Whitworth Community High School
Energy Strategy

Date: April 2021
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Revision: 1

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Checked By: Mark J Nelson

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Amendment Sheet

Revision	Description	Date	Author	Checked
0	Initial Issue	March 2021	Ben Wilson	Mark J Nelson
1	Comments Incorporated	April 2021	Ben Wilson	Mark J Nelson

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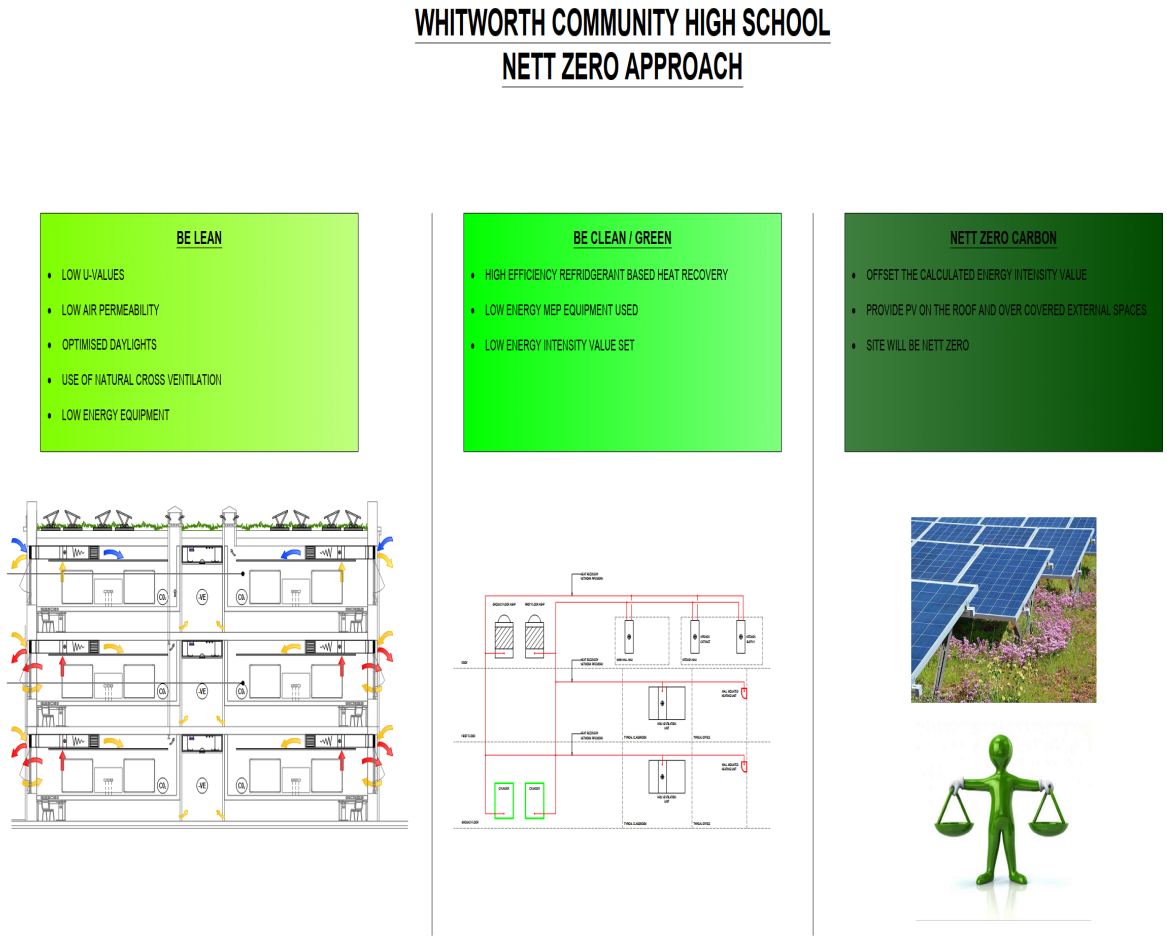
1 INTRODUCTION

Whitworth Community High School forms part of the DfE SRP batch of schools. The SRP schools have a target of lowering the energy intensity / m^2 for the development and then providing on site generation to match this intensity to provide a Nett Zero Energy in use development.

This approach is far more stringent than any local plans or building regulation targets.

The hierarchy follows the well tested Lean/Clean and Green approach. The simple diagram below shows the stages detailed further below.



2 DEMAND REDUCTION (BE LEAN)

To establish the building CO_2 emissions rate (BER) for this section of the energy hierarchy we have implemented the following active and passive design measures during the design stage to show betterment over the TER.
The measures included within the scheme are as follows:

- Orientation - Risk of overheating is reduced due to the orientation of the development. The large volume intermittently used spaces taking the peak solar gain, with teaching spaces benefitting from this strategic positioning. The building fabric has been enhanced with low G-Values throughout the glazing to further reduce the solar gain.
- Built Form – Buildings (non-specialist areas) are shallow plan therefore there is increasing potential for natural/hybrid ventilation and daylighting.
- Thermal Insulation/U Valves - Building Construction materials have enhanced standards of insulation beyond the minimum requirements of Part L of the Building Regulations. The U values used for the building are:

	Whitworth High School	Minimum Building Regulations
Walls	0.15	0.35
Roof	0.12	0.25
Floor	0.12	0.25
Glazing	1.1	2.2

- Natural Ventilation –The project aim is to maximise the use of natural/HRU ventilation. The natural ventilation is enhanced by the provision of chimneys at the rear of teaching spaces to generate crossflow across the room.

The summary of the ventilation strategy used is below.

Teaching Areas

Each classroom will contain local HRU ventilation units, located below the exposed soffit close-coupled to the façade louvres. The ventilation units shall be capable of providing sufficient ventilation to control the CO_2 level to 1200ppm. The fans in the units shall have speed control and shall vary the ventilation volume to the space dependent on readings from a CO_2 / Temperature sensor in each space. The heating is provided by DX 2pipe coils.

Main Hall/Drama

A dedicated air handling unit serving each will be located on the respective roof. The Air Handling unit (AHU) provides fresh, filtered & tempered air to maintain temperature and CO_2 conditions.

Each AHU is provided with a highly efficient thermal wheel to maximise heat recovery and coupled with Air Source Heat pumps (ASHP's), which provides the heat source to each space.

WC / Changing Area Ventilation

Main core WC / changing areas are provided with heat recovery ventilation systems. Heat traditionally lost to atmosphere through extract only systems is recovered and used to pre-heat supply air going back into ancillary spaces.

Local extract ventilation is proposed to small individual spaces. The extract systems shall have a limited specific fan power of 0.5W/l/s.

Heating - Heating shall be predominantly provided by high efficiency air source heat pumps serving heater batteries and wall mounted room units.

DHWS (Domestic Hot Water System) Generation – is via DX calorifiers fed from the ASHP with high insulation k factors to minimise standing losses.

