide a 11.09% total energy saving over the Baseline DSM compliance results however there is no Carbon Emissions saving with these H1 measures alone.

The H1 supporting BRUKL output is provided in Appendix B for information.

The following table details a full comparison between the Baseline model and the H1 [Be Lean] model:

Table 4.5: Hierarchy 1 Summary

Summary		Baseline rev 0 ADL2A Notional Building [2014]		Hierarchy 1 rev 0 Passive and Active be Lean Reduce the Need for Energy
Drawings Provided	Ground floor Plan	Planning		Planning
	First Floor Plan	Planning		Planning
	Sections	Planning		Planning
	Elevations	Planning		Planning
New Build U Values	Walls	0.26	W/m2K	0.15
	Ground Floor	0.22	W/m2K	0.12
	Exposed Floor	0.22	W/m2K	0.12
	Windows	1.60	W/m2K	1.00
	Roof Lights	1.80		1.00
	Roof	0.18	W/m2K	0.09
Air Permeability	New Build	3.00	m3/hr/m2 @ 50Pa	3
	Photovoltaic Systems	Yes as Per Modelling Guide		None
	CHP Generators	None		None
	Solar Thermal Systems	None		None
	Air Source Heat Pumps	None		None
Power Factor Correction	Not Installed	< 0.9		>= 0.95
Lighting	Lighting Metering	Yes		Yes
	Out of Range Values	No		Yes
	Lamp Type	LED		LED Lamp Type
	Luminaire Efficacy	65 ll/cW		Initial Design Data
	Heating Efficiency	81.9% [Nat Gas]		81.9% [Nat Gas]
	Control	PIR and Daylight Control		PIR and Daylight Control
	Heat Recovery	70%		75%
	Cooling SEER	3.6		3.6
	Cooling EER	2.5		2.5
	Other	Summary Table ADL2A Appendix B		Improved Heat recovery
				Improved SFP's
				Glazing Improvements

Performance	TER [BER from 'H' models]	19.9	kgCO2/m2 annum	20.4	kgCO2/m2
	Model Floor Area	6516.9	m2	6516.9	m2
	Regulated Energy	89.76	Kwh/m2	77.04	Kwh/m2
	Total Energy	114.71	Kwh/m2	101.99	Kwh/m2
	Total Carbon	129.69	TCO2 annum	132.94	TCO2
		Reduction in Carbon Emissions		-3.26	TCO2
		Cumulative Reduction in Carbon		-3.26	TCO2
		Cumulative Improvement [%]		-2.51%	
		Hierarchy Improvement [%]		-2.51%	
	Heating	27.12	Kwh/m2	17.77	Kwh/m2
	Cooling	0.47	Kwh/m2	0.49	Kwh/m2
	Auxiliary	2.84	Kwh/m2	2.66	Kwh/m2
	Lighting	10.63	Kwh/m2	7.42	Kwh/m2
	Hot Water	48.70	Kwh/m2	48.70	Kwh/m2
	Equipment	24.95	Kwh/m2	24.95	Kwh/m2
	Regulated Energy	89.76	Kwh/m2	77.04	Kwh/m2
	Total Energy	114.71	Kwh/m2	101.99	Kwh/m2

5.0 Heating Infrastructure [Be Clean] H2

There are no available district heating networks and as such this is not a practical option however this section has been included for completeness of the energy assessment.

5.1 Decentralised Energy

Planning guidance and ADL2A requests that all developments investigate the feasibility of:

- Connecting to an existing or planned decentralised energy scheme.
- Installing combined heat on power (CHP) or combined cooling, heat and power (CCHP).
- Designing in the flexibility to connect to any future decentralised energy network.

District heating networks are considered to provide more efficient energy delivery as network losses are often considerably less than conventional energy supplies.

There are no current large-scale heating or cooling networks in economical proximity to the site and its inclusion in the developments design has been discounted.

5.2 Combined Heat and Power

CHP (combined heat and power) provides both heat and electricity locally for use in a single building or larger heating network. Providing heat and electricity in this way has an efficiency benefit over conventional systems due to the relative inefficiency of grid supplied power.

Small to medium scale CHP most often use purpose built or converted reciprocating internal combustion engines to drive a generator supplying three phase electricity. The efficiency of IC engines is relatively low because of the amount of energy lost as heat. In a CHP unit this otherwise waste heat is used to heat water, this water is used to provide space heating and DHW either directly or via a heat exchanger.

The Scheme is to consider as a fundamental criterion on the design of the school, the reduction in demand of Carbon-based fossil fuels and it was decided as a main feature of the scheme that Natural Gas shall not be used for heating or Domestic hot water and as such the Use of CHP was not viable.

The results and details of the H2 ‘Be Clean’ DSM modelling analysis are as follows:

Table 5.1: Hierarchy 2 Carbon Dioxide Emissions from each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide emissions for non-domestic buildings [Tonnes CO2 per annum]	
Baseline: ADL2A 2014 of the Building Regulations Compliant Building	129.69	
After energy demand reduction (Be Lean H1)	132.94	
After heat network / CHP (Be Clean H2)	132.94	

Table 5.2: Hierarchy 2 Carbon dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic Carbon Dioxide Savings	
	[Tonnes CO2 per annum]	[%]
Savings from energy demand reduction (Be Lean H1)	-3.26	-2.51%
Savings from heat network / CHP (Be Clean H2)	0.00	0.00%

Table 5.3: Hierarchy 2 Total Energy from each stage of the Energy Hierarchy for non-domestic buildings

	Total Energy [kWh/m2 per annum]		
	Regulated	Unregulated	Total
Baseline	89.76	24.95	114.71
Be Lean H1	77.04	24.95	101.99
Be Clean H2	77.04	24.95	101.99

Table 5.4: Hierarchy 2 Total Energy savings from each stage of the Energy Hierarchy for non-domestic buildings

	Total Energy Savings	
	[kWh/m2 per annum]	[%] over baseline
Be Lean H1	12.72	11.09%
Be Clean H2	0.00	0.00%

It can be seen from the analysis the H2 [Be Clean] actions provide a 0.00% saving

The H2 supporting BRUKL output has not been included in the report.

6.0 Applicability of Renewable and LZC's [Be Green] H3

The following section details the considerations and practicalities of Renewable and Low Zero Carbon (LZC) technologies.

6.1 Renewable Technologies

Energy resources accepted as Renewable or Low Carbon Technologies are defined by the Department of Energy & Climate change Low Carbon Buildings Program. Those which are suitable for consideration in this case are:

- Solar photovoltaics
- Wind turbines
- Solar thermal hot water
- Heat pumps

6.2 Solar Photovoltaics

Photovoltaics (PVs) generate electricity from daylight using semiconductors. PV's are also a simple technology requiring little in the way of maintenance and offer a proven way of generating zero Carbon, renewable electricity. Photovoltaics generate electricity which displaces that which would otherwise be provided by the grid.

It is proposed that the PV systems shall be designed to incorporate battery storage which shall store electrical energy generated by the PV array for use when direct solar energy is not available and would normally need to draw from the local electrical grid to maintain systems operations.

Given the area of available roof space and minimal over shading, PV is considered as the primary low carbon technology for the project.

6.3 Wind Turbines

Wind turbines generate electricity via a conventional generator connected to turbine blades which are in turn powered by the prevailing wind.

Given the location of the development, Wind turbine technology would be suitable in terms of wind availability but the close proximity to residential building and access requirements wind turbines were felt unsuitable for the location even though potentially viable.

6.4 Solar Thermal

The proposed development has a reasonable DHWS load and a small-scale solar thermal used in conjunction with the PV generated electrical loads was considered suitable in that the PV with battery storage would provide an electrical load above the building base load and in summer months the solar thermal and PV could be used to generate domestic hot water for community use outside school hours an reduce the running hours on the proposed heat generating plant and auxiliary pumping energy systems.

6.5 Heat Pumps

The design team have considered the use of heat pumps in detail and feel it is the best solution for the schemes heating demands.

The heat pump technology proposed is a highly efficient air sourced heat pump system consisting of a number of suitable sized units that will be demand controlled in a cascade mode of operation ensuring each of the heat pumps operates at optimum efficiency.

Details of the typical system type are included in Appendix F.

The H1 Be Lean approach has considered the carbon benefits in previous analysis and the H3 Be Green analysis shall report the renewable carbon reduction only.

Table 6.1: LZC Summary of Considerations

Description	Comments applicable to the scheme
District Heating	There is no network available
Air Sourced Heat Pumps	Possible to serve the building heating demands and equipment can be selected to operate at low ambient noise levels and offer very high heating performance and is considered a viable technology
Ground Sourced Heat Pumps	Possible to serve the building heating and cooling demands but the number of bore holes means it's not financially viable
Biomass Boiler Plant	Not applicable to the scheme because of cost, building location and space requirements
Solar Thermal (solar water heating)	Possible to serve the domestic hot water systems of the and is considered a viable technology
Active Solar (Photovoltaic)	Appropriate for this scheme and considering the roof area availability is considered a viable technology
Small Hydro	Not applicable to the scheme
Combined Heat and Power (CHP)	Not applicable due to the expected running hours to be less than that required to make it financially viable and design intent to not use natural gas in the design
Energy from Waste	Not applicable to the scheme
Anaerobic Digestion	Not applicable to the scheme

A Fourth DSM model has been created [H3] taking account renewable improvements to establish the emission reductions possible through these actions. The results and input data are shown in the following tables:

Table 6.2: Hierarchy 3 Carbon Dioxide Emissions from each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide emissions for non-domestic buildings [Tonnes CO2 per annum]	
Baseline: ADL2A 2014 of the Building Regulations Compliant Building	129.69	
After energy demand reduction (Be Lean H1)	132.94	
After heat network / CHP (Be Clean H2)	132.94	
After renewable energy (Be Green H3)	-53.44	

Table 6.3: Hierarchy 3 Carbon dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic Carbon Dioxide Savings	
	[Tonnes CO2 per annum]	[%]
Savings from energy demand reduction (Be Lean H1)	-3.26	-2.51%
Savings from heat network / CHP (Be Clean H2)	0.00	0.00%
Savings from renewable energy (Be Green H3)	186.38	143.72%

Table 6.4: Hierarchy 3 Total Energy from each stage of the Energy Hierarchy for non-domestic buildings

	Total Energy [kWh/m2 per annum]		
	Regulated	Unregulated	Total
Baseline	89.76	24.95	114.71
Be Lean H1	77.04	24.95	101.99
Be Clean H2	77.04	24.95	101.99
Be Green H3	29.28	24.95	9.00

Table 6.5: Hierarchy 3 Total Energy savings from each stage of the Energy Hierarchy for non-domestic buildings

	Total Energy Savings	
	[kWh/m2 per annum]	[%] over baseline
Be Lean H1	12.72	11.09%
Be Clean H2	0.00	0.00%
Be Green H3	92.99	81.07%

It can be seen from the analysis the H3 [Be Green] actions provide a 143.72% of Carbon savings and 81.07% Total Energy saving. This equates to a reduction in carbon emissions of 186.38 (tonnes of Carbon per annum) and Energy of 92.99 (kW/m2 per annum).

The H3 supporting BRUKL output is provided in Appendix D for Information.

The following table details a full comparison between the Baseline model and the H3 [Be Green] model:

Table 6.6: Hierarchy 3 Summary

Summary		Baseline rev 0 ADL2A Notional Building [2014]		Hierarchy 1 rev 0 Passive and Active be Lean Reduce the Need for Energy		Hierarchy 2 rev 0 DH Be Clean Use energy More Efficiency		Hierarchy 3 rev 0 Be Green Use of Renewable Energy	
Drawings Provided	Ground floor Plan	Planning		Planning		Planning		Planning	
	First Floor Plan	Planning		Planning		Planning		Planning	
	Sections	Planning		Planning		Planning		Planning	
	Elevations	Planning		Planning		Planning		Planning	
New Build U Values	Walls	0.26	W/m2K	0.15		0.15		0.15	
	Ground Floor	0.22	W/m2K	0.12		0.12		0.12	
	Exposed Floor	0.22	W/m2K	0.12		0.12		0.12	
	Windows	1.60	W/m2K	1.00		1.00		1.18	
	Roof Lights	1.80		1.00		1.00		1.18	
	Roof	0.18	W/m2K	0.09		0.09		0.09	
Air Permeability	New Build	3.00	m3/hr/m2 @ 50Pa	3		3		3	
	Photovoltaic Systems	Yes as Per Modelling Guide		None		None		Yes	
	CHP Generators	None		None		None		None	
	Solar Thermal Systems	None		None		None		None	
	Air Source Heat Pumps	None		None		None		Yes	
Power Factor Correction	Not Installed	< 0.9		>= 0.95		>= 0.95		>= 0.95	
Lighting	Lighting Metering	Yes		Yes		Yes		Yes	
	Out of Range Values	No		Yes		Yes		Yes	
	Lamp Type	LED		LED Lamp Type		LED Lamp Type		LED Lamp Type	
	Luminaire Efficacy	65 ll/cW		Initial Design Data		Initial Design Data		Initial Design Data	
	Heating Efficiency	81.9% [Nat Gas]		81.9% [Nat Gas]		DH Not Viable		5.5	
	Control	PIR and Daylight Control		PIR and Daylight Control		PIR and Daylight Control		PIR and Daylight Control	
	Heat Recovery	70%		75%		75%		75%	
	Cooling SEER	3.6		3.6		3.6		5	
	Cooling EER	2.5		2.5		2.5		3.5	
	Other	Summary Table ADL2A Appendix B		Improved Heat recovery		Improved Heat recovery		Improved Heat recovery	
				Improved SFP's		Improved SFP's		Improved SFP's	
				Glazing Improvements		Glazing Improvements		Further Glazing Improvements	
						No CHP or DH		ASHP and Solar DHWS	
								xxxm2 Solar	
								xxxm2 PV	
Performance	TER [BER from 'H' models]	19.9	kgCO2/m2 annum	20.4	kgCO2/m2	20.4	kgCO2/m2	-8.2	kgCO2/m2
	Model Floor Area	6516.9	m2	6516.9	m2	6516.9	m2	6516.9	m2
	Regulated Energy	89.76	Kwh/m2	77.04	Kwh/m2	77.04	Kwh/m2	29.28	Kwh/m2
	Total Energy	114.71	Kwh/m2	101.99	Kwh/m2	101.99	Kwh/m2	9	Kwh/m2
	Total Carbon	129.69	TCO2 annum	132.94	TCO2	132.94	TCO2	-53.44	TCO2
	Reduction in Carbon Emissions			-3.26	TCO2	0.00	TCO2	186.38	TCO2
	Cumulative Reduction in Carbon			-3.26	TCO2	-3.26	TCO2	183.12	TCO2
	Cumulative Improvement [%]			-2.51%		-2.51%		141.21%	
	Hierarchy Improvement [%]			-2.51%		0.00%		143.72%	
	Heating	27.12	Kwh/m2	17.77	Kwh/m2	17.77	Kwh/m2	4.14	Kwh/m2
	Cooling	0.47	Kwh/m2	0.49	Kwh/m2	0.49	Kwh/m2	0.21	Kwh/m2
	Auxiliary	2.84	Kwh/m2	2.66	Kwh/m2	2.66	Kwh/m2	2.69	Kwh/m2
	Lighting	10.63	Kwh/m2	7.42	Kwh/m2	7.42	Kwh/m2	7.42	Kwh/m2
	Hot Water	48.70	Kwh/m2	48.70	Kwh/m2	48.70	Kwh/m2	14.82	Kwh/m2
	Equipment	24.95	Kwh/m2	24.95	Kwh/m2	24.95	Kwh/m2	24.95	Kwh/m2
	Regulated Energy	89.76	Kwh/m2	77.04	Kwh/m2	77.04	Kwh/m2	29.28	Kwh/m2
	Total Energy	114.71	Kwh/m2	101.99	Kwh/m2	101.99	Kwh/m2	9.00	Kwh/m2

7.0 Summary of Energy Strategy

The energy strategy considered is based on the Energy Hierarchy as detailed in the introduction of this report. The summary of estimated savings anticipated from implementing this energy strategy on the Baseline energy demand for the development can be seen in Table 7.1 and Table 7.2.

Table 7.1: Carbon dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic Carbon Dioxide Savings	
	[Tonnes CO2 per annum]	[%]
Savings from energy demand reduction (Be Lean H1)	-3.26	-2.51%
Savings from heat network / CHP (Be Clean H2)	0.00	0.00%
Savings from renewable energy (Be Green H3)	186.38	143.72%
Total Cumulative Savings	183.12	141.21%

Table 7.2: Total Energy Savings after each stage of the energy Hierarchy for non-domestic buildings

	Total Energy Savings	
	[kWh/m2 per annum]	[%] over baseline
Be Lean H1	12.72	11.09%
Be Clean H2	0.00	0.00%
Be Green H3	92.99	81.07%
Total Cumulative Savings	105.71	92.15%

The building fabric will be improved beyond current regulatory requirements by improving levels of insulation where practical.

Passive and Active design features have been incorporated including designing internal layouts to maximise the use of natural light and high thermal insulation to reduce energy demand and help moderate internal temperatures throughout the year.

Energy efficient lighting and other system improvements that will be installed which use less energy and have suitable control so as to be operated at optimum performance while providing a comfortable internal environment.

The use of ASHP's, shows improvement is predicted over the Baseline energy analysis is also possible.

The proposed use of Renewable and Low Zero Carbon (LZC) technologies is consistent with the planning policies commitments and achieves the target of net zero standard.

It is anticipated that these measures in combination would achieve 141.21% (183.12 tonnes CO2) of Carbon reduction in emissions compared to the Baseline analysis and 92.15% (105.71kWh/m2 per annum) Energy saving compared to the Baseline analysis with the use of renewable technologies and systems proposed.

Sub-meters will be provided for all substantial energy uses.

All external lighting will be energy efficient and controlled for the presence of daylight.

The following table details a full comparison between the Baseline model and the H1 - H3 models:

Table 7.3: LZC Summary of Analysis

Summary		Baseline rev 0 ADL2A Notional Building [2014]		Hierarchy 1 rev 0 Passive and Active be Lean Reduce the Need for Energy		Hierarchy 2 rev 0 DH Be Clean Use energy More Efficiency		Hierarchy 3 rev 0 Be Green Use of Renewable Energy	
Drawings Provided	Ground floor Plan	Planning		Planning		Planning		Planning	
	First Floor Plan	Planning		Planning		Planning		Planning	
	Sections	Planning		Planning		Planning		Planning	
	Elevations	Planning		Planning		Planning		Planning	
New Build U Values	Walls	0.26	W/m2K	0.15		0.15		0.15	
	Ground Floor	0.22	W/m2K	0.12		0.12		0.12	
	Exposed Floor	0.22	W/m2K	0.12		0.12		0.12	
	Windows	1.60	W/m2K	1.00		1.00		1.18	
	Roof Lights	1.80		1.00		1.00		1.18	
	Roof	0.18	W/m2K	0.09		0.09		0.09	
Air Permeability	New Build	3.00	m3/hr/m2 @ 50Pa	3		3		3	
	Photovoltaic Systems	Yes as Per Modelling Guide		None		None		Yes	
	CHP Generators	None		None		None		None	
	Solar Thermal Systems	None		None		None		None	
	Air Source Heat Pumps	None		None		None		Yes	
Power Factor Correction	Not Installed	< 0.9		>= 0.95		>= 0.95		>= 0.95	
Lighting	Lighting Metering	Yes		Yes		Yes		Yes	
	Out of Range Values	No		Yes		Yes		Yes	
	Lamp Type	LED		LED Lamp Type		LED Lamp Type		LED Lamp Type	
	Luminaire Efficacy	65 ll/cW		Initial Design Data		Initial Design Data		Initial Design Data	
	Heating Efficiency	81.9% [Nat Gas]		81.9% [Nat Gas]		DH Not Viable		5.5	
	Control	PIR and Daylight Control		PIR and Daylight Control		PIR and Daylight Control		PIR and Daylight Control	
	Heat Recovery	70%		75%		75%		75%	
	Cooling SEER	3.6		3.6		3.6		5	
	Cooling EER	2.5		2.5		2.5		3.5	
	Other	Summary Table ADL2A Appendix B		Improved Heat recovery		Improved Heat recovery		Improved Heat recovery	
				Improved SFP's		Improved SFP's		Improved SFP's	
				Glazing Improvements		Glazing Improvements		Further Glazing Improvements	
						No CHP or DH		ASHP and Solar DHWS	
								xxxm2 Solar	
								xxxm2 PV	
Performance	TER [BER from 'H' models]	19.9	kgCO2/m2 annum	20.4	kgCO2/m2	20.4	kgCO2/m2	-8.2	kgCO2/m2
	Model Floor Area	6516.9	m2	6516.9	m2	6516.9	m2	6516.9	m2
	Regulated Energy	89.76	Kwh/m2	77.04	Kwh/m2	77.04	Kwh/m2	29.28	Kwh/m2
	Total Energy	114.71	Kwh/m2	101.99	Kwh/m2	101.99	Kwh/m2	9	Kwh/m2
	Total Carbon	129.69	TCO2 annum	132.94	TCO2	132.94	TCO2	-53.44	TCO2
	Reduction in Carbon Emissions			-3.26	TCO2	0.00	TCO2	186.38	TCO2
	Cumulative Reduction in Carbon			-3.26	TCO2	-3.26	TCO2	183.12	TCO2
	Cumulative Improvement [%]			-2.51%		-2.51%		141.21%	
	Hierarchy Improvement [%]			-2.51%		0.00%		143.72%	
	Heating	27.12	Kwh/m2	17.77	Kwh/m2	17.77	Kwh/m2	4.14	Kwh/m2
	Cooling	0.47	Kwh/m2	0.49	Kwh/m2	0.49	Kwh/m2	0.21	Kwh/m2
	Auxiliary	2.84	Kwh/m2	2.66	Kwh/m2	2.66	Kwh/m2	2.69	Kwh/m2
	Lighting	10.63	Kwh/m2	7.42	Kwh/m2	7.42	Kwh/m2	7.42	Kwh/m2
	Hot Water	48.70	Kwh/m2	48.70	Kwh/m2	48.70	Kwh/m2	14.82	Kwh/m2
	Equipment	24.95	Kwh/m2	24.95	Kwh/m2	24.95	Kwh/m2	24.95	Kwh/m2
	Regulated Energy	89.76	Kwh/m2	77.04	Kwh/m2	77.04	Kwh/m2	29.28	Kwh/m2
	Total Energy	114.71	Kwh/m2	101.99	Kwh/m2	101.99	Kwh/m2	9.00	Kwh/m2

BRUKL Output Document

Compliance with Wales Building Regulations Part L 2014

Llywodraeth Cymru
Welsh Government

Project name

Ysgol Plas Brondyffryn B0

As designed

Date: Mon May 16 09:05:32 2022

Administrative information

Building Details

Address: Ysgol Plas Brondyffryn, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Wilson Gray Consulting Ltd

Telephone number: 0191 691 6770

Address: Swan Building, Prestwick Park, Newcastle upon Tyne, NE20 9SJ

Criterion 1: The calculated BER and BPEC for the building must not exceed the targets

The building does not comply with Wales Building Regulations Part L 2014

Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	24.1	
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	19.9	
Building Primary Energy Consumption (BPEC), $kWh/m^2.annum$	121.34	
Target Primary Energy Consumption (TPEC), $kWh/m^2.annum$	116.76	
Do the building's emissions and primary energy consumption exceed the targets?	BER > TER	BPEC > TPEC

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	ST000011:Surf[5]
Floor	0.25	0.22	0.22	SH000049:Surf[0]
Roof	0.25	0.18	0.18	SH000032:Surf[2]
Windows***, roof windows, and rooflights	2.2	1.6	1.61	ST000011:Surf[2]
Personnel doors	2.2	1.09	1.19	ST000011:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.
** 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.
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	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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- B03 MVHR With Heating Coil H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	1.5	0.7
Standard value	0.91	N/A	N/A	1.1^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

2- B04 Radiators Natural Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0.19	0	-
Standard value	0.91*	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. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- B01 NVHR with Heating Coil H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	0.2	-
Standard value	0.91	N/A	N/A	1.1^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

4- B05 Radiators Extract Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0.19	0	-
Standard value	0.91*	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. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

5- B08 Kitchen Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	1.5	0.7
Standard value	0.91	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

6- B02 AHU Mechanical Ventilation Hall H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	1.5	0.7
Standard value	0.91	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

7- B10 Convectors Nat Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	0	-
Standard value	0.91*	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. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

8- B07 ASHP and MVHR H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	2.6	0	0	0.7
Standard value	0.91*	2.6	N/A	N/A	0.5
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. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

9- B11 Door Heater H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	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- B06 ASHP Server H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.6	2.6	0	0	-
Standard value	2.5*	2.6	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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1072 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1073 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1074 WC	-	-	0.4	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1076 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1077 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1084 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1085 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1089 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1094 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1096 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1117 Vis. AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1125 AWC C_Access	-	-	0.4	-	-	-	-	-	-	-	N/A
1199 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1200 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1208 St. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1209 St. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1213 S. Staff Ch. / Lockers	-	-	0.4	-	-	-	-	-	-	-	N/A
1214 S. Staff Ch. / Lockers	-	-	0.4	-	-	-	-	-	-	-	N/A
1215 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1216 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1222 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1223 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1225 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1227 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1231 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1232 Staff AWC / Ch.	-	-	0.4	-	-	-	-	-	-	-	N/A
1375 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1392 WCs Cloak	-	-	0.4	-	-	-	-	-	-	-	N/A
1393 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1396 WC / Change	-	-	0.4	-	-	-	-	-	-	-	N/A
1396 WC / Change	-	-	0.4	-	-	-	-	-	-	-	N/A
1429 Laundry	-	-	0.4	-	-	-	-	-	-	-	N/A
1437 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1438 St AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1493 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1503 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1504 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1510 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1511 Cl.	-	-	0.4	-	-	-	-	-	-	-	N/A
1529 Cloak	-	-	0.4	-	-	-	-	-	-	-	N/A
1546 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1547 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1551 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1552 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1553 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1571 WC	-	-	0.4	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1572 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1573 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1581 Laundry	-	-	0.4	-	-	-	-	-	-	-	N/A
1587 Staff / AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1593 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1596 Vis. AWC	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
1056 Medical	65	-	-	238
1057 SLT Office	65	-	-	180
1060 Admin Store	65	-	-	9
1062 Stair	-	65	-	87
1063 Stair	-	65	-	71
1071 KS1 Group Room 1	65	-	-	137
1072 WC	-	65	-	49
1073 WC	-	65	-	49
1074 WC	-	65	-	49
1075 KS1 Group Room 2	65	-	-	137
1076 Staff WC	-	65	-	50
1077 Staff WC	-	65	-	53
1078 Stair C_Access	-	65	-	29
1078 Stair C_Access	-	65	-	100
1079 Hygiene Suite	65	-	-	127
1084 Staff WC	-	65	-	55
1085 Staff WC	-	65	-	55
1088 Stair	-	65	-	71
1089 AWC	-	65	-	54
1094 WC	-	65	-	46
1095 KS3 Group Room 1	65	-	-	123
1096 WC	-	65	-	48
1107 Lobby PE Change	-	65	-	27
1107 PE Change	-	65	-	62
1108 PE Staff Ch.	-	65	-	34
1112 Catering Kitchen	-	65	-	1116
1113 Secondary Dining C_Access	-	65	-	591
1114 Lobby PE Change	-	65	-	16
1114 PE Change	-	65	-	67
1115 PE Staff Ch.	-	65	-	39
1117 Vis. AWC	-	65	-	51
1121 Reception / Admin	65	-	-	346
1122 Kitchenette	65	-	-	72