Energy Demand Reduction methods

- Thermal Mass – exposed concrete soffits are provided throughout the majority of rooms to reduce diurnal temperature swings and reduce the risk of overheating when coupled with night cooling.
- Night time purge Cooling – This is provided in the teaching spaces via the ventilation units.
- Air Tightness – The development is committed to achieving an air permeability of $3m^2/hr/m^2$ which corresponds to one third of the allowable value stipulated in Part L of the building regulations.
- Electric Lighting and Controls – High efficiency LED lamps throughout, with lighting control being via daylight dimming and absence detection.
- Energy Efficient ICT – Use of lower power terminals (and tablets) to be promoted to lower heat gain and the need for cooling.
- Efficient Water Fittings – Low flow taps and low flow showers are used to minimise the amount of water used and the hot water energy consumption.
- Pumps – Pumps are fitted with inverter driven motors to lower the pumping energy demand to the water systems by varying the flow rate to suit load down to a minimum 10%.

3 BUILDING SERVICES INFRATRUCTURE (BE CLEAN / GREEN)

The use of district heating mains for this site is not an option as: -

1. There are no local networks.
2. The reduction in energy intensity for HWS & Heating is not as efficient as the proposed servicing below.

The Building Services Strategy is to utilise the following technologies: -

- ASHP DX Heating and HWS generation
- Heat recovery ventilation throughout
- Heat recovery ventilation from the kitchen extract
- Low SFP equipment – Fans, HRU's, AHU's etc
- High efficiency lighting and controls

The ASHP is the renewable technology to be adopted for the site having considered and discounted Ground Source Heat Pumps (GSHP's) due to its high capital cost and its worse efficiency.

4 NETT ZERO ENERGY IN USE

The DFE have set an energy intensity target reduction for a secondary school from the standard default figure of 75 kwhr /m^2 to 55 kwhr/m^2.

This target has been achieved.

To make the development nett zero energy in use for the new building, we have provided a PV array to match the site intensity figures so that energy used on the site is offset fully by the onsite generation from the PV arrays.

5 SUMMARY

As can be seen in the following Part L2A SBEM and EPC the impact on these is quite profound and way beyond building regulations i.e., negative EPC (-40) and negative BER (-18kg CO_2/m^2/annum).

6 APPENDICES

6.1 APPENDIX A: BRUKL OUTPUT REPORT – BE CLEAN/GREEN

Yonder
Engineering a better environment

Part L2A Compliance Report

Whitworth High

As Designed

2329 Rev 01

March 21

Revision Record

Revision	Description	Date	Prepared by	Checked by	Approved by
01	Preliminary issue for information	12/03/21	NBE	IA	NBE

Disclaimer

This report has been prepared by Yonder Limited, with all reasonable skill, care and diligence within the terms of the contract with the client, and in line with our general terms and conditions of business.

We disclaim any responsibility to the client and others of any matters outside the scope above.

Whilst the simulations have been undertaken in good faith using reasonable skill and care, Yonder Limited can take no responsibility for differences between the computer simulations and the actual performance of the completed building due to the inherent complexity and variability of the physics in a building and its environment.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or part thereof, is made known. Any such party relies on the report at its own risk.

Executive Summary

Assuming the building is constructed in a manner consistent with the assumptions made in this report, the following results are predicted:

The Building Emission Rate (BER) for this building is -18 $kgCO_2/m^2$/annum and the Target Emission Rate is 12.9 $kgCO_2/m^2$/annum; therefore, this building achieves a pass under Criterion 1.

CO_2 emission rate calculations show that the predicted Building Emissions Rate (BER) improves upon the Target Emissions Rate (TER) by 239.5%.

There is one instance of the solar gain limit being exceeded in 00.055 Dining.

Preliminary Energy Performance Certificate (EPC) 2013 methodology predicts a rating of A+, with an asset rating of -40.

Contents

Input & Results Tables

1 Introduction

The purpose of this report is to demonstrate that the proposed building will comply with Part L2A (2013) of Building Regulations.

The model input data is based upon the information provided and as detailed throughout this document and in Appendix A.

Accreditation Details	
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Assessor Number:	LCEA138924
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Qualifications:	NOS5
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1.1 Methodology

IES Virtual Environment dynamic thermal simulation software version 2019.3.1.0 has been used to carry out the calculations and simulations required to demonstrate compliance with Criteria 1 & 3, Part L of the Building Regulations.

The simulations for criterion 1 CO_2 emission calculations have been carried out utilising the 7.0.13 calculation engine, which is an approved calculation method validated for ADL2a Compliance Calculations. The BRUKL Compliance Check Version is v5.6.b.0.

The CO_2 emission rate calculations use the National Calculation Methodology (NCM) standard activity templates which are assigned to each activity zone for the purpose of Building Regulations CO_2 compliance. These templates set out the occupancy profiles usage, internal gains and plant operation in each zone.

1.2 External Weather Data

TRY data, Test Reference Year, contains 'typical' weather data for the selected location, and is used primarily for assessment of criterion 1 (CO_2 emissions) of Building Regulations Part L (England / Wales) and Section 6 (Scotland).

MANCHESTER weather data has been used in this calculation as this weather location is the closest to the project location.

2 Model Data

The thermal model has been built using the input data within this section. A comprehensive overview of the thermal model input data can be found in Appendix 4.1.

2.1 Incoming Drawing Register

Table 2.1: Incoming drawing register

Description	Discipline	Reference	Revision
ADP - Strategic Plan	Architectural	0920	-
ADP - GF Layout	Architectural	1000	-
ADP - FF Layout	Architectural	1001	-
ADP - SF Layout	Architectural	1002	-

2.2 Input Data

Table 2.2: Fabric input data

Element	Description	Proposed area-weighted u-value (W/m2.K)	Area-weighted average (Table 3, AD L2A (a))
External Walls		0.15	0.35
Internal Walls		0.55	n/a
Ground-Contact Floors		0.12	0.25
Internal Floors		1.98	n/a
Roof		0.12	0.25
Windows		1.10	2.20
Rooflights		1.10	2.20
Pedestrian doors		1.20	2.20

Table 2.3: Glazing input data

Element	Description	g-value (BS EN 410)	Light transmittance (LT)
General Glazing	North elevation	0.35	0.78
	All other elevations	0.35	0.70
Rooflights		0.25	0.50

Table 2.4: Air permeability input data

Air Permeability	Description	This building (Design Value)	Worst acceptable standard
$m^3/(h.m^2)$ @ 50 Pa		3	10

HVAC Details

Table 2.5: HVAC systems & efficiencies

System	Heating Seasonal Efficiency	Cooling Seasonal Efficiency	SFP (W/l/s)	Auto Metering & Monitoring	Alarms for out-of-range values	Heat Recovery Efficiency
HVAC 00a: SV (SF)	-	-	1.00	-	-	-
HVAC 00b: EV (EF)	-	-	0.50	-	-	-
HVAC 01a: EPH NV	1.00	-	-	Yes	Yes	-
HVAC 01b: EPH SVHR (HRU)	1.00	-	1.00	Yes	Yes	0.80
HVAC 01c: EPH EV (EF)	1.00	-	0.50	Yes	Yes	-
HVAC 02a: HRU SVHR (HRU)	4.17	-	0.73	Yes	Yes	0.83
HVAC 03a: VRF NV	4.17	3.50	-	Yes	Yes	-
HVAC 03b: VRF MV	4.17	3.50	1.00	Yes	Yes	0.80
HVAC 04a: ODH NV	1.00	-	-	Yes	Yes	-
HVAC 07a: Kitchen	4.17	-	1.60	Yes	Yes	0.50
HVAC 07B: AHUs	4.17	-	1.60	Yes	Yes	0.70
DHW 01: ASHP	4.17	-	-	Yes	Yes	-

Domestic Hot Water

Table 2.6: DHW systems & efficiencies

System	Delivery Efficiency	Generator Type	Fuel Type	Storage Volume (l)	Storage Losses (kWh/l/day)
DHW 01: ASHP	1.00	Heat Pump	Electricity	1500	0.001

Table 2.7: DHW secondary circulation

System	Secondary Circulation	Circulation Losses (W/m)	Pump Power (kW)	Loop Length (m)	Time Switch
DHW 01: ASHP	Yes	6.00	0.10	500	yes

Renewables

PV Array to achieve: 299.3kWp~265,000 kWh/year

General & Display Lighting Efficacy

Refer to Appendix A: Input Data for all lighting efficacies, display lighting efficacies and controls.

The Contractor shall provide a schedule of fixed internal lighting confirming that the building average efficacy luminaire lumens per circuit-watt, as required by Part L2A 2013 of the Building Regulations.

Power Factor Correction

Table 2.8: Power factor correction equipment

Building/Zone	Description	PFC equipment installed?	Electric power factor
Whole building		Yes	>0.95

Metering

Table 2.9: Systems metering & warning

System	Description	Auto metering & monitoring	Alarms for out-of-range values
Lighting		Yes	Yes

Thermal Bridging

In a DSM analysis an additional 10% heat loss is added to make an allowance for the extra conduction via non-repeating thermal bridges. For this reason, you should observe an Alpha value of 10% in the Technical Data Sheet within the BRUKL document. The differentiation between metal clad and non-metal clad constructions is only made when following the EN ISO 14683 method which is only applicable to an SBEM calculation. Note from the paragraph above that it is not a requirement of the NCM Modelling guide to use a method that satisfies EN ISO 14683.

3 Part L Criteria

All text in grey italic writing is extracted from Approved Document L2A 2013 to help illustrate the relevant criterion. All references to documents and tables can be found within Approved Document L2.

3.1 Criterion 1 – Achieving the BER

1.4 Criteria 1: in accordance with regulation 26 the calculated CO_2 emission rate for the building (the Building CO_2 Emission Rate, BER) must not be greater than the Target CO_2 Emission Rate (TER), which is determined by following the procedures set out in paragraphs 2.7 to 2.36.

	Criteria	Emission rate ($kgCO_2/m^2/annum$)
1.1	CO_2 emission rate notional building	12.9
1.2	Target CO_2 Emissions Rating (TER)	12.9
1.3	Building CO_2 Emissions Rating (BER)	-18
1.4	Are emissions from building less than or equal to the target?	**Yes**
1.5	Are as built details the same as used in BER calculations?	Separate submission

3.2 Criterion 2 – Limits on design flexibility

Building Fabric

2.39 Table 3 sets out the limiting standards for the properties of fabric elements of the building. The stated value represents the area-weighted average value for all elements of that type. In general, achievement of the TER is likely to need better fabric performance than that set out in table 3.

Table 3.1: Element U-values

Element	$U_{a\text{-}Limit}$ ($W/m^2/K$)	$U_{a\text{-}Calc}$ ($W/m^2/K$)	$U_{l\text{-}Calc}$ ($W/m^2/K$)
Wall	0.35	0.15	0.15
Floor	0.25	0.12	0.12
Roof	0.25	0.12	0.12
Windows	2.20	1.09	1.6
Personnel doors	2.20	2.2	2.2
Vehicle access & similar large doors	1.50	-	-
High usage entrance doors	3.50	-	-

Table 3.2: Building Air Permeability

Air Permeability	Worst Acceptable Standard	This Building
$m^3/h/m^2$ at 50 Pa	10	3

Building Services Systems

Controls

2.43 System should be provided with appropriate controls to enable the achievement of reasonable standards of energy efficiency in use. In normal circumstances, the following features would be appropriate for heating, ventilation and air-conditioning controls:

a. *The system should be subdivided into separate control zones to correspond to each area of the building that has a significantly different solar exposure, or pattern or type of use; and*
b. *Each separate control zone should be capable of independent timing and temperature control and, where appropriate, ventilation and air recirculation rate; and*
c. *The provision of the service should respond to the requirements of the space it serves. If both heating and cooling are provided, they should be controlled so as not to operate simultaneously; and*
d. *Central plant should operate only as and the zone systems require it. The default condition should be off.*

2.44 In addition to these general control provisions, the systems should meet specific control and efficiency standards as set out in the paragraphs below.

System efficiencies

2.45 Each fixed building service should be at least as efficient as the worst acceptable value for the particular type of appliance as set out in the Non-Domestic Building Services Compliance Guide. If the type of appliance is not covered by the Guide, then reasonable provision would be to demonstrate that the proposed system is not less efficient than a comparable system that is covered by the Guide.

NOTE: To not inhibit innovation

2.46 The efficiency claimed for the fixed building service should be based in the appropriate test standard as set out in the Non-Domestic Building Services Compliance Guide and the test data should be certified by a notified body. It would be reasonable for BCB's to accept such data at face value. In the absence of such quality-assured data, the BCB should satisfy that the claimed performance is justified.

Energy Metering

2.47 Reasonable provision for energy meters would be to install energy metering systems that enable:

at least 90% of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories (heating, lighting, etc.). Detailed guidance on how this can be achieved is given in CIBSE TM 39; and the performance of any LZC system to be separately monitored; and
in buildings with a total useful floor area greater than 1000m^2, automatic meter reading and data collection facilities.
***2.48** The metering provisions should be designed such as to facilitate the benchmarking or energy performance as set out in CIBSE TM 46 Energy Benchmarks.*

Metering Strategy Document to CIBSE TM39 to be provided by the Electrical Contractor.

Centralised Switching of Appliances

***2.49** Consideration should be given to the provision of centralised switches to allow the facilities manager to switch off appliances when they are not needed (e.g. overnight and at weekends). Where appropriate, these should be automated (with manual override) so that energy savings are maximised.*

NOTE: A centralised switch would be more reliable than depending on each individual occupant to switch off their (e.g.) computer.

3.3 Criterion 3 – Limiting solar gains in summer

***2.50** This section sets out the approach to limiting heat gains as required by paragraph L1(a)(i) of schedule 1 to the Building Regulations.*

***2.51** The following guidance applies to all buildings, irrespective of whether they are air conditioned or not. The intention is to limit solar gains during the summer period to either:*
a. reduce the need for air-conditioning; or
b. reduce the installed capacity of any air-conditioning system that is installed.