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1124 Head	65	-	-	206
1125 AWC C_Access	-	65	-	57
1139 Lobby PE Change	-	65	-	16
1139 PE Change	-	65	-	67
1140 PE Store	65	-	-	30
1141 Secondary Hall C_Access	65	-	-	1275
1143 Primary Hall / Dining C_Access	65	-	-	1057
1146 KS1 Classroom 1	65	-	-	432
1148 KS1 Classroom 2	65	-	-	430
1152 KS1 Classroom 3	65	-	-	438
1153 Circulation	-	65	-	118
1160 Circulation	-	65	-	169
1162 KS3 Classroom 3 (English)	65	-	-	439
1164 KS3 Classroom 1 (English)	65	-	-	422
1178 Cafe / Bistro C_Access	-	65	60	274
1179 Dist.	65	-	-	5
1180 KS3/4 Calming Space	65	-	-	139
1181 Stair	-	65	-	72
1182 Stair	-	65	-	74
1183 Stair	-	65	-	69
1184 Stair	-	65	-	67
1185 KS2 Group Room 1	65	-	-	139
1187 Staff Work Room	65	-	-	162
1188 Primary Art / Science / Design Tech.	65	-	-	224
1189 Primary Food Technology	65	-	-	226
1190 Res St	65	-	-	11
1191 Food Store	65	-	-	11
1194 KS2 Group Room 2	65	-	-	141
1196 Cl.	65	-	-	10
1199 AWC	-	65	-	51
1200 WCs	-	65	-	86
1201 Primary Teaching Res. Store	65	-	-	30
1203 P. Staff Ch. / Lockers	-	65	-	56
1204 P. Staff Ch. / Lockers	-	65	-	56
1205 Primary Library	65	-	-	263
1206 Primary ICT	65	-	-	171
1207 Primary SEN Resource	65	-	-	243
1208 St. WC	-	65	-	50
1209 St. WC	-	65	-	51
1211 ICT Store	65	-	-	14
1212 Stair	-	65	-	106
1213 S. Staff Ch. / Lockers	-	65	-	49
1213 S. Staff Ch. / Lockers	-	65	-	24

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1214 S. Staff Ch. / Lockers	-	65	-	49
1214 S. Staff Ch. / Lockers	-	65	-	24
1215 Staff WC	-	65	-	55
1216 Staff WC	-	65	-	55
1218 KS4 Group Room 4	65	-	-	108
1219 SEN Resource Base	65	-	-	278
1221 ICT Room 2	65	-	-	435
1222 WC	-	65	-	55
1223 WC	-	65	-	56
1225 WCs	-	65	-	78
1227 AWC	-	65	-	51
1229 Group Room	65	-	-	127
1230 Group Room	65	-	-	151
1231 AWC	-	65	-	53
1232 Staff AWC / Ch.	-	65	-	62
1233 Post 16 Common Room	65	-	-	314
1234 Centr. Staff Room	65	-	-	411
1236 Sensory	65	-	-	212
1237 Circulation	-	65	-	331
1239 KS2 Classroom 1	65	-	-	424
1241 KS2 Classroom 3	65	-	-	429
1244 KS2 Classroom 4	65	-	-	430
1247 KS2 Classroom 2	65	-	-	432
1250 KS2 Classroom 6	65	-	-	438
1254 KS2 Classroom 5	65	-	-	427
1255 Circulation	-	65	-	306
1257 KS4 Classroom 4 (Maths)	65	-	-	425
1260 KS4 Classroom 2 (Maths)	65	-	-	423
1263 KS4 Classroom 1 (Maths)	65	-	-	422
1266 KS4 Classroom 3 (MFL)	65	-	-	430
1269 ICT Room 1	65	-	-	430
1270 Post 16 Class 4	65	-	-	429
1273 Post 16 Class 2	65	-	-	453
1276 Circulation	-	65	-	229
1277 Post 16 Class 3	65	-	-	429
1280 Post 16 Class 5	65	-	-	427
1283 Post 16 Class 1	65	-	-	437
1288 Group Room	65	-	-	93
1290 Circulation	-	65	-	94
1291 Ent. Lobby	-	65	-	53
1292 Circulation	-	65	-	57
1299 Ext. PE Store	65	-	-	24
1300 Art / Science Store	65	-	-	16

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1301 Head of Primary	65	-	-	153
1310 Cl.	65	-	-	9
1311 Stair	-	65	-	74
1312 Science Studio	65	-	-	1235
1314 Prep / Store	65	-	-	25
1315 Science Lab	65	-	-	1289
1329 Primary Therapy	65	-	-	145
1331 KS3/4 Library C_Access	65	-	-	334
1333 File Server	65	-	-	50
1341 Lobby C_Access	-	65	-	40
1350 Art Store 2	65	-	-	18
1351 Art Room 2	65	-	-	427
1357 Primary Calm Space	65	-	-	122
1358 Primary Staff Social	65	-	-	200
1360 Office Kitchen	65	-	-	124
1361 Kitchen Food Store	65	-	-	16
1364 Kitchen Store	65	-	-	11
1365 Cl.	65	-	-	9
1369 Mob Store	65	-	-	11
1370 Art Store 1	65	-	-	18
1371 WIP Store	65	-	-	15
1372 WIP Store	65	-	-	15
1375 WC	-	65	-	49
1383 KS3/4 Music / Drama	65	-	-	403
1386 Early Years Sensory	65	-	-	124
1387 Early Years Group Room	65	-	-	108
1391 Recep. Group Room	65	-	-	111
1392 WCs Cloak	-	65	-	33
1393 WCs	-	65	-	56
1394 Reception Classroom	65	-	-	415
1396 WC / Change	-	65	-	48
1396 WC / Change	-	65	-	103
1398 Early Years	65	-	-	417
1402 Supplies St.	65	-	-	12
1403 Food Technology	65	-	-	498
1405 Food Store	65	-	-	20
1407 Design Technology	65	-	-	510
1408 WIP Store	65	-	-	17
1409 Res. Store	65	-	-	18
1413 Circulation C_Access	-	65	-	212
1420 Circulation C_Access	-	65	-	584
1429 Laundry	-	65	-	54
1435 Circulation	-	65	-	172

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1436 Circulation	-	65	-	147
1436 Server Hub 1	65	-	-	39
1437 WCs	-	65	-	86
1438 St AWC	-	65	-	51
1444 Cleaner	65	-	-	9
1451 Circulation	-	65	-	359
1453 Parents / Waiting Room	65	-	-	196
1454 Circulation	-	65	-	168
1458 Meeting Room	65	-	-	343
1472 Premises Store	65	-	-	15
1473 Prem. Off	65	-	-	151
1480 Cl. Store	65	-	-	11
1482 Plant 2	65	-	-	237
1493 WCs	-	65	-	79
1496 Ext. PE Store	65	-	-	28
1497 Res Cl. Store	65	-	-	14
1498 Hygiene Suite 2	65	-	-	180
1499 KS4 Group Room 5	65	-	-	131
1500 KS4 Classroom 5 (MFL)	65	-	-	429
1503 WC	-	65	-	49
1504 WC	-	65	-	49
1505 KS4 Group Room 6	65	-	-	134
1506 Primary Music / Drama	65	-	-	406
1507 Music / Drama Store	65	-	-	18
1510 WC	-	65	-	52
1511 Cl.	65	-	-	9
1516 WC/Ch Kitchen	-	65	-	29
1516 WC/Ch Kitchen	-	65	-	47
1518 Central Resource Cl. St 1	65	-	-	20
1519 Plant 1	65	-	-	229
1520 Chair Store	65	-	-	20
1521 KS3/4 Therapy	65	-	-	129
1523 Furniture Store C_Access	65	-	-	22
1525 Mob Store	65	-	-	12
1527 Intimate Dining C_Access	65	-	-	164
1528 Early Years Off / Res.	65	-	-	110
1529 Cloak	65	-	-	17
1530 Ext. Maint Store	65	-	-	19
1531 Inclusion	65	-	-	179
1532 Life Skills	65	-	-	238
1533 Circulation	-	65	-	306
1534 Sensory	65	-	-	148
1535 Immersion	65	-	-	138

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1536 SSP Group	65	-	-	113
1537 SSP Tutor Base	65	-	-	401
1538 SSP Group	65	-	-	112
1539 SSP Group	65	-	-	112
1540 SSP Tutor Base	65	-	-	402
1541 SSP Group	65	-	-	112
1542 SSP Group	65	-	-	112
1543 Music Store / Quiet Room	65	-	-	21
1544 SSP Tutor Base	65	-	-	402
1545 SSP Group	65	-	-	113
1546 WC	-	65	-	41
1547 WC	-	65	-	42
1550 KS3 Group Room 2	65	-	-	134
1551 Staff WC	-	65	-	52
1552 WC	-	65	-	50
1553 WC	-	65	-	49
1555 KS3 Classroom 2 (English)	65	-	-	423
1566 KS3 Classroom 4 (Humanities)	65	-	-	427
1567 Art Room 1	65	-	-	428
1570 KS3 Group Room 3	65	-	-	135
1571 WC	-	65	-	47
1572 WC	-	65	-	49
1573 WC	-	65	-	50
1575 P. General Store	65	-	-	21
1577 Soft Play	65	-	-	215
1578 Primary Sensory	65	-	-	230
1581 Laundry	-	65	-	60
1582 Cleaner	65	-	-	9
1583 Equip. St	65	-	-	20
1585 SSP Office	65	-	-	195
1587 Staff / AWC	-	65	-	59
1589 Bursar	65	-	-	185
1589 Circulation C_Access	-	65	-	90
1591 Staff Work Room	65	-	-	191
1592 Server Hub 2	65	-	-	36
1593 WC	-	65	-	52
1596 Vis. AWC	-	65	-	50
1597 Lobby C_Access	-	65	-	32
1598 Prem. Store	65	-	-	17
1599 Lobby C_Access	-	65	-	28
1600 Chem St.	65	-	-	15
1603 EY Ext St.	65	-	-	17
1605 Science Breakout	65	-	-	122

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1606 Comm Store	-	65	-	39
1608 Sec. Store	65	-	-	5
1609 Primary Servery	-	65	-	203
1609 St	65	-	-	12
1610 Secondary Servery	-	65	-	205
1611 General Store	65	-	-	18
1611 PE store	65	-	-	25
1612 Store	65	-	-	13
1615 SLT Office 1	65	-	-	198
1616 Visiting Prof Office	65	-	-	183
1617 Kitchen Cl.	-	65	-	82
1618 Circulation	-	65	-	129
5041/5042 ICT Store	65	-	-	14
Plantroom Water Tank	65	-	-	355
Stairs to Roof	-	65	-	49