***2.52** If the criterion set out below is satisfied in the context of a naturally ventilated building, this is NOT evidence that the internal environment of the building will be satisfactory, since many factors that are not covered by the compliance assessment procedure will have a bearing on the incidence of overheating (incidental gains, thermal capacity, ventilation provisions, etc.).*

NOTE: Therefore, the developer should work with the design team to specify what constitutes an acceptable indoor environment in the particular case, and carry out the necessary design assessments to develop solutions that meet the agreed brief. Some ways of assessing overheating risk are given in CIBSE TM37 Design for improved solar shading control and, for education buildings, in Building Bulletin 101 ventilation of school buildings.

***2.53** For the purposes of Part L, reasonable provision for limiting solar gain through the building fabric would be demonstrated by showing that, for each space in the building that is either occupied or mechanical cooled, the solar gains through the glazing aggregated over the period from April to September inclusive are no greater than would occur through one of the following reference glazing systems with a defined total solar energy transmittance (g-value) calculated according to BE EN 410:*

a. *For every space that is defined in the NCM database as being side lit, the reference case is an east-facing facade with full-width glazing to a height of 1.0m having a framing factor of 10% and a normal solar energy transmittance (g-value) of 0.68.*
b. *For every space that is defined in the NCM database as being top lit, and whose average zone height is not greater than 6m, the reference case is a horizontal roof of the same total area that is 10% glazed as viewed from the inside out and having rooflights that have a framing factor of 25% and a normal solar energy transmittance (g-value) of 0.68.*
c. *For every space that is defined in the NCM database as being top lit, and whose average zone height is greater than 6m, the reference case is a horizontal roof of the same total area that is 20% glazed as viewed from the inside out and having rooflights that have a framing factor of 15% and a normal solar energy transmittance (g-value) of 0.46.*
d. *For the purpose of this specific guidance, an occupied space means a space that is intended to be occupied by the same person for a substantial part of the day. This excludes circulation spaces, and other areas of transient occupancy, such as toilets, as well as spaces that are intended for occupation (e.g. display windows).*

There is one instance of the solar gain limit being exceeded in 00.055 Dining.

3.4 Criterion 4 – Building performance consistent with the BER

Have the key features of the design been included (or bettered) in practice?

'As Built' compliance report to be submitted on building completion.

Building fabric

3.2 The building fabric should be constructed to a reasonable quality so that:
a. The insulation is reasonably continuous over the whole building envelope; and
b. The air permeability is within reasonable limits.

Is the continuity of insulation acceptable?

3.3 The building fabric should be constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at the joints between elements and at the edges of elements such as those around window and door openings.

Schedule of accredited details to be provide by Contractor.

Has satisfactory documentary evidence of site inspection checks been produced?

Site checklist pro-formas to be provided by the Main Contractor.

Air permeability

Air Permeability	Worst Acceptable Standard	This Building
$m^3/h/m^2$ at 50 Pa	10	3

Has evidence been provided that demonstrates that the design air permeability has been achieved satisfactorily?

Air permeability test certificate to be provided.

Commissioning of the Building Services Systems

3.16 It would be useful to prepare a commissioning plan, identifying the systems that need to be tested and the tests that will be carried out and provide this with the design stage TER/BER calculation so that the BCB can check that the commissioning is being done as the work proceeds.

3.22 The notice should include a declaration confirming that;

a. A commissioning plan has been followed so that every system has been inspected and commissioned in an appropriate sequence and to a reasonable standard; and
b. The results of tests confirm that the performance is reasonably in accordance with the actual building designs, including written commentaries where excursions are proposed to be accepted.

Commissioning report to be issued by the Contractor.

Has evidence been provided that demonstrates that the ductwork is sufficiently airtight?

3.26 Ductwork leakage testing should be carried out in accordance with the procedures set out in B&ES DW/143 and B&ES DW/144 on systems served by fans with a design flow rate greater than 1m^3/s.

Membership of the B&ES specialist ductwork group or the Association of Ductwork Contractors and Allied Services (ADCAS) could be a way of demonstrating suitable qualifications for this testing work.

Ductwork leakage test certificates to be provided by Contractor.

3.5 Criterion 5 – Provisions for energy-efficient operation of the building

4.1 In accordance with regulation 40, the owner of the building should be provided with sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more power than is reasonable in the circumstances.

Building log-book

4.2 A way of showing compliance with regulation 40 would be to produce information following the guidance in CIBSE TM 31 Building Log Book Toolkit. The information should be presented in templates as or similar to those in TM31. The information could draw on or refer to information available as part of other documentation, such as the Operation and Maintenance Manuals and the Health and Safety file required by the CDM Regulations.

4.3 The data used to calculate the TER and the BER should be included in the log-book. The occupier should also be provided with the recommendations report generated in parallel with the 'on-construction' Energy performance Certificate. This will inform the occupier how the energy performance of the building might be further improved.

NOTE: It would also be sensible to retain an electronic copy of the BER/TER input file for the energy calculation to facilitate any future analysis that may be required by the owner when altering or improving the building.

Has a suitable building log-book been prepared?

Building log-book to CIBSE TM31 to be provided by Contractor at fit-out.

4 Appendices

4.1 Thermal Model Input Data

Input Data Sheet

General Details

Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

Site Details

CIBSE Weather File:	Manchester
Orientation (North angle from vertical):	0
Building Type:	D1: Primary or Secondary school (Primary)
Name:	Whitworth High School
Address Line 1	-
Address Line 2	-
Address Line 3	-
Address Line 4	-
City:	-
Postcode:	-
UPRN:	-

Building Owner

Name:	-
Telephone:	-
Street Address:	-
City:	-
Postcode:	-

Building Details

PFC equipment installed?:	Yes
Electric power factor:	>0.95
Lighting systems metered?:	Yes
Warns for out-of-range values?:	Yes
Project Complexity:	Level 5

Simulation Settings

Calculation Method:	Apache
Time Step:	10 minutes
Reporting Interval:	30 minutes
Preconditioning:	20 days

Notes

Cells shaded in light grey have drop down boxes for selections

Cells shaded in light purple are automatically copied or calculated

Cells shaded in Yellow are assumptions made at this stage of the assessment

Input Data Sheet

Fabric Details

Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

Element	Description	Proposed area-weighted u-value (W/m2.K)	Area-weighted average (Table 3, AD L2A (a))
External Walls		0.15	0.35
Internal Walls		0.55	n/a
Ground-Contact Floors		0.12	0.25
Internal Floors		1.98	n/a
Roof		0.12	0.25
Windows		1.10	2.20
Rooflights		1.10	2.20
Pedestrian doors		1.20	2.20

Element	Description	g-value (BS EN 410)	Light transmittance (LT)
General Glazing	North elevation	0.35	0.78
	All other elevations	0.35	0.70
Rooflights		0.25	0.50

Air Permeability	Description	This building (Design Value)	Worst acceptable standard
$m^3/(h.m^2)$ @ 50 Pa		3	10