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1056 Medical	NO (-99.9%)	NO
1057 SLT Office	NO (-99.8%)	NO
1071 KS1 Group Room 1	NO (-94.8%)	YES
1075 KS1 Group Room 2	NO (-95.5%)	YES
1079 Hygiene Suite	N/A	N/A
1095 KS3 Group Room 1	NO (-89.6%)	YES
1113 Secondary Dining C_Access	NO (-5.8%)	YES
1121 Reception / Admin	NO (-86.7%)	YES
1122 Kitchenette	N/A	N/A
1124 Head	NO (-73.9%)	YES
1141 Secondary Hall C_Access	YES (+2.6%)	YES
1143 Primary Hall / Dining C_Access	NO (-56.3%)	YES
1146 KS1 Classroom 1	NO (-87.1%)	YES
1148 KS1 Classroom 2	NO (-87.4%)	YES
1152 KS1 Classroom 3	NO (-88.4%)	YES
1162 KS3 Classroom 3 (English)	NO (-75.9%)	YES
1164 KS3 Classroom 1 (English)	NO (-88.1%)	YES
1178 Cafe / Bistro C_Access	NO (-51.8%)	YES
1180 KS3/4 Calming Space	N/A	N/A
1185 KS2 Group Room 1	NO (-89.5%)	YES
1187 Staff Work Room	NO (-70.7%)	YES
1188 Primary Art / Science / Design Tech.	NO (-63.7%)	YES
1189 Primary Food Technology	NO (-74.7%)	YES
1194 KS2 Group Room 2	NO (-80.2%)	YES
1205 Primary Library	NO (-68%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1206 Primary ICT	NO (-99.6%)	NO
1207 Primary SEN Resource	NO (-73.3%)	YES
1218 KS4 Group Room 4	NO (-84.8%)	YES
1219 SEN Resource Base	NO (-80.6%)	YES
1221 ICT Room 2	NO (-84.1%)	YES
1229 Group Room	NO (-69.7%)	YES
1230 Group Room	NO (-76.2%)	YES
1233 Post 16 Common Room	NO (-81.8%)	YES
1234 Centr. Staff Room	NO (-77.7%)	YES
1236 Sensory	NO (-85.9%)	YES
1239 KS2 Classroom 1	NO (-67.5%)	YES
1241 KS2 Classroom 3	NO (-67.9%)	YES
1244 KS2 Classroom 4	NO (-80.9%)	YES
1247 KS2 Classroom 2	NO (-80.6%)	YES
1250 KS2 Classroom 6	NO (-83.1%)	YES
1254 KS2 Classroom 5	NO (-67.8%)	YES
1257 KS4 Classroom 4 (Maths)	NO (-71.8%)	YES
1260 KS4 Classroom 2 (Maths)	NO (-78.6%)	YES
1263 KS4 Classroom 1 (Maths)	NO (-91.2%)	YES
1266 KS4 Classroom 3 (MFL)	NO (-80.9%)	YES
1269 ICT Room 1	NO (-82.3%)	YES
1270 Post 16 Class 4	NO (-63.5%)	YES
1273 Post 16 Class 2	NO (-77.6%)	YES
1277 Post 16 Class 3	NO (-68%)	YES
1280 Post 16 Class 5	NO (-81.3%)	YES
1283 Post 16 Class 1	NO (-81.3%)	YES
1288 Group Room	NO (-94.5%)	YES
1301 Head of Primary	NO (-92.7%)	YES
1312 Science Studio	NO (-73.6%)	YES
1315 Science Lab	NO (-74%)	YES
1329 Primary Therapy	NO (-84%)	YES
1331 KS3/4 Library C_Access	NO (-44.6%)	YES
1333 File Server	N/A	N/A
1351 Art Room 2	NO (-66.4%)	YES
1357 Primary Calm Space	NO (-80.2%)	YES
1358 Primary Staff Social	NO (-76.4%)	YES
1360 Office Kitchen	N/A	N/A
1383 KS3/4 Music / Drama	NO (-87%)	YES
1386 Early Years Sensory	N/A	N/A
1387 Early Years Group Room	NO (-92.5%)	YES
1391 Recep. Group Room	N/A	N/A
1394 Reception Classroom	NO (-86.9%)	YES
1398 Early Years	NO (-83.6%)	YES
1403 Food Technology	NO (-80%)	YES
1407 Design Technology	NO (-79.1%)	YES
1453 Parents / Waiting Room	NO (-68.2%)	YES
1458 Meeting Room	N/A	N/A
1473 Prem. Off	N/A	N/A
1498 Hygiene Suite 2	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1499 KS4 Group Room 5	NO (-85.8%)	YES
1500 KS4 Classroom 5 (MFL)	NO (-81.5%)	YES
1505 KS4 Group Room 6	NO (-92.6%)	YES
1506 Primary Music / Drama	NO (-70%)	YES
1521 KS3/4 Therapy	NO (-82.7%)	YES
1527 Intimate Dining C_Access	NO (-87.7%)	YES
1528 Early Years Off / Res.	NO (-82.4%)	YES
1531 Inclusion	NO (-91.7%)	YES
1532 Life Skills	NO (-90.6%)	YES
1534 Sensory	NO (-87.6%)	YES
1535 Immersion	N/A	N/A
1536 SSP Group	NO (-93.3%)	YES
1537 SSP Tutor Base	NO (-84.2%)	YES
1538 SSP Group	NO (-93%)	YES
1539 SSP Group	NO (-92.6%)	YES
1540 SSP Tutor Base	NO (-85.9%)	YES
1541 SSP Group	NO (-92.7%)	YES
1542 SSP Group	NO (-92.6%)	YES
1544 SSP Tutor Base	NO (-85.1%)	YES
1545 SSP Group	NO (-92.6%)	YES
1550 KS3 Group Room 2	N/A	N/A
1555 KS3 Classroom 2 (English)	NO (-70.3%)	YES
1566 KS3 Classroom 4 (Humanities)	NO (-61.6%)	YES
1567 Art Room 1	NO (-62.9%)	YES
1570 KS3 Group Room 3	N/A	N/A
1577 Soft Play	NO (-96.1%)	YES
1578 Primary Sensory	NO (-88.9%)	YES
1585 SSP Office	NO (-86.4%)	YES
1589 Bursar	NO (-81.8%)	YES
1591 Staff Work Room	NO (-99.9%)	NO
1605 Science Breakout	NO (-92.7%)	YES
1615 SLT Office 1	NO (-72.8%)	YES
1616 Visiting Prof Office	NO (-82.4%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER and BPEC

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	6516.9	6516.9
External area [m^2]	10984.2	10984.2
Weather	CAR	CAR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	3710.48	4062.88
Average U-value [W/m^2K]	0.34	0.37
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
1	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
98	**D1 Non-residential Institutions: Education**
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
1	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

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

	Actual	Notional
Heating	27.12	19.46
Cooling	0.47	0.1
Auxiliary	2.84	5.79
Lighting	10.63	12
Hot water	48.7	45.04
Equipment*	24.95	24.95
TOTAL**	**89.77**	**82.4**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	6.36
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	73.66	61.82
Primary energy* [kWh/m^2]	121.34	116.76
Total emissions [kg/m^2]	24.1	19.9

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	109.2	0	46.3	0	0.9	0.66	0	0.82	0
	Notional	13.8	0	4.5	0	0	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	84.5	0	33.9	0	1.1	0.69	0	0.82	0
	Notional	61.9	0	20	0	8.1	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	119.1	0	39.9	0	7.8	0.83	0	0.82	0
	Notional	73.6	0	23.7	0	5.9	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	10.4	0	3.5	0	9.5	0.83	0	0.82	0
	Notional	18.8	0	6.1	0	6.9	0.86	0	----	----
[ST] Central heating using water: convectors, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	16.9	0	6.4	0	2.2	0.73	0	0.82	0
	Notional	9.1	0	2.9	0	1.2	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	56.1	0	18.8	0	6.1	0.83	0	0.82	0
	Notional	112.7	0	36.3	0	6.6	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1213.4	0	182.6	0	2.42	1.85	2.6	2.6
	Notional	0	429.8	0	31.5	0	1.33	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	134.4	0	51.1	0	1.6	0.73	0	0.82	0
	Notional	135.9	0	43.8	0	0.9	0.86	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	74.5	13.9	27.1	2.1	0	0.76	1.85	0.82	2.6
	Notional	86.8	19.2	28	1.4	0	0.86	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	24.3	0	9.2	0	12	0.73	0	0.82	0
	Notional	42.8	0	13.8	0	15.3	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency
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

BRUKL Output Document

Compliance with Wales Building Regulations Part L 2014

Llywodraeth Cymru
Welsh Government

Project name

Ysgol Plas Brondyffryn H1

As designed

Date: Sun May 15 11:00:34 2022

Administrative information

Building Details

Address: Ysgol Plas Brondyffryn, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Wilson Gray Consulting Ltd

Telephone number: 0191 691 6770

Address: Swan Building, Prestwick Park, Newcastle upon Tyne, NE20 9SJ

Criterion 1: The calculated BER and BPEC for the building must not exceed the targets

The building does not comply with Wales Building Regulations Part L 2014

Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	20.4	
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	20.1	
Building Primary Energy Consumption (BPEC), $kWh/m^2.annum$	102.46	
Target Primary Energy Consumption (TPEC), $kWh/m^2.annum$	117.84	
Do the building's emissions and primary energy consumption exceed the targets?	BER > TER	BPEC =< TPEC

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	ST000011:Surf[5]
Floor	0.25	0.12	0.12	SH000049:Surf[0]
Roof	0.25	0.12	0.12	SH000032:Surf[2]
Windows***, roof windows, and rooflights	2.2	1.22	1.4	10000004:Surf[0]
Personnel doors	2.2	1.33	1.9	ST000011:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.
** 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.
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	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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- B03 MVHR With Heating Coil H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	1.5	0.8
Standard value	0.91	N/A	N/A	1.1^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

2- B04 Radiators Natural Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0.19	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- B01 NVHR with Heating Coil H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	0.2	-
Standard value	0.91	N/A	N/A	1.1^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

4- B05 Radiators Extract Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0.19	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

5- B08 Kitchen Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	1.5	0.75
Standard value	0.91	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

6- B02 AHU Mechanical Ventilation Hall H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	1.5	0.75
Standard value	0.91	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

7- B10 Convectors Nat Ventilation H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

8- B07 ASHP and MVHR H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	2.6	0	0	0.75
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

9- B11 Door Heater H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	0	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- B06 ASHP Server H1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.6	2.6	0	0	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1072 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1073 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1074 WC	-	-	0.4	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1076 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1077 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1084 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1085 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1089 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1094 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1096 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1117 Vis. AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1125 AWC C_Access	-	-	0.4	-	-	-	-	-	-	-	N/A
1199 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1200 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1208 St. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1209 St. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1213 S. Staff Ch. / Lockers	-	-	0.4	-	-	-	-	-	-	-	N/A
1214 S. Staff Ch. / Lockers	-	-	0.4	-	-	-	-	-	-	-	N/A
1215 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1216 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1222 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1223 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1225 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1227 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1231 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1232 Staff AWC / Ch.	-	-	0.4	-	-	-	-	-	-	-	N/A
1375 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1392 WCs Cloak	-	-	0.4	-	-	-	-	-	-	-	N/A
1393 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1396 WC / Change	-	-	0.4	-	-	-	-	-	-	-	N/A
1396 WC / Change	-	-	0.4	-	-	-	-	-	-	-	N/A
1429 Laundry	-	-	0.4	-	-	-	-	-	-	-	N/A
1437 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1438 St AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1493 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1503 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1504 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1510 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1511 Cl.	-	-	0.4	-	-	-	-	-	-	-	N/A
1529 Cloak	-	-	0.4	-	-	-	-	-	-	-	N/A
1546 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1547 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1551 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1552 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1553 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1571 WC	-	-	0.4	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1572 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1573 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1581 Laundry	-	-	0.4	-	-	-	-	-	-	-	N/A
1587 Staff / AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1593 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1596 Vis. AWC	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
1056 Medical	100	-	-	155
1057 SLT Office	100	-	-	117
1060 Admin Store	100	-	-	6
1062 Stair	-	100	-	57
1063 Stair	-	100	-	46
1071 KS1 Group Room 1	100	-	-	89
1072 WC	-	100	-	32
1073 WC	-	100	-	32
1074 WC	-	100	-	32
1075 KS1 Group Room 2	100	-	-	89
1076 Staff WC	-	100	-	32
1077 Staff WC	-	100	-	35
1078 Stair C_Access	-	100	-	19
1078 Stair C_Access	-	100	-	65
1079 Hygiene Suite	100	-	-	82
1084 Staff WC	-	100	-	36
1085 Staff WC	-	100	-	36
1088 Stair	-	100	-	46
1089 AWC	-	100	-	35
1094 WC	-	100	-	30
1095 KS3 Group Room 1	100	-	-	80
1096 WC	-	100	-	31
1107 Lobby PE Change	-	100	-	18
1107 PE Change	-	100	-	40
1108 PE Staff Ch.	-	100	-	22
1112 Catering Kitchen	-	100	-	725
1113 Secondary Dining C_Access	-	100	-	384
1114 Lobby PE Change	-	100	-	10
1114 PE Change	-	100	-	44
1115 PE Staff Ch.	-	100	-	25
1117 Vis. AWC	-	100	-	33
1121 Reception / Admin	100	-	-	225
1122 Kitchenette	100	-	-	47

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1124 Head	100	-	-	134
1125 AWC C_Access	-	100	-	37
1139 Lobby PE Change	-	100	-	10
1139 PE Change	-	100	-	43
1140 PE Store	100	-	-	19
1141 Secondary Hall C_Access	100	-	-	829
1143 Primary Hall / Dining C_Access	100	-	-	687
1146 KS1 Classroom 1	100	-	-	281
1148 KS1 Classroom 2	100	-	-	280
1152 KS1 Classroom 3	100	-	-	285
1153 Circulation	-	100	-	77
1160 Circulation	-	100	-	110
1162 KS3 Classroom 3 (English)	100	-	-	286
1164 KS3 Classroom 1 (English)	100	-	-	274
1178 Cafe / Bistro C_Access	-	100	60	178
1179 Dist.	100	-	-	3
1180 KS3/4 Calming Space	100	-	-	90
1181 Stair	-	100	-	47
1182 Stair	-	100	-	48
1183 Stair	-	100	-	45
1184 Stair	-	100	-	44
1185 KS2 Group Room 1	100	-	-	90
1187 Staff Work Room	100	-	-	105
1188 Primary Art / Science / Design Tech.	100	-	-	146
1189 Primary Food Technology	100	-	-	147
1190 Res St	100	-	-	7
1191 Food Store	100	-	-	7
1194 KS2 Group Room 2	100	-	-	91
1196 Cl.	100	-	-	7
1199 AWC	-	100	-	33
1200 WCs	-	100	-	56
1201 Primary Teaching Res. Store	100	-	-	20
1203 P. Staff Ch. / Lockers	-	100	-	36
1204 P. Staff Ch. / Lockers	-	100	-	36
1205 Primary Library	100	-	-	171
1206 Primary ICT	100	-	-	111
1207 Primary SEN Resource	100	-	-	158
1208 St. WC	-	100	-	33
1209 St. WC	-	100	-	33
1211 ICT Store	100	-	-	9
1212 Stair	-	100	-	69
1213 S. Staff Ch. / Lockers	-	100	-	32
1213 S. Staff Ch. / Lockers	-	100	-	16