Notes

Cells shaded in light grey have drop down boxes for selections

Cells shaded in light purple are automatically copied or calculated

Cells shaded in Yellow are assumptions made at this stage of the assessment

Cells shaded in Green are values derived from the Nov 2020 Feasibility Study

Input Data Sheet

DHW Systems

Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

Apache System Title:		DHW 01: ASHP
Associated Room Type:		All
System	**Parameter**	
Domestic Hot Water	DHW Delivery Efficiency	100.0%
	Generator Type	Heat Pump
	Fuel Type	Electricity
	Does the system have storage?	Yes
	Storage Volume (litres)	1500
	Storage Losses (kWh/l day)	0.0013
	Does the system have secondary circulation?	Yes
	Circulation Losses (W/m)	6
	Pump Power (kW)	0.1
	Loop Length (m)	500
	Time Switch?	yes
Solar Water Heating	**Panel**	
	Area (m^2)	
	Azimuth (^{o} clockwise from North)	
	Tilt (^{o} from horizontal)	
	Shading Factor	
	Degradation Factor	
	Conversion Efficiency at Ambient Temperature	
	First Order Heat Loss Coefficient (W/m^2K)	None
	Second Order Heat Loss Coefficient (W/m^2K)	
	Flow Rate ($l/h.m^2$)	
	Pump Power (kW)	
	Heat Exchanger Effectiveness	
	Cylinder	
	Volume (Litres)	
	Storage Loss at max. temperature (kWh/l.day)	

Notes

Cells shaded in light grey have drop down boxes for selections

Cells shaded in light purple are automatically copied or calculated

Cells shaded in Yellow are assumptions made at this stage of the assessment

Input Data Sheet

HVAC System Details

Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

HVAC System Details	HVAC system name	HVAC 00a: SV (SF)	HVAC 00b: EV (EF)	HVAC 01a: EPH NV	HVAC 01b: EPH SVHR (HRU)
	NCM System Type	None	None	Other local room heater - unfanned	Other local room heater - unfanned
Heating	Heat source	-	-	Direct or storage electric heater	Direct or storage electric heater
	Fuel	-	-	Electricity	Electricity
	Does system use CHP?	-	-	No	No
	Heat Gen. SEER	-	-	1	1
Cooling	Pack chiller type	-	-	-	-
	Pack chiller power	-	-	-	-
	SEER	-	-	-	-
	EER	-	-	-	-
	Mixed Mode	-	-	-	-
System Adjustment	Ductwork Leakage Tested	No	No	-	No
	AHU Leakage Tested	-	-	-	-
	SFP (W/l/S)	1	0.5	-	1
	Variable Speed Pumps	-	-	-	-
Metering Provision	Met.	-	-	Yes	Yes
	Alarm for out of range	-	-	Yes	Yes
Ventilation	Cooling/vent. Mechanism	Mechanical ventilation	Mechanical ventilation	Natural ventilation	Mechanical ventilation
	Air Supply Mechanism	Zonal supply	Zonal extract	-	Zonal supply
	Heat Recovery Method	No heat recovery	No heat recovery	-	Plate heat exchanger
	Heat Recovery Efficiency	-	-	-	80%
Zonal Ventilation & Extract (Entered at Zone Level)	Mechanical supply?	Yes	No	No	Yes
	Specific fan power (W/l/s)	1	-	-	1
	Local mechanical exhaust?	No	Yes	No	-
	Specific fan power (W/l/s)	-	0.5	-	-
	Extract flow rate	-	6 l/s/toilet 0.3 achr stores	-	-
	Extract remote from room?	-	Yes	-	-
	Demand controlled ventilation type	-	-	-	-

Notes

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Cells shaded in Yellow are assumptions made at this stage of the assessment

Input Data Sheet

HVAC System Details

Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

HVAC System Details	HVAC system name	HVAC 01c: EPH EV (EF)	HVAC 02a: HRU SVHR (HRU)	HVAC 03a: VRF NV	HVAC 03b: VRF MV
	NCM System Type	Other local room heater - unfanned	Other local room heater - fanned	Split or multi-split system	Split or multi-split system
Heating	Heat source	Direct or storage electric heater	Heat pump (electric): air source	Heat pump (electric): air source	Heat pump (electric): air source
	Fuel	Electricity	Electricity	Electricity	Electricity
	Does system use CHP?	No	No	No	No
	Heat Gen. SEER	1	4.17	4.17	4.17
Cooling	Pack chiller type	-	-	Heat pump (electric)	Heat pump (electric)
	Pack chiller power	-	-	Up to 100kW	Up to 100kW
	SEER	-	-	4	4
	EER	-	-	3.5	3.5
	Mixed Mode	-	-	-	-
System Adjustment	Ductwork Leakage Tested	No	No	-	No
	AHU Leakage Tested	-	-	-	-
	SFP (W/l/S)	0.5	0.73	-	1
	Variable Speed Pumps	-	-	-	-
Metering Provision	Met.	Yes	Yes	Yes	Yes
	Alarm for out of range	Yes	Yes	Yes	Yes
Ventilation	Cooling/vent. Mechanism	Mechanical ventilation	Mechanical ventilation	Natural ventilation	Mechanical ventilation
	Air Supply Mechanism	Zonal extract	Zonal supply	-	Zonal supply
	Heat Recovery Method	No heat recovery	Plate heat exchanger	-	Plate heat exchanger
	Heat Recovery Efficiency	-	83%	-	80%
Zonal Ventilation & Extract (Entered at Zone Level)	Mechanical supply?	No	Yes	No	Yes
	Specific fan power (W/l/s)	-	0.73	-	1
	Local mechanical exhaust?	Yes	-	No	-
	Specific fan power (W/l/s)	0.5	-	-	-
	Extract flow rate	6 l/s/toilet	-	-	-
	Extract remote from room?	Yes	-	-	-
	Demand controlled ventilation type	-	-	-	-

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Input Data Sheet

HVAC System Details

Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

HVAC System Details	HVAC system name	HVAC 04a: ODH NV	HVAC 07a: Kitchen	HVAC 07B: AHUs	DHW 01: ASHP
	NCM System Type	Other local room heater - fanned	Central heating with air distribution	Central heating with air distribution	Central heating using water: radiators
Heating	Heat source	Direct or storage electric heater	Heat pump (electric): air source	Heat pump (electric): air source	Heat pump (electric): air source
	Fuel	Electricity	Electricity	Electricity	Electricity
	Does system use CHP?	No	No	No	No
	Heat Gen. SEER	1	4.17	4.17	4.17
Cooling	Pack chiller type	-	-	-	-
	Pack chiller power	-	-	-	-
	SEER	-	-	-	-
	EER	-	-	-	-
	Mixed Mode	-	-	-	-
System Adjustment	Ductwork Leakage Tested	-	No	No	-
	AHU Leakage Tested	-	-	-	-
	SFP (W/l/S)	-	1.6	1.6	-
	Variable Speed Pumps	-	-	-	-
Metering Provision	Met.	Yes	Yes	Yes	Yes
	Alarm for out of range	Yes	Yes	Yes	Yes
Ventilation	Cooling/vent. Mechanism	Natural ventilation	Mechanical ventilation	Mechanical ventilation	-
	Air Supply Mechanism	-	Central balanced	Central balanced	-
	Heat Recovery Method	-	Plate heat exchanger	Plate heat exchanger	-
	Heat Recovery Efficiency	-	50%	70%	-
Zonal Ventilation & Extract (Entered at Zone Level)	Mechanical supply?	No	Yes	Yes	No
	Specific fan power (W/l/s)	-	1.6	1.6	-
	Local mechanical exhaust?	No	-	-	No
	Specific fan power (W/l/s)	-	-	-	-
	Extract flow rate	-	-	-	-
	Extract remote from room?	-	-	-	-
	Demand controlled ventilation type	-	-	-	-

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Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

System	Parameter	
PVS Generator	PV array type Derive performance parameters from PV array type? PV module efficiency Reference irradiance for NOCT (W/m^2) Nominal cell temp. (NOCT) (^OC) Temp. Coefficient for module efficiency Degradation factor Shading factor Electrical conversion efficiency Area (m^2) Azimuth (^{O} clockwise from North) Inclination (^{O} from horizontal)	Array to achieve: 299.3kWp ~265,000 kWh/year
Wind Generator	Hub height (m) Rated power (kW)	None proposed
CHP Generator	Fuel type Performance at rated output: Heat output (kW) Thermal efficiency power efficiency Performance at minimum output: Fraction of rated heat output Thermal efficiency power efficiency Profile for heat matching strategy	None proposed

Notes

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Input Data Sheet

Lighting Details

Project Name:	Whitworth High School
Project Nr:	2329
Project Engineer:	NBE

Zone Name	Lm/Cw	Photoelectric Control Type (Switching / Dimming)	Photoelectric Sensor Type (Standalone / Addressable)	Back Sensor? (Yes / No)	Parasitic power (W/m^2)	Occ. Sensing	Parasitic power (W/m^2)
Changing	100	-	-	-	-	Auto-on-off (Foc = 0.90)	0.1
Circulation	100	-	-	-	-	Auto-on-off (Foc = 0.90)	0.1
Classroom	100	Dimming	Standalone	No	0.1	Man-on-Auto-off (Foc = 0.82)	0.1
Dining	100	Dimming	Standalone	No	0.1	None (Foc = 1.0)	-
Drama	100	Dimming	Standalone	No	0.1	None (Foc = 1.0)	-
Hall	100	Dimming	Standalone	No	0.1	None (Foc = 1.0)	-
IT	100	Dimming	Standalone	No	0.1	Auto-on-off (Foc = 0.90)	0.1
Kitchen	100	-	-	-	-	None (Foc = 1.0)	-
Meeting	100	Dimming	Standalone	No	0.1	Man-on-Auto-off (Foc = 0.82)	0.1
Offices	100	Dimming	Standalone	No	0.1	Man-on-Auto-off (Foc = 0.82)	0.1
Plant	100	-	-	-	-	None (Foc = 1.0)	-
Reception	100	Dimming	Standalone	No	0.1	None (Foc = 1.0)	-
Science	100	Dimming	Standalone	No	0.1	Man-on-Auto-off (Foc = 0.82)	0.1
Server	100	-	-	-	-	Auto-on-off (Foc = 0.90)	0.1
Store	-	-	-	-	-	Auto-on-off (Foc = 0.90)	0.1
WC	100	-	-	-	-	Auto-on-off (Foc = 0.90)	0.1

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4.2 BRUKL Output Document

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Whitworth High School

As designed

Date: Thu Mar 11 18:16:36 2021

Administrative information

Building Details

Address: Whitworth High School, ,

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: Nathan Evans

Telephone number: 01134931280

Address: Third Floor, Concordia Works, 30 Sovereign Street, Leeds, LS1 4BA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	12.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	12.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	-18
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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	00000000:Surf[3]
Floor	0.25	0.12	0.12	00000000:Surf[0]
Roof	0.25	0.12	0.12	01000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.09	1.6	01000004:Surf[4]
Personnel doors	2.2	2.2	2.2	0000003A:Surf[4]
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- 04a: ODH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	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

2- 03a: VRF NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.17	3.5	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.					

3- 00a: SV (SF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	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

4- 01a: EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	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

5- 00b: EV (EF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	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

6- 01b: EPH MVHR (HRU)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	0	0.8
Standard value	N/A	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

7- 01c: EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	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

8- 02a: HRU MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.17	-	0	0	0.83
Standard value	2.5*	N/A	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 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- 03b: VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.17	3.5	0	0	0.8
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					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- 05b: AHU HALLS

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.17	-	0	1.5	0.7
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					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. ^ 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.					

11- 05a: AHU KITCHEN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.17	-	0.67	1.5	0.5
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					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. ^ 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.					

1- DHW 01: ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4.17	0.001
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