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1214 S. Staff Ch. / Lockers	-	100	-	32
1214 S. Staff Ch. / Lockers	-	100	-	16
1215 Staff WC	-	100	-	36
1216 Staff WC	-	100	-	36
1218 KS4 Group Room 4	100	-	-	71
1219 SEN Resource Base	100	-	-	181
1221 ICT Room 2	100	-	-	283
1222 WC	-	100	-	36
1223 WC	-	100	-	36
1225 WCs	-	100	-	51
1227 AWC	-	100	-	33
1229 Group Room	100	-	-	82
1230 Group Room	100	-	-	98
1231 AWC	-	100	-	35
1232 Staff AWC / Ch.	-	100	-	40
1233 Post 16 Common Room	100	-	-	204
1234 Centr. Staff Room	100	-	-	267
1236 Sensory	100	-	-	138
1237 Circulation	-	100	-	215
1239 KS2 Classroom 1	100	-	-	275
1241 KS2 Classroom 3	100	-	-	279
1244 KS2 Classroom 4	100	-	-	280
1247 KS2 Classroom 2	100	-	-	281
1250 KS2 Classroom 6	100	-	-	285
1254 KS2 Classroom 5	100	-	-	277
1255 Circulation	-	100	-	199
1257 KS4 Classroom 4 (Maths)	100	-	-	276
1260 KS4 Classroom 2 (Maths)	100	-	-	275
1263 KS4 Classroom 1 (Maths)	100	-	-	274
1266 KS4 Classroom 3 (MFL)	100	-	-	279
1269 ICT Room 1	100	-	-	280
1270 Post 16 Class 4	100	-	-	279
1273 Post 16 Class 2	100	-	-	295
1276 Circulation	-	100	-	149
1277 Post 16 Class 3	100	-	-	279
1280 Post 16 Class 5	100	-	-	278
1283 Post 16 Class 1	100	-	-	284
1288 Group Room	100	-	-	60
1290 Circulation	-	100	-	61
1291 Ent. Lobby	-	100	-	35
1292 Circulation	-	100	-	37
1299 Ext. PE Store	100	-	-	16
1300 Art / Science Store	100	-	-	11

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1301 Head of Primary	100	-	-	99
1310 Cl.	100	-	-	6
1311 Stair	-	100	-	48
1312 Science Studio	100	-	-	803
1314 Prep / Store	100	-	-	16
1315 Science Lab	100	-	-	838
1329 Primary Therapy	100	-	-	94
1331 KS3/4 Library C_Access	100	-	-	217
1333 File Server	100	-	-	32
1341 Lobby C_Access	-	100	-	26
1350 Art Store 2	100	-	-	12
1351 Art Room 2	100	-	-	278
1357 Primary Calm Space	100	-	-	79
1358 Primary Staff Social	100	-	-	130
1360 Office Kitchen	100	-	-	81
1361 Kitchen Food Store	100	-	-	10
1364 Kitchen Store	100	-	-	7
1365 Cl.	100	-	-	6
1369 Mob Store	118	-	-	6
1370 Art Store 1	100	-	-	12
1371 WIP Store	100	-	-	10
1372 WIP Store	100	-	-	10
1375 WC	-	100	-	32
1383 KS3/4 Music / Drama	100	-	-	262
1386 Early Years Sensory	100	-	-	81
1387 Early Years Group Room	100	-	-	70
1391 Recep. Group Room	100	-	-	72
1392 WCs Cloak	-	100	-	21
1393 WCs	-	100	-	37
1394 Reception Classroom	100	-	-	270
1396 WC / Change	-	100	-	31
1396 WC / Change	-	100	-	67
1398 Early Years	100	-	-	271
1402 Supplies St.	100	-	-	8
1403 Food Technology	100	-	-	324
1405 Food Store	100	-	-	13
1407 Design Technology	100	-	-	331
1408 WIP Store	100	-	-	11
1409 Res. Store	100	-	-	12
1413 Circulation C_Access	-	100	-	138
1420 Circulation C_Access	-	100	-	380
1429 Laundry	-	100	-	35
1435 Circulation	-	100	-	112

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1436 Circulation	-	100	-	95
1436 Server Hub 1	100	-	-	25
1437 WCs	-	100	-	56
1438 St AWC	-	100	-	33
1444 Cleaner	120	-	-	5
1451 Circulation	-	100	-	234
1453 Parents / Waiting Room	100	-	-	128
1454 Circulation	-	100	-	109
1458 Meeting Room	100	-	-	223
1472 Premises Store	100	-	-	10
1473 Prem. Off	100	-	-	98
1480 Cl. Store	100	-	-	7
1482 Plant 2	100	-	-	154
1493 WCs	-	100	-	51
1496 Ext. PE Store	100	-	-	18
1497 Res Cl. Store	100	-	-	9
1498 Hygiene Suite 2	100	-	-	117
1499 KS4 Group Room 5	100	-	-	85
1500 KS4 Classroom 5 (MFL)	100	-	-	279
1503 WC	-	100	-	32
1504 WC	-	100	-	32
1505 KS4 Group Room 6	100	-	-	87
1506 Primary Music / Drama	100	-	-	264
1507 Music / Drama Store	100	-	-	12
1510 WC	-	100	-	34
1511 Cl.	100	-	-	6
1516 WC/Ch Kitchen	-	100	-	19
1516 WC/Ch Kitchen	-	100	-	30
1518 Central Resource Cl. St 1	100	-	-	13
1519 Plant 1	100	-	-	149
1520 Chair Store	100	-	-	13
1521 KS3/4 Therapy	100	-	-	84
1523 Furniture Store C_Access	100	-	-	15
1525 Mob Store	116	-	-	6
1527 Intimate Dining C_Access	100	-	-	107
1528 Early Years Off / Res.	100	-	-	72
1529 Cloak	100	-	-	11
1530 Ext. Maint Store	100	-	-	12
1531 Inclusion	100	-	-	116
1532 Life Skills	100	-	-	155
1533 Circulation	-	100	-	199
1534 Sensory	100	-	-	96
1535 Immersion	100	-	-	89

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1536 SSP Group	100	-	-	73
1537 SSP Tutor Base	100	-	-	261
1538 SSP Group	100	-	-	73
1539 SSP Group	100	-	-	73
1540 SSP Tutor Base	100	-	-	261
1541 SSP Group	100	-	-	73
1542 SSP Group	100	-	-	73
1543 Music Store / Quiet Room	100	-	-	14
1544 SSP Tutor Base	100	-	-	262
1545 SSP Group	100	-	-	74
1546 WC	-	100	-	26
1547 WC	-	100	-	28
1550 KS3 Group Room 2	100	-	-	87
1551 Staff WC	-	100	-	34
1552 WC	-	100	-	32
1553 WC	-	100	-	32
1555 KS3 Classroom 2 (English)	100	-	-	275
1566 KS3 Classroom 4 (Humanities)	100	-	-	277
1567 Art Room 1	100	-	-	278
1570 KS3 Group Room 3	100	-	-	88
1571 WC	-	100	-	30
1572 WC	-	100	-	32
1573 WC	-	100	-	32
1575 P. General Store	100	-	-	13
1577 Soft Play	100	-	-	140
1578 Primary Sensory	100	-	-	149
1581 Laundry	-	100	-	39
1582 Cleaner	100	-	-	6
1583 Equip. St	100	-	-	13
1585 SSP Office	100	-	-	127
1587 Staff / AWC	-	100	-	38
1589 Bursar	100	-	-	120
1589 Circulation C_Access	-	100	-	59
1591 Staff Work Room	100	-	-	124
1592 Server Hub 2	100	-	-	23
1593 WC	-	100	-	34
1596 Vis. AWC	-	100	-	33
1597 Lobby C_Access	-	100	-	21
1598 Prem. Store	100	-	-	11
1599 Lobby C_Access	-	100	-	18
1600 Chem St.	100	-	-	10
1603 EY Ext St.	100	-	-	11
1605 Science Breakout	100	-	-	79

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1606 Comm Store	-	100	-	25
1608 Sec. Store	100	-	-	3
1609 Primary Servery	-	100	-	132
1609 St	100	-	-	8
1610 Secondary Servery	-	100	-	133
1611 General Store	100	-	-	12
1611 PE store	100	-	-	16
1612 Store	100	-	-	8
1615 SLT Office 1	100	-	-	129
1616 Visiting Prof Office	100	-	-	119
1617 Kitchen Cl.	-	100	-	53
1618 Circulation	-	100	-	84
5041/5042 ICT Store	100	-	-	9
Plantroom Water Tank	100	-	-	231
Stairs to Roof	-	100	-	32

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1056 Medical	NO (-99.9%)	NO
1057 SLT Office	NO (-99.8%)	NO
1071 KS1 Group Room 1	NO (-94.9%)	YES
1075 KS1 Group Room 2	NO (-95.5%)	YES
1079 Hygiene Suite	N/A	N/A
1095 KS3 Group Room 1	NO (-89.8%)	YES
1113 Secondary Dining C_Access	NO (-7.3%)	YES
1121 Reception / Admin	NO (-86.9%)	YES
1122 Kitchenette	N/A	N/A
1124 Head	NO (-74.3%)	YES
1141 Secondary Hall C_Access	YES (+1%)	YES
1143 Primary Hall / Dining C_Access	NO (-56.9%)	YES
1146 KS1 Classroom 1	NO (-87.3%)	YES
1148 KS1 Classroom 2	NO (-87.6%)	YES
1152 KS1 Classroom 3	NO (-88.6%)	YES
1162 KS3 Classroom 3 (English)	NO (-76.2%)	YES
1164 KS3 Classroom 1 (English)	NO (-88.2%)	YES
1178 Cafe / Bistro C_Access	NO (-52.5%)	YES
1180 KS3/4 Calming Space	N/A	N/A
1185 KS2 Group Room 1	NO (-89.7%)	YES
1187 Staff Work Room	NO (-71.1%)	YES
1188 Primary Art / Science / Design Tech.	NO (-64.2%)	YES
1189 Primary Food Technology	NO (-75.1%)	YES
1194 KS2 Group Room 2	NO (-80.5%)	YES
1205 Primary Library	NO (-68.5%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1206 Primary ICT	NO (-99.6%)	NO
1207 Primary SEN Resource	NO (-73.8%)	YES
1218 KS4 Group Room 4	NO (-85.1%)	YES
1219 SEN Resource Base	NO (-80.9%)	YES
1221 ICT Room 2	NO (-84.4%)	YES
1229 Group Room	NO (-70.1%)	YES
1230 Group Room	NO (-76.6%)	YES
1233 Post 16 Common Room	NO (-82.1%)	YES
1234 Centr. Staff Room	NO (-78%)	YES
1236 Sensory	NO (-86.1%)	YES
1239 KS2 Classroom 1	NO (-68%)	YES
1241 KS2 Classroom 3	NO (-68.5%)	YES
1244 KS2 Classroom 4	NO (-81.2%)	YES
1247 KS2 Classroom 2	NO (-80.9%)	YES
1250 KS2 Classroom 6	NO (-83.4%)	YES
1254 KS2 Classroom 5	NO (-68.3%)	YES
1257 KS4 Classroom 4 (Maths)	NO (-72.3%)	YES
1260 KS4 Classroom 2 (Maths)	NO (-78.9%)	YES
1263 KS4 Classroom 1 (Maths)	NO (-91.3%)	YES
1266 KS4 Classroom 3 (MFL)	NO (-81.2%)	YES
1269 ICT Room 1	NO (-82.6%)	YES
1270 Post 16 Class 4	NO (-64%)	YES
1273 Post 16 Class 2	NO (-77.8%)	YES
1277 Post 16 Class 3	NO (-68.5%)	YES
1280 Post 16 Class 5	NO (-81.6%)	YES
1283 Post 16 Class 1	NO (-81.6%)	YES
1288 Group Room	NO (-94.6%)	YES
1301 Head of Primary	NO (-92.8%)	YES
1312 Science Studio	NO (-74%)	YES
1315 Science Lab	NO (-74.5%)	YES
1329 Primary Therapy	NO (-84.3%)	YES
1331 KS3/4 Library C_Access	NO (-45.4%)	YES
1333 File Server	N/A	N/A
1351 Art Room 2	NO (-66.9%)	YES
1357 Primary Calm Space	NO (-80.5%)	YES
1358 Primary Staff Social	NO (-76.7%)	YES
1360 Office Kitchen	N/A	N/A
1383 KS3/4 Music / Drama	NO (-87.2%)	YES
1386 Early Years Sensory	N/A	N/A
1387 Early Years Group Room	NO (-92.6%)	YES
1391 Recep. Group Room	N/A	N/A
1394 Reception Classroom	NO (-87.1%)	YES
1398 Early Years	NO (-83.8%)	YES
1403 Food Technology	NO (-80.3%)	YES
1407 Design Technology	NO (-79.4%)	YES
1453 Parents / Waiting Room	NO (-68.7%)	YES
1458 Meeting Room	N/A	N/A
1473 Prem. Off	N/A	N/A
1498 Hygiene Suite 2	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1499 KS4 Group Room 5	NO (-86%)	YES
1500 KS4 Classroom 5 (MFL)	NO (-81.8%)	YES
1505 KS4 Group Room 6	NO (-92.7%)	YES
1506 Primary Music / Drama	NO (-70.5%)	YES
1521 KS3/4 Therapy	NO (-82.9%)	YES
1527 Intimate Dining C_Access	NO (-87.9%)	YES
1528 Early Years Off / Res.	NO (-82.7%)	YES
1531 Inclusion	NO (-91.9%)	YES
1532 Life Skills	NO (-90.8%)	YES
1534 Sensory	NO (-87.8%)	YES
1535 Immersion	N/A	N/A
1536 SSP Group	NO (-93.5%)	YES
1537 SSP Tutor Base	NO (-84.5%)	YES
1538 SSP Group	NO (-93.1%)	YES
1539 SSP Group	NO (-92.8%)	YES
1540 SSP Tutor Base	NO (-86.1%)	YES
1541 SSP Group	NO (-92.8%)	YES
1542 SSP Group	NO (-92.8%)	YES
1544 SSP Tutor Base	NO (-85.3%)	YES
1545 SSP Group	NO (-92.8%)	YES
1550 KS3 Group Room 2	N/A	N/A
1555 KS3 Classroom 2 (English)	NO (-70.7%)	YES
1566 KS3 Classroom 4 (Humanities)	NO (-62.2%)	YES
1567 Art Room 1	NO (-63.5%)	YES
1570 KS3 Group Room 3	N/A	N/A
1577 Soft Play	NO (-96.2%)	YES
1578 Primary Sensory	NO (-89%)	YES
1585 SSP Office	NO (-86.7%)	YES
1589 Bursar	NO (-82.1%)	YES
1591 Staff Work Room	NO (-99.9%)	NO
1605 Science Breakout	NO (-92.8%)	YES
1615 SLT Office 1	NO (-73.2%)	YES
1616 Visiting Prof Office	NO (-82.6%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER and BPEC