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
00.003 Interview Room	-	-	-	1	-	-	-	-	-	-	N/A
00.010 SENco Office	-	-	-	1	-	-	-	-	-	-	N/A
00.011 Staff WC	-	-	0.5	-	-	-	-	-	-	-	N/A
00.012 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
00.015 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
00.017 Staff Office	-	-	-	1	-	-	-	-	-	-	N/A
00.023 Hygeine Room	-	-	0.5	-	-	-	-	-	-	-	N/A
00.025 MP Room	-	-	-	1	-	-	-	-	-	-	N/A
00.026 MP Room	-	-	-	1	-	-	-	-	-	-	N/A
00.032 Food Tech	-	-	-	0.7	-	-	-	-	-	-	N/A
00.034 Multi Materials Store	-	-	-	0.7	-	-	-	-	-	-	N/A
00.035 RM Workshop	-	-	-	0.7	-	-	-	-	-	-	N/A
00.036 Office	-	-	-	1	-	-	-	-	-	-	N/A
00.038 Graphic Products	-	-	-	0.7	-	-	-	-	-	-	N/A
00.043 Constructional Textiles	-	-	-	0.7	-	-	-	-	-	-	N/A
00.043 Recor Studio	-	-	-	1	-	-	-	-	-	-	N/A
00.044 Ex MP Room	-	-	-	1	-	-	-	-	-	-	N/A
00.046 Music Classroom	-	-	-	0.7	-	-	-	-	-	-	N/A
00.047 Double Classroom	-	-	-	0.7	-	-	-	-	-	-	N/A
00.058 WC Room	-	-	0.5	-	-	-	-	-	-	-	N/A
00.064 Premis. Office	-	-	-	1	-	-	-	-	-	-	N/A
01.001 General Classroom - MFL	-	-	-	0.7	-	-	-	-	-	-	N/A
01.004 General Classroom - MFL	-	-	-	0.7	-	-	-	-	-	-	N/A
01.005 General Classroom - Humanties	-	-	0.7	-	-	-	-	-	-	N/A	
01.006 General Classroom - Humanties	-	-	0.7	-	-	-	-	-	-	N/A	
01.007 General Classroom - Humanties	-	-	0.7	-	-	-	-	-	-	N/A	
01.020 General Classroom - English	-	-	-	0.7	-	-	-	-	-	-	N/A
01.019 General Classroom - English	-	-	-	0.7	-	-	-	-	-	-	N/A
01.018 General Classroom - Maths	-	-	-	0.7	-	-	-	-	-	-	N/A
01.017 General Classroom - Maths	-	-	-	0.7	-	-	-	-	-	-	N/A
01.023 General Classroom - English	-	-	-	0.7	-	-	-	-	-	-	N/A
01.024 General Classroom - English	-	-	-	0.7	-	-	-	-	-	-	N/A
01.025 General Classroom - English	-	-	-	0.7	-	-	-	-	-	-	N/A
01.026 General Classroom - Maths	-	-	-	0.7	-	-	-	-	-	-	N/A
01.027 General Classroom - Maths	-	-	-	0.7	-	-	-	-	-	-	N/A
01.028 General Classroom - Humanities	-	-	0.7	-	-	-	-	-	-	N/A	
01.029 General Classroom - Humanities	-	-	0.7	-	-	-	-	-	-	N/A	
01.029 ICT / Business Studies	-	-	-	0.7	-	-	-	-	-	-	N/A
01.038 Library Resource Centre	-	-	-	0.7	-	-	-	-	-	-	N/A
01.016 General Classroom - Maths	-	-	-	0.7	-	-	-	-	-	-	N/A
01.012 Acc WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.011 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
01.010 WC	-	-	0.5	-	-	-	-	-	-	-	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
01.036 Office	-	-	-	1	-	-	-	-	-	-	N/A
01.040 Office	-	-	-	1	-	-	-	-	-	-	N/A
01.042 SGR	-	-	-	1	-	-	-	-	-	-	N/A
01.043 SGR	-	-	-	1	-	-	-	-	-	-	N/A
01.033 Control Room	-	-	-	1	-	-	-	-	-	-	N/A
02.012 Acc WC	-	-	-	1	-	-	-	-	-	-	N/A
02. 005 Staff WC	-	-	0.5	-	-	-	-	-	-	-	N/A
02. 006 Chem. Store	-	-	0.5	-	-	-	-	-	-	-	N/A
02.011 WC	-	-	-	1	-	-	-	-	-	-	N/A
02.010 WC	-	-	-	1	-	-	-	-	-	-	N/A
02.013 Dark Room	-	-	0.5	-	-	-	-	-	-	-	N/A
02.012 Office	-	-	-	1	-	-	-	-	-	-	N/A
02.015 Central Stock Store	-	-	0.5	-	-	-	-	-	-	-	N/A
02.011 General Science Lab 1	-	-	-	0.7	-	-	-	-	-	-	N/A
02.010 General Science Lab 2	-	-	-	0.7	-	-	-	-	-	-	N/A
02.009 Science Studio	-	-	-	0.7	-	-	-	-	-	-	N/A
02.007 Prep Room	-	-	-	0.7	-	-	-	-	-	-	N/A
02.022 General Science Lab 5	-	-	-	0.7	-	-	-	-	-	-	N/A
02.021 General Science Lab 4	-	-	-	0.7	-	-	-	-	-	-	N/A
02.020 General Science Lab 3	-	-	-	0.7	-	-	-	-	-	-	N/A
02.014 3D Art Room	-	-	-	0.7	-	-	-	-	-	-	N/A
01.031 ICT Work Room	-	-	-	1	-	-	-	-	-	-	N/A
01.030 SGR	-	-	-	1	-	-	-	-	-	-	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	
00.001 Entrance Lobby	-	100	-	30
00.002 Reception	-	100	15	82
00.003 Interview Room	100	-	-	77
00.004/5 Pastoral Office	100	-	-	137
00.C01 Stairwell 1	-	100	-	60
00.006 Office	100	-	-	114
00.008 Conference	100	-	-	152
00.007 Repro	100	-	-	91
00.009 Pastoral	100	-	-	84
00.010 SENco Office	100	-	-	88
00.011 Staff WC	-	100	-	38
00.012 WC	-	100	-	90
00.015 WC	-	100	-	90
00.013 Acc. WC	-	100	-	30
00.014 Cln	100	-	-	6
00.016 Entrance Lobby	-	100	-	32

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00.018 Staff Office	100	-	-	78
00.017 Staff Office	100	-	-	90
00.019 SEN Resource Base	100	-	-	135
00.020 SEN 1	100	-	-	115
00.021 SEN Store	100	-	-	6
00.022 Water Plantroom	100	-	-	124
00.023 Hygeine Room	-	100	-	28
00.024 SEN Store	100	-	-	5
00.025 MP Room	100	-	-	88
00.026 MP Room	100	-	-	99
00.027 Main Store	100	-	-	12
00.028 Inclusion Room	100	-	-	173
00.029 Staff Work Room	100	-	-	134
00.030 Music Store	100	-	-	9
00.031 Music Store	100	-	-	9
00.032 Food Tech	100	-	-	469
00.033 Food Store	100	-	-	15
00.034 Multi Materials Store	100	-	-	30
00.035 RM Workshop	100	-	-	835
00.036 Office	100	-	-	81
00.037 Large Group Room	100	-	-	143
00.038 Graphic Products	100	-	-	381
00.039 Store	100	-	-	9
00.040 Store	100	-	-	11
00.041 Store	100	-	-	11
00.042 Store	100	-	-	9
00.043 Constructional Textiles	100	-	-	380
00.043 Recor Studio	100	-	-	69
00.044 Ex MP Room	100	-	-	138
00.046 Music Classroom	100	-	-	291
00.047 Double Classroom	100	-	-	484
00.C02 Stairwell 2	-	100	-	66
00.048 Drama	100	-	-	515
00.049 Drama Store	100	-	-	13
00.050 Chair/Table Store	100	-	-	20
00.051 Main Hall	-	100	-	1071
00.054 Lobby	-	100	-	15
00.056 Kitchen	-	100	-	728
00.061 LV Switch Plantroom	100	-	-	62
00.060 Exam Store	100	-	-	11
00.059 Exam Store	100	-	-	11
00.057 WC	-	100	-	23
00.058 WC Room	-	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	
00.062 Head's Office	100	-	-	132
00.063 PA to Head	100	-	-	93
00.064 Premis. Office	100	-	-	103
00.065 General Office	100	-	-	211
00.066 Acc WC	-	100	-	32
00.067 Corridor	-	100	-	171
00.076 Corridor	-	100	-	132
00.069 Corridor	-	100	-	235
01.001 General Classroom - MFL	100	-	-	250
01.C01 Stairwell	-	100	-	59
01.002 Store	100	-	-	7
01.003 Staff Work Room	100	-	-	150
01.004 General Classroom - MFL	100	-	-	252
01.005 General Classroom - Humanties	100	-	-	252
01.006 General Classroom - Humanties	100	-	-	252
01.007 General Classroom - Humanties	100	-	-	252
01.020 General Classroom - English	100	-	-	265
01.019 General Classroom - English	100	-	-	264
01.018 General Classroom - Maths	100	-	-	264
01.017 General Classroom - Maths	100	-	-	264
01.023 General Classroom - English	100	-	-	261
01.024 General Classroom - English	100	-	-	260
01.025 General Classroom - English	100	-	-	260
01.026 General Classroom - Maths	100	-	-	260
01.027 General Classroom - Maths	100	-	-	260
01.028 General Classroom - Humanities	100	-	-	260
01.029 General Classroom - Humanities	100	-	-	263
01.029 ICT / Business Studies	100	-	-	298
01.038 Library Resource Centre	100	-	-	609
00.C03 Stairs	-	100	-	62
01.C03 Stairs	-	100	-	61
01.021 Store	100	-	-	9
01.022 Staff Work Room	100	-	-	143
01.016 General Classroom - Maths	100	-	-	264
01.050 Corrdior	-	100	-	147
01.015 Staff Work Room	100	-	-	148
01.014 Store	100	-	-	8
01.013 Cln	100	-	-	7
01.012 Acc WC	-	100	-	30
01.011 WC	-	100	-	92
01.010 WC	-	100	-	93
01.C02 Stairwell 2	-	100	-	65
01.035 Store	100	-	-	8