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	6516.9	6516.9
External area [m^2]	10984.2	10984.2
Weather	CAR	CAR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	2597.37	4062.81
Average U-value [W/m^2K]	0.24	0.37
Alpha value* [%]	9.99	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
1	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
98	**D1 Non-residential Institutions: Education**
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
1	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

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

	Actual	Notional
Heating	17.77	20.43
Cooling	0.49	0.11
Auxiliary	2.66	5.79
Lighting	7.42	12
Hot water	48.7	45.04
Equipment*	24.95	24.95
TOTAL**	**77.05**	**83.37**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	6.36
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	51.84	64.87
Primary energy* [kWh/m^2]	102.46	117.84
Total emissions [kg/m^2]	20.4	20.1

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	57.3	0	24.3	0	0.5	0.66	0	0.82	0
	Notional	19.9	0	6.4	0	0	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	60.8	0	23.2	0	1.1	0.73	0	0.82	0
	Notional	64.7	0	20.8	0	8.1	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	68.3	0	21.7	0	7.1	0.87	0	0.82	0
	Notional	75.5	0	24.3	0	5.9	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	6.3	0	2	0	9	0.87	0	0.82	0
	Notional	20.1	0	6.5	0	6.9	0.86	0	----	----
[ST] Central heating using water: convectors, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	7.8	0	2.8	0	2	0.77	0	0.82	0
	Notional	13.2	0	4.2	0	1.2	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	32.8	0	10.4	0	5.6	0.87	0	0.82	0
	Notional	115.4	0	37.2	0	6.6	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1270.5	0	181.6	0	2.55	1.94	2.6	2.6
	Notional	0	431.9	0	31.7	0	1.33	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	98.7	0	35.6	0	1.5	0.77	0	0.82	0
	Notional	139.1	0	44.8	0	0.9	0.86	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	58	21.2	20.1	3	0	0.8	1.94	0.82	2.6
	Notional	89.8	21.4	28.9	1.6	0	0.86	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	16.2	0	5.8	0	11.4	0.77	0	0.82	0
	Notional	48.2	0	15.5	0	15.3	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency
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

BRUKL Output Document

Compliance with Wales Building Regulations Part L 2014

Llywodraeth Cymru
Welsh Government

Project name

Ysgol Plas Brondyffryn H3

As designed

Date: Sun May 15 08:29:36 2022

Administrative information

Building Details

Address: Ysgol Plas Brondyffryn, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Wilson Gray Consulting Ltd

Telephone number: 0191 691 6770

Address: Swan Building, Prestwick Park, Newcastle upon Tyne, NE20 9SJ

Criterion 1: The calculated BER and BPEC for the building must not exceed the targets

Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	-8.2	
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	15.3	
Building Primary Energy Consumption (BPEC), $kWh/m^2.annum$	73.66	
Target Primary Energy Consumption (TPEC), $kWh/m^2.annum$	92.36	
Do the building's emissions and primary energy consumption exceed the targets?	BER =< TER	BPEC =< TPEC

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	ST000011:Surf[5]
Floor	0.25	0.12	0.12	SH000049:Surf[0]
Roof	0.25	0.12	0.12	SH000032:Surf[2]
Windows***, roof windows, and rooflights	2.2	1.22	1.4	10000004:Surf[0]
Personnel doors	2.2	1.33	1.9	ST000011:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.
** 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.
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	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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- B03 MVHR With Heating Coil

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0	1.5	0.8
Standard value	2.5*	N/A	N/A	1.1^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

2- B04 Radiators Natural Ventilation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0.19	0	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

3- B01 NVHR with Heating Coil

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0	0.2	-
Standard value	2.5*	N/A	N/A	1.1^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- B05 Radiators Extract Ventilation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0.19	0	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

5- B08 Kitchen Ventilation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0	1.5	0.75
Standard value	2.5*	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

6- B02 AHU Mechanical Ventilation Hall

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0	1.5	0.75
Standard value	2.5*	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

7- B10 Convectors Nat Ventilation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0	0	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

8- B07 ASHP and MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	3.5	0	0	0.75
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

9- B11 Door Heater

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0	0	-
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. For types <=12 kW output, refer to EN 14825 for limiting standards.

10- B06 ASHP Server

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.42	3.01	0	0	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1072 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1073 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1074 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1076 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1077 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1084 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1085 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1089 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1094 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1096 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1117 Vis. AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1125 AWC C_Access	-	-	0.4	-	-	-	-	-	-	-	N/A
1199 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1200 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1208 St. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1209 St. WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1213 S. Staff Ch. / Lockers	-	-	0.4	-	-	-	-	-	-	-	N/A
1214 S. Staff Ch. / Lockers	-	-	0.4	-	-	-	-	-	-	-	N/A
1215 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1216 Staff WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1222 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1223 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1225 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1227 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1231 AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1232 Staff AWC / Ch.	-	-	0.4	-	-	-	-	-	-	-	N/A
1375 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1392 WCs Cloak	-	-	0.4	-	-	-	-	-	-	-	N/A
1393 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1396 WC / Change	-	-	0.4	-	-	-	-	-	-	-	N/A
1396 WC / Change	-	-	0.4	-	-	-	-	-	-	-	N/A
1429 Laundry	-	-	0.4	-	-	-	-	-	-	-	N/A
1437 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1438 St AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1493 WCs	-	-	0.4	-	-	-	-	-	-	-	N/A
1503 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1504 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1510 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1511 Cl.	-	-	0.4	-	-	-	-	-	-	-	N/A
1529 Cloak	-	-	0.4	-	-	-	-	-	-	-	N/A
1546 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1547 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1551 Staff WC	-	-	0.4	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1552 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1553 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1571 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1572 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1573 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1581 Laundry	-	-	0.4	-	-	-	-	-	-	-	N/A
1587 Staff / AWC	-	-	0.4	-	-	-	-	-	-	-	N/A
1593 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
1596 Vis. AWC	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
1056 Medical	100	-	-	155
1057 SLT Office	100	-	-	117
1060 Admin Store	100	-	-	6
1062 Stair	-	100	-	57
1063 Stair	-	100	-	46
1071 KS1 Group Room 1	100	-	-	89
1072 WC	-	100	-	32
1073 WC	-	100	-	32
1074 WC	-	100	-	32
1075 KS1 Group Room 2	100	-	-	89
1076 Staff WC	-	100	-	32
1077 Staff WC	-	100	-	35
1078 Stair C_Access	-	100	-	19
1078 Stair C_Access	-	100	-	65
1079 Hygiene Suite	100	-	-	82
1084 Staff WC	-	100	-	36
1085 Staff WC	-	100	-	36
1088 Stair	-	100	-	46
1089 AWC	-	100	-	35
1094 WC	-	100	-	30
1095 KS3 Group Room 1	100	-	-	80
1096 WC	-	100	-	31
1107 Lobby PE Change	-	100	-	18
1107 PE Change	-	100	-	40
1108 PE Staff Ch.	-	100	-	22
1112 Catering Kitchen	-	100	-	725
1113 Secondary Dining C_Access	-	100	-	384
1114 Lobby PE Change	-	100	-	10
1114 PE Change	-	100	-	44
1115 PE Staff Ch.	-	100	-	25

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1117 Vis. AWC	-	100	-	33
1121 Reception / Admin	100	-	-	225
1122 Kitchenette	100	-	-	47
1124 Head	100	-	-	134
1125 AWC C_Access	-	100	-	37
1139 Lobby PE Change	-	100	-	10
1139 PE Change	-	100	-	43
1140 PE Store	100	-	-	19
1141 Secondary Hall C_Access	100	-	-	829
1143 Primary Hall / Dining C_Access	100	-	-	687
1146 KS1 Classroom 1	100	-	-	281
1148 KS1 Classroom 2	100	-	-	280
1152 KS1 Classroom 3	100	-	-	285
1153 Circulation	-	100	-	77
1160 Circulation	-	100	-	110
1162 KS3 Classroom 3 (English)	100	-	-	286
1164 KS3 Classroom 1 (English)	100	-	-	274
1178 Cafe / Bistro C_Access	-	100	60	178
1179 Dist.	100	-	-	3
1180 KS3/4 Calming Space	100	-	-	90
1181 Stair	-	100	-	47
1182 Stair	-	100	-	48
1183 Stair	-	100	-	45
1184 Stair	-	100	-	44
1185 KS2 Group Room 1	100	-	-	90
1187 Staff Work Room	100	-	-	105
1188 Primary Art / Science / Design Tech.	100	-	-	146
1189 Primary Food Technology	100	-	-	147
1190 Res St	100	-	-	7
1191 Food Store	100	-	-	7
1194 KS2 Group Room 2	100	-	-	91
1196 Cl.	100	-	-	7
1199 AWC	-	100	-	33
1200 WCs	-	100	-	56
1201 Primary Teaching Res. Store	100	-	-	20
1203 P. Staff Ch. / Lockers	-	100	-	36
1204 P. Staff Ch. / Lockers	-	100	-	36
1205 Primary Library	100	-	-	171
1206 Primary ICT	100	-	-	111
1207 Primary SEN Resource	100	-	-	158
1208 St. WC	-	100	-	33
1209 St. WC	-	100	-	33
1211 ICT Store	100	-	-	9

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1212 Stair	-	100	-	69
1213 S. Staff Ch. / Lockers	-	100	-	32
1213 S. Staff Ch. / Lockers	-	100	-	16
1214 S. Staff Ch. / Lockers	-	100	-	32
1214 S. Staff Ch. / Lockers	-	100	-	16
1215 Staff WC	-	100	-	36
1216 Staff WC	-	100	-	36
1218 KS4 Group Room 4	100	-	-	71
1219 SEN Resource Base	100	-	-	181
1221 ICT Room 2	100	-	-	283
1222 WC	-	100	-	36
1223 WC	-	100	-	36
1225 WCs	-	100	-	51
1227 AWC	-	100	-	33
1229 Group Room	100	-	-	82
1230 Group Room	100	-	-	98
1231 AWC	-	100	-	35
1232 Staff AWC / Ch.	-	100	-	40
1233 Post 16 Common Room	100	-	-	204
1234 Centr. Staff Room	100	-	-	267
1236 Sensory	100	-	-	138
1237 Circulation	-	100	-	215
1239 KS2 Classroom 1	100	-	-	275
1241 KS2 Classroom 3	100	-	-	279
1244 KS2 Classroom 4	100	-	-	280
1247 KS2 Classroom 2	100	-	-	281
1250 KS2 Classroom 6	100	-	-	285
1254 KS2 Classroom 5	100	-	-	277
1255 Circulation	-	100	-	199
1257 KS4 Classroom 4 (Maths)	100	-	-	276
1260 KS4 Classroom 2 (Maths)	100	-	-	275
1263 KS4 Classroom 1 (Maths)	100	-	-	274
1266 KS4 Classroom 3 (MFL)	100	-	-	279
1269 ICT Room 1	100	-	-	280
1270 Post 16 Class 4	100	-	-	279
1273 Post 16 Class 2	100	-	-	295
1276 Circulation	-	100	-	149
1277 Post 16 Class 3	100	-	-	279
1280 Post 16 Class 5	100	-	-	278
1283 Post 16 Class 1	100	-	-	284
1288 Group Room	100	-	-	60
1290 Circulation	-	100	-	61
1291 Ent. Lobby	-	100	-	35

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1292 Circulation	-	100	-	37
1299 Ext. PE Store	100	-	-	16
1300 Art / Science Store	100	-	-	11
1301 Head of Primary	100	-	-	99
1310 Cl.	100	-	-	6
1311 Stair	-	100	-	48
1312 Science Studio	100	-	-	803
1314 Prep / Store	100	-	-	16
1315 Science Lab	100	-	-	838
1329 Primary Therapy	100	-	-	94
1331 KS3/4 Library C_Access	100	-	-	217
1333 File Server	100	-	-	32
1341 Lobby C_Access	-	100	-	26
1350 Art Store 2	100	-	-	12
1351 Art Room 2	100	-	-	278
1357 Primary Calm Space	100	-	-	79
1358 Primary Staff Social	100	-	-	130
1360 Office Kitchen	100	-	-	81
1361 Kitchen Food Store	100	-	-	10
1364 Kitchen Store	100	-	-	7
1365 Cl.	100	-	-	6
1369 Mob Store	118	-	-	6
1370 Art Store 1	100	-	-	12
1371 WIP Store	100	-	-	10
1372 WIP Store	100	-	-	10
1375 WC	-	100	-	32
1383 KS3/4 Music / Drama	100	-	-	262
1386 Early Years Sensory	100	-	-	81
1387 Early Years Group Room	100	-	-	70
1391 Recep. Group Room	100	-	-	72
1392 WCs Cloak	-	100	-	21
1393 WCs	-	100	-	37
1394 Reception Classroom	100	-	-	270
1396 WC / Change	-	100	-	31
1396 WC / Change	-	100	-	67
1398 Early Years	100	-	-	271
1402 Supplies St.	100	-	-	8
1403 Food Technology	100	-	-	324
1405 Food Store	100	-	-	13
1407 Design Technology	100	-	-	331
1408 WIP Store	100	-	-	11
1409 Res. Store	100	-	-	12
1413 Circulation C_Access	-	100	-	138

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1420 Circulation C_Access	-	100	-	380
1429 Laundry	-	100	-	35
1435 Circulation	-	100	-	112
1436 Circulation	-	100	-	95
1436 Server Hub 1	100	-	-	25
1437 WCs	-	100	-	56
1438 St AWC	-	100	-	33
1444 Cleaner	120	-	-	5
1451 Circulation	-	100	-	234
1453 Parents / Waiting Room	100	-	-	128
1454 Circulation	-	100	-	109
1458 Meeting Room	100	-	-	223
1472 Premises Store	100	-	-	10
1473 Prem. Off	100	-	-	98
1480 Cl. Store	100	-	-	7
1482 Plant 2	100	-	-	154
1493 WCs	-	100	-	51
1496 Ext. PE Store	100	-	-	18
1497 Res Cl. Store	100	-	-	9
1498 Hygiene Suite 2	100	-	-	117
1499 KS4 Group Room 5	100	-	-	85
1500 KS4 Classroom 5 (MFL)	100	-	-	279
1503 WC	-	100	-	32
1504 WC	-	100	-	32
1505 KS4 Group Room 6	100	-	-	87
1506 Primary Music / Drama	100	-	-	264
1507 Music / Drama Store	100	-	-	12
1510 WC	-	100	-	34
1511 Cl.	100	-	-	6
1516 WC/Ch Kitchen	-	100	-	19
1516 WC/Ch Kitchen	-	100	-	30
1518 Central Resource Cl. St 1	100	-	-	13
1519 Plant 1	100	-	-	149
1520 Chair Store	100	-	-	13
1521 KS3/4 Therapy	100	-	-	84
1523 Furniture Store C_Access	100	-	-	15
1525 Mob Store	116	-	-	6
1527 Intimate Dining C_Access	100	-	-	107
1528 Early Years Off / Res.	100	-	-	72
1529 Cloak	100	-	-	11
1530 Ext. Maint Store	100	-	-	12
1531 Inclusion	100	-	-	116
1532 Life Skills	100	-	-	155

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1533 Circulation	-	100	-	199
1534 Sensory	100	-	-	96
1535 Immersion	100	-	-	89
1536 SSP Group	100	-	-	73
1537 SSP Tutor Base	100	-	-	261
1538 SSP Group	100	-	-	73
1539 SSP Group	100	-	-	73
1540 SSP Tutor Base	100	-	-	261
1541 SSP Group	100	-	-	73
1542 SSP Group	100	-	-	73
1543 Music Store / Quiet Room	100	-	-	14
1544 SSP Tutor Base	100	-	-	262
1545 SSP Group	100	-	-	74
1546 WC	-	100	-	26
1547 WC	-	100	-	28
1550 KS3 Group Room 2	100	-	-	87
1551 Staff WC	-	100	-	34
1552 WC	-	100	-	32
1553 WC	-	100	-	32
1555 KS3 Classroom 2 (English)	100	-	-	275
1566 KS3 Classroom 4 (Humanities)	100	-	-	277
1567 Art Room 1	100	-	-	278
1570 KS3 Group Room 3	100	-	-	88
1571 WC	-	100	-	30
1572 WC	-	100	-	32
1573 WC	-	100	-	32
1575 P. General Store	100	-	-	13
1577 Soft Play	100	-	-	140
1578 Primary Sensory	100	-	-	149
1581 Laundry	-	100	-	39
1582 Cleaner	100	-	-	6
1583 Equip. St	100	-	-	13
1585 SSP Office	100	-	-	127
1587 Staff / AWC	-	100	-	38
1589 Bursar	100	-	-	120
1589 Circulation C_Access	-	100	-	59
1591 Staff Work Room	100	-	-	124
1592 Server Hub 2	100	-	-	23
1593 WC	-	100	-	34
1596 Vis. AWC	-	100	-	33
1597 Lobby C_Access	-	100	-	21
1598 Prem. Store	100	-	-	11
1599 Lobby C_Access	-	100	-	18

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1600 Chem St.	100	-	-	10
1603 EY Ext St.	100	-	-	11
1605 Science Breakout	100	-	-	79
1606 Comm Store	-	100	-	25
1608 Sec. Store	100	-	-	3
1609 Primary Servery	-	100	-	132
1609 St	100	-	-	8
1610 Secondary Servery	-	100	-	133
1611 General Store	100	-	-	12
1611 PE store	100	-	-	16
1612 Store	100	-	-	8
1615 SLT Office 1	100	-	-	129
1616 Visiting Prof Office	100	-	-	119
1617 Kitchen Cl.	-	100	-	53
1618 Circulation	-	100	-	84
5041/5042 ICT Store	100	-	-	9
Plantroom Water Tank	100	-	-	231
Stairs to Roof	-	100	-	32

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1056 Medical	NO (-99.9%)	NO
1057 SLT Office	NO (-99.8%)	NO
1071 KS1 Group Room 1	NO (-94.9%)	YES
1075 KS1 Group Room 2	NO (-95.5%)	YES
1079 Hygiene Suite	N/A	N/A
1095 KS3 Group Room 1	NO (-89.8%)	YES
1113 Secondary Dining C_Access	NO (-7.3%)	YES
1121 Reception / Admin	NO (-86.9%)	YES
1122 Kitchenette	N/A	N/A
1124 Head	NO (-74.3%)	YES
1141 Secondary Hall C_Access	YES (+1%)	YES
1143 Primary Hall / Dining C_Access	NO (-56.9%)	YES
1146 KS1 Classroom 1	NO (-87.3%)	YES
1148 KS1 Classroom 2	NO (-87.6%)	YES
1152 KS1 Classroom 3	NO (-88.6%)	YES
1162 KS3 Classroom 3 (English)	NO (-76.2%)	YES
1164 KS3 Classroom 1 (English)	NO (-88.2%)	YES
1178 Cafe / Bistro C_Access	NO (-52.5%)	YES
1180 KS3/4 Calming Space	N/A	N/A
1185 KS2 Group Room 1	NO (-89.7%)	YES
1187 Staff Work Room	NO (-71.1%)	YES
1188 Primary Art / Science / Design Tech.	NO (-64.2%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1189 Primary Food Technology	NO (-75.1%)	YES
1194 KS2 Group Room 2	NO (-80.5%)	YES
1205 Primary Library	NO (-68.5%)	YES
1206 Primary ICT	NO (-99.6%)	NO
1207 Primary SEN Resource	NO (-73.8%)	YES
1218 KS4 Group Room 4	NO (-85.1%)	YES
1219 SEN Resource Base	NO (-80.9%)	YES
1221 ICT Room 2	NO (-84.4%)	YES
1229 Group Room	NO (-70.2%)	YES
1230 Group Room	NO (-76.6%)	YES
1233 Post 16 Common Room	NO (-82.1%)	YES
1234 Centr. Staff Room	NO (-78%)	YES
1236 Sensory	NO (-86.1%)	YES
1239 KS2 Classroom 1	NO (-68%)	YES
1241 KS2 Classroom 3	NO (-68.5%)	YES
1244 KS2 Classroom 4	NO (-81.2%)	YES
1247 KS2 Classroom 2	NO (-80.9%)	YES
1250 KS2 Classroom 6	NO (-83.4%)	YES
1254 KS2 Classroom 5	NO (-68.3%)	YES
1257 KS4 Classroom 4 (Maths)	NO (-72.3%)	YES
1260 KS4 Classroom 2 (Maths)	NO (-78.9%)	YES
1263 KS4 Classroom 1 (Maths)	NO (-91.3%)	YES
1266 KS4 Classroom 3 (MFL)	NO (-81.2%)	YES
1269 ICT Room 1	NO (-82.6%)	YES
1270 Post 16 Class 4	NO (-64%)	YES
1273 Post 16 Class 2	NO (-77.8%)	YES
1277 Post 16 Class 3	NO (-68.5%)	YES
1280 Post 16 Class 5	NO (-81.6%)	YES
1283 Post 16 Class 1	NO (-81.6%)	YES
1288 Group Room	NO (-94.6%)	YES
1301 Head of Primary	NO (-92.8%)	YES
1312 Science Studio	NO (-74%)	YES
1315 Science Lab	NO (-74.5%)	YES
1329 Primary Therapy	NO (-84.3%)	YES
1331 KS3/4 Library C_Access	NO (-45.4%)	YES
1333 File Server	N/A	N/A
1351 Art Room 2	NO (-66.9%)	YES
1357 Primary Calm Space	NO (-80.5%)	YES
1358 Primary Staff Social	NO (-76.7%)	YES
1360 Office Kitchen	N/A	N/A
1383 KS3/4 Music / Drama	NO (-87.2%)	YES
1386 Early Years Sensory	N/A	N/A
1387 Early Years Group Room	NO (-92.6%)	YES
1391 Recep. Group Room	N/A	N/A
1394 Reception Classroom	NO (-87.1%)	YES
1398 Early Years	NO (-83.8%)	YES
1403 Food Technology	NO (-80.3%)	YES
1407 Design Technology	NO (-79.4%)	YES
1453 Parents / Waiting Room	NO (-68.7%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1458 Meeting Room	N/A	N/A
1473 Prem. Off	N/A	N/A
1498 Hygiene Suite 2	N/A	N/A
1499 KS4 Group Room 5	NO (-86%)	YES
1500 KS4 Classroom 5 (MFL)	NO (-81.8%)	YES
1505 KS4 Group Room 6	NO (-93.3%)	YES
1506 Primary Music / Drama	NO (-70.5%)	YES
1521 KS3/4 Therapy	NO (-82.9%)	YES
1527 Intimate Dining C_Access	NO (-87.9%)	YES
1528 Early Years Off / Res.	NO (-82.7%)	YES
1531 Inclusion	NO (-91.9%)	YES
1532 Life Skills	NO (-90.8%)	YES
1534 Sensory	NO (-87.8%)	YES
1535 Immersion	N/A	N/A
1536 SSP Group	NO (-93.5%)	YES
1537 SSP Tutor Base	NO (-84.5%)	YES
1538 SSP Group	NO (-93.2%)	YES
1539 SSP Group	NO (-92.8%)	YES
1540 SSP Tutor Base	NO (-86.1%)	YES
1541 SSP Group	NO (-92.9%)	YES
1542 SSP Group	NO (-92.8%)	YES
1544 SSP Tutor Base	NO (-85.3%)	YES
1545 SSP Group	NO (-92.8%)	YES
1550 KS3 Group Room 2	N/A	N/A
1555 KS3 Classroom 2 (English)	NO (-70.7%)	YES
1566 KS3 Classroom 4 (Humanities)	NO (-62.3%)	YES
1567 Art Room 1	NO (-63.5%)	YES
1570 KS3 Group Room 3	NO (-100%)	NO
1577 Soft Play	NO (-96.2%)	YES
1578 Primary Sensory	NO (-89%)	YES
1585 SSP Office	NO (-86.7%)	YES
1589 Bursar	NO (-82.1%)	YES
1591 Staff Work Room	NO (-99.9%)	NO
1605 Science Breakout	NO (-93.3%)	YES
1615 SLT Office 1	NO (-73.2%)	YES
1616 Visiting Prof Office	NO (-82.6%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER and BPEC

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	6516.9	6516.9
External area [m^2]	10984.2	10984.2
Weather	CAR	CAR
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	2597.37	4062.81
Average U-value [W/m^2K]	0.24	0.37
Alpha value* [%]	9.99	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
1	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
98	**D1 Non-residential Institutions: Education**
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
1	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

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

	Actual	Notional
Heating	4.14	13.28
Cooling	0.21	0.11
Auxiliary	2.69	5.79
Lighting	7.42	12
Hot water	14.82	29.28
Equipment*	24.95	24.95
TOTAL**	**29.28**	**60.46**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	45.23	6.36
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0.61	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	51.94	64.87
Primary energy* [kWh/m^2]	73.65	92.36
Total emissions [kg/m^2]	-8.2	15.3

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - fanned, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	57.4	0	5.7	0	0.1	2.8	0	3.5	0
	Notional	19.9	0	4.2	0	0	1.33	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	60.9	0	5.4	0	1.1	3.11	0	3.5	0
	Notional	64.7	0	13.6	0	8.1	1.33	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	68.6	0	5.1	0	7.1	3.73	0	3.5	0
	Notional	75.5	0	15.8	0	5.9	1.33	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	6.3	0	0.5	0	9	3.73	0	3.5	0
	Notional	20.1	0	4.2	0	6.9	1.33	0	----	----
[ST] Central heating using water: convectors, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	7.9	0	0.7	0	2	3.29	0	3.5	0
	Notional	13.2	0	2.8	0	1.2	1.33	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	32.9	0	2.4	0	5.6	3.73	0	3.5	0
	Notional	115.4	0	24.2	0	6.6	1.33	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1269.8	0	76.2	0	3.35	4.63	3.42	6.19
	Notional	0	431.9	0	31.7	0	1.33	3.79	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	99	0	8.4	0	1.5	3.29	0	3.5	0
	Notional	139.1	0	29.1	0	0.9	1.33	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	58	20.7	3.7	1.3	0	4.41	4.48	4.5	6
	Notional	89.8	21.4	18.8	1.6	0	1.33	3.79	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	16.2	0	1.4	0	11.4	3.29	0	3.5	0
	Notional	48.2	0	10.1	0	15.3	1.33	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency
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

DISCIPLINE	ASSIGNED STATUS			CHK	DATE
WATES (FINAL REVIEW)	A	B	C		
CLIENT	A	B	C		
ARCHITECT	A	B	C		
STRUCTURAL CONSULTANT	A	B	C		
SERVICES CONSULTANT	A	B	C		
OTHER 1	A	B	C		
OTHER 2	A	B	C		
OTHER 3	A	B	C		

GENERAL NOTES

LEGEND

- NVHR WITH HEATING COIL
- AHU MECHANICAL VENTILATION HALL
- MVHR WITH HEATING COIL
- RADIATIORS NATURAL VENTILATION
- RADIATORS EXTRACT VENTILATION
- ASHP AND MVHR
- KITCHEN VENTILATION
- CENTRAL DHWS
- CONVECTORS NAT VENTILATION
- DOOR HEATER
- ASHP SERVER

Rev.	Date	Description (Purpose of Issue):	CHK
P01	25.02.22	RIBA STAGE 2	SL

Client:
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Project:
YSGOL PLAS BRONDYFFRYN SEN SCHOOL

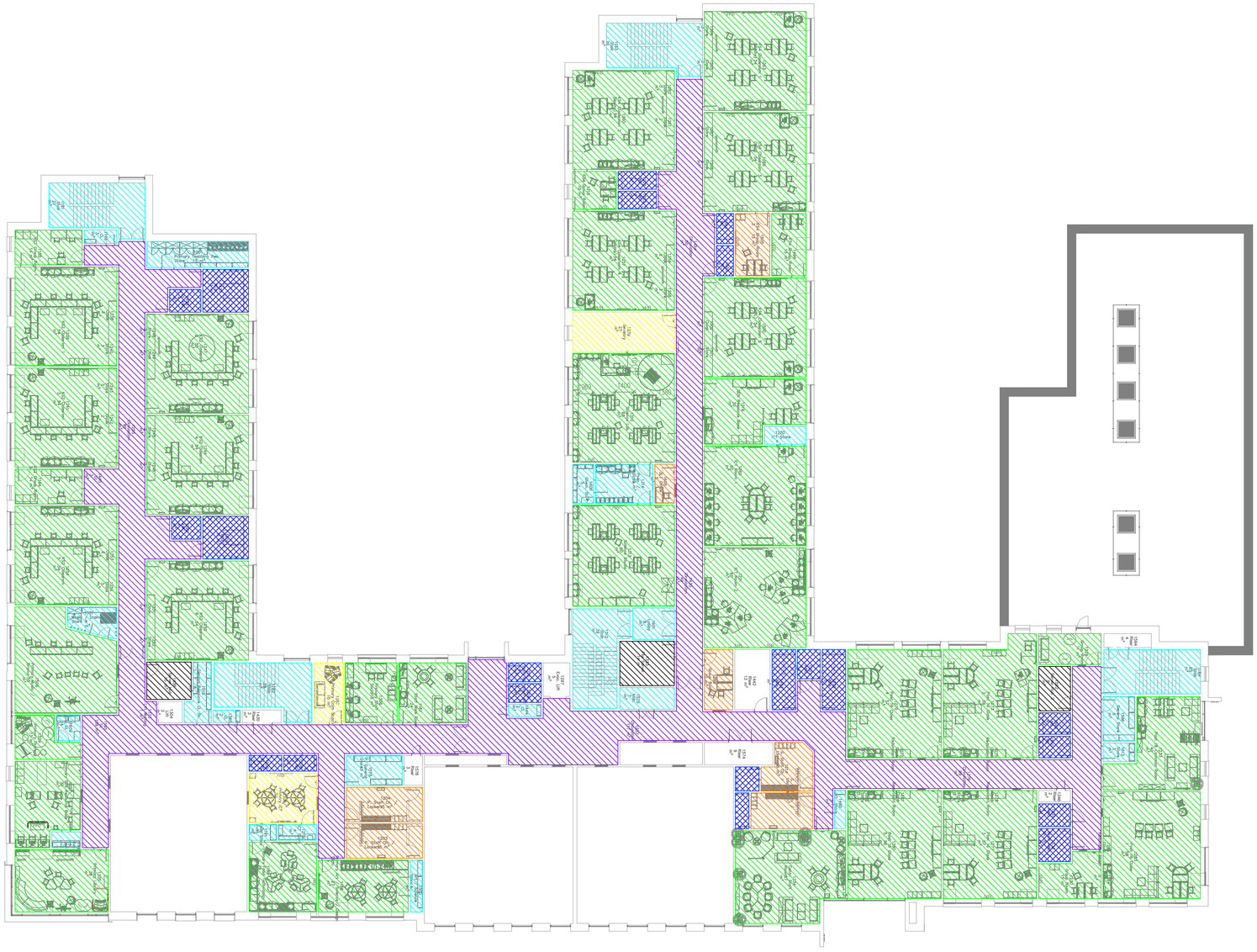
Drawing Title:
MECHANICAL ENGINEERING SERVICES
HEATING ENVIRONMENTAL TREATMENT
GROUND FLOOR
RIBA STAGE 2

Date of Issue:	Scale @ A1:	DRW:	CHK:
25.02.22	1:200 @ A1	MM	SL

Filename: YPB-WGC-ZZ-00-DR-M-20000 — Revision: P01

Suitability: ISSUED FOR STAGE APPROVAL — Suitability: S4

Proj.	Orig.	Zone	Volume	Doc. Type	Disc.	Series
YPB	WGC	ZZ	00	DR	M	20000



DISCIPLINE	ASSIGNED STATUS			CHK	DATE
WATES (FINAL REVIEW)	A	B	C		
CLIENT	A	B	C		
ARCHITECT	A	B	C		
STRUCTURAL CONSULTANT	A	B	C		
SERVICES CONSULTANT	A	B	C		
OTHER 1	A	B	C		
OTHER 2	A	B	C		
OTHER 3	A	B	C		

GENERAL NOTES

LEGEND

- NVHR WITH HEATING COIL
- AHU MECHANICAL VENTILATION HALL
- MVHR WITH HEATING COIL
- RADIATIORS NATURAL VENTILATION
- RADIATORS EXTRACT VENTILATION
- ASHP AND MVHR
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- CONVECTORS NAT VENTILATION
- DOOR HEATER
- ASHP SERVER

Rev.	Date	Description (Purpose of Issue):	CHK
P01	25.02.22	RIBA STAGE 2	SL

Client:
DENBIGHSHIRE COUNCIL

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Project:
YSGOL PLAS BRONDYFFRYN SEN SCHOOL

Drawing Title:
MECHANICAL ENGINEERING SERVICES
ENVIRONMENTAL TREATMENT
FIRST FLOOR
RIBA STAGE 2

Date of Issue:	Scale @ A1:	DRW:	CHK:
25.02.22	1:200 @ A1	MM	SL

Filename: YPB-WGC-ZZ-01-DR-M-20000 — Revision: P01

Suitability: ISSUED FOR STAGE APPROVAL — Suitability: S4

Proj.	Orig.	Zone	Volume	Doc. Type	Disc.	Series
YPB	WGC	ZZ	01	DR	M	20000

CAHV Monobloc System

CAHV-P500YA-HPB

The Ecodan CAHV air source heat pump monobloc system can operate singularly, or form part of a multiple unit system. The CAHV also comes equipped with a wide range of controller features as standard.

A multiple unit system has the ability to cascade available units on and off to meet the load from a building. As an example of this modulation, a 16 unit system allows 0.5kW increments of capacity, from 18kW all the way up to 688kW. This level of modulation is unprecedented within the heating industry and with cascade and rotation built in as standard, the Ecodan CAHV system is perfectly suited to a wide range of commercial applications.

- Multiple unit cascade control of up to 688kW capacity
- Split refrigerant circuits within each CAHV provide 50% back up
- Ability to rotate units based on accumulated run hours
- Provides from 25ºC up to 70°C water flow temperatures without boost heaters
- Low maintenance, hermetically-sealed monobloc design
- Low on-site refrigerant volume
- HIC (Zubadan) technology delivers 43kW at -3ºC with minimal drop off down to -20ºC

The CAHV Monobloc system qualifies for the Energy Technology List. It is also an MCS certified product, helping to build a rapidly growing Microgeneration industry based on quality and reliability.

APPROVED PRODUCT

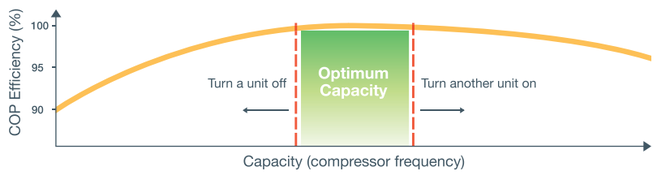
Certificate Number:
MCS HP0002
Product Reference:
CAHV-P500YA-HPB

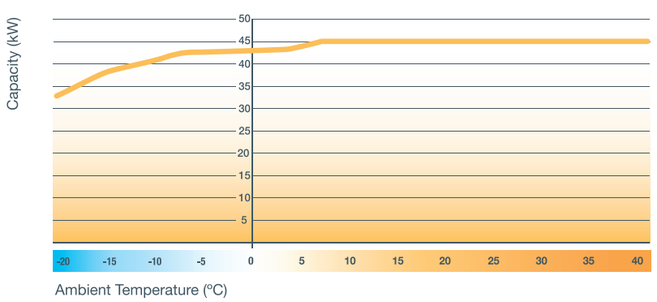
Optimisation of Cascading Units Deliver Maximum Efficiency

Optimisation is built into the CAHV systems logic in order to deliver maximum efficiency.

The standard controller adapts the capacity delivered to ensure that compressors work within their most efficient range, turning individual CAHV units on and off as necessary.

This feature utilises inverter technology to its greatest potential, whilst also ensuring capacity is available at all working ambient temperatures.





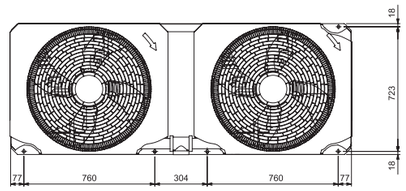
MODEL		CAHV-P500YA-HPB
Heating*1 (A7/W35)	Capacity (kW)	45
	Power Input (kW)	10.9
	Running Current [MAX] (A)	17.6 [52.9]
	COP	4.13
Heating*2 (A-3/W35)	Capacity (kW)	43
	Power Input (kW)	15.2
	Running Current [MAX] (A)	24.58 [52.9]
	COP	2.80
Water Pressure Drop*1 *2 (kPa)		18
Temperature Range	Outlet Water Temperature	25-70°C
	Outdoor Temperature D.B	-20-40°C
Circulating Water Volume Range		7.5m³/h - 15.0m³/h
Sound Pressure Level (measured in anechoic room)*1 at 1m (dBA)*3		59
Sound Pressure Level (measured in anechoic room)*1 at 10m (dBA)*3		51
Diameter of Water Pipe Connection mm(in)	Inlet	38.1 (Rc 1 1/2") screw
	Outlet	38.1 (Rc 1 1/2") screw
External Finish		Acrylic painted steel plate - MUNSELL 5Y 6/1 or similar
Dimensions (mm)	Width	1978
	Depth	759
	Height	1710 (1650 without legs)
Weight (kg)		526
Electrical Supply		380-415v, 50Hz
Phase		3
Compressor		Inverter scroll hematic compressor
Refrigerant	Type x original charge	R407c x (5.5kg) x 2
	Control	LEV and HIC circuit

*1 Under normal heating conditions at outdoor temp; 7°CDB / 6°CWB, outlet water temp 35°C, inlet water temp 30°C as tested to BS EN14511.
*2 Under normal heating conditions at outdoor temp; -3°CDB / -4°CWB, outlet water temp 35°C, inlet water temp 30°C.
*3 Sound power level 70.7dBA tested to BS EN12102.

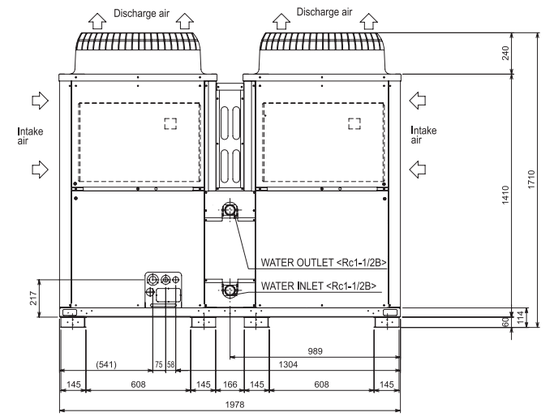
- Please don't use the steel material for the water piping material.
- Please always make water circulate or pull out the circulation water completely when not using it.
- Please do not use groundwater or well water.
- Install the unit in an environment where the wet bulb temperature will not exceed 32°C.
- The water circuit must be a closed circuit.

Schematics

Upper View



Front View



Side View