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01.036 Office	100	-	-	76
01.040 Office	100	-	-	76
01.041 Store	100	-	-	9
01.042 SGR	100	-	-	93
01.043 SGR	100	-	-	93
01.044 Corridor	-	100	-	114
01.009 Staff Social	100	-	-	201
00.055 Dining	-	100	-	452
01.046 Corridor	-	100	-	58
01.033 Control Room	100	-	-	80
02.C03 Stairs	-	100	-	60
02.012 Acc WC	-	100	-	27
02.050 Corrdior	-	100	-	27
02.008 Cln	100	-	-	5
02. 005 Staff WC	-	100	-	35
02. 006 Chem. Store	100	-	-	11
02.011 WC	-	100	-	87
02.010 WC	-	100	-	88
02.013 Dark Room	100	-	-	11
02.012 Office	100	-	-	89
02.017 Specialist Store	100	-	-	8
02.015 Central Stock Store	100	-	-	10
02.016 Specialist Store	100	-	-	9
02.050 Corrdior	-	100	-	127
02.018 Staff Work Room	100	-	-	143
02.019 Store	100	-	-	8
02.C02 Stairwell 2	-	100	-	68
01.047 Corridor	-	100	-	69
01.047 Corridor	-	100	-	140
02.001 Staff Work Room	100	-	-	130
02.023 Corridor	-	100	-	105
02.011 General Science Lab 1	100	-	-	1069
02.010 General Science Lab 2	100	-	-	1073
02.009 Science Studio	100	-	-	894
02.007 Prep Room	100	-	-	361
02.022 General Science Lab 5	100	-	-	1062
02.021 General Science Lab 4	100	-	-	1050
02.020 General Science Lab 3	100	-	-	1052
02.014 3D Art Room	100	-	-	429
01.031 ICT Work Room	100	-	-	100
01.032 Server Room	100	-	-	39
01.030 SGR	100	-	-	125

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?
00.002 Reception	NO (-58.8%)	YES
00.003 Interview Room	N/A	N/A
00.004/5 Pastoral Office	NO (-73.5%)	YES
00.006 Office	NO (-66.1%)	YES
00.008 Conference	NO (-50.9%)	YES
00.007 Repro	N/A	N/A
00.009 Pastoral	NO (-52%)	YES
00.010 SENco Office	N/A	N/A
00.016 Entrance Lobby	NO (-53.9%)	YES
00.018 Staff Office	NO (-82.4%)	YES
00.017 Staff Office	N/A	N/A
00.019 SEN Resource Base	NO (-82.1%)	YES
00.020 SEN 1	NO (-84.5%)	YES
00.025 MP Room	N/A	N/A
00.026 MP Room	N/A	N/A
00.028 Inclusion Room	NO (-77.9%)	YES
00.029 Staff Work Room	NO (-60.4%)	YES
00.032 Food Tech	NO (-62.5%)	YES
00.035 RM Workshop	NO (-70.2%)	YES
00.036 Office	N/A	N/A
00.037 Large Group Room	NO (-69.2%)	YES
00.038 Graphic Products	NO (-62.1%)	YES
00.043 Constructional Textiles	NO (-61.9%)	YES
00.043 Recor Studio	NO (-54.8%)	YES
00.044 Ex MP Room	N/A	N/A
00.046 Music Classroom	NO (-67.7%)	YES
00.047 Double Classroom	NO (-63.8%)	YES
00.048 Drama	NO (-45.3%)	YES
00.051 Main Hall	NO (-64.5%)	YES
00.062 Head's Office	NO (-60.3%)	YES
00.063 PA to Head	NO (-72.5%)	YES
00.064 Premis. Office	N/A	N/A
00.065 General Office	NO (-78.4%)	YES
01.001 General Classroom - MFL	NO (-77%)	YES
01.003 Staff Work Room	NO (-65.7%)	YES
01.004 General Classroom - MFL	NO (-38.7%)	YES
01.005 General Classroom - Humanties	NO (-53.2%)	YES
01.006 General Classroom - Humanties	NO (-54.4%)	YES
01.007 General Classroom - Humanties	NO (-46%)	YES
01.020 General Classroom - English	NO (-78.5%)	YES
01.019 General Classroom - English	NO (-52.7%)	YES
01.018 General Classroom - Maths	NO (-52.8%)	YES
01.017 General Classroom - Maths	NO (-53.2%)	YES
01.023 General Classroom - English	NO (-63.9%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01.024 General Classroom - English	NO (-63.9%)	YES
01.025 General Classroom - English	NO (-63.7%)	YES
01.026 General Classroom - Maths	NO (-63.6%)	YES
01.027 General Classroom - Maths	NO (-63.6%)	YES
01.028 General Classroom - Humanities	NO (-63.7%)	YES
01.029 General Classroom - Humanities	NO (-69.1%)	YES
01.029 ICT / Business Studies	NO (-65.7%)	YES
01.038 Library Resource Centre	NO (-25.7%)	YES
01.022 Staff Work Room	NO (-73%)	YES
01.016 General Classroom - Maths	NO (-54.7%)	YES
01.015 Staff Work Room	NO (-57.5%)	YES
01.036 Office	N/A	N/A
01.040 Office	N/A	N/A
01.042 SGR	N/A	N/A
01.043 SGR	N/A	N/A
01.009 Staff Social	NO (-58.4%)	YES
00.055 Dining	YES (+24%)	YES
01.033 Control Room	N/A	N/A
02.012 Office	N/A	N/A
02.018 Staff Work Room	NO (-65.4%)	YES
02.001 Staff Work Room	NO (-90.6%)	YES
02.011 General Science Lab 1	NO (-73.6%)	YES
02.010 General Science Lab 2	NO (-53.7%)	YES
02.009 Science Studio	NO (-62.3%)	YES
02.007 Prep Room	NO (-77%)	YES
02.022 General Science Lab 5	NO (-63.6%)	YES
02.021 General Science Lab 4	NO (-64.5%)	YES
02.020 General Science Lab 3	NO (-64.5%)	YES
02.014 3D Art Room	NO (-70%)	YES
01.031 ICT Work Room	N/A	N/A
01.032 Server Room	NO (-99.9%)	NO
01.030 SGR	N/A	N/A

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

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 [m²]	5077.5	5077.5
External area [m²]	7449.5	7449.5
Weather	MAN	MAN
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	1787.41	2839.19
Average U-value [W/m²K]	0.24	0.38
Alpha value* [%]	9.77	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
	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
100	**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
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.39	4.28
Cooling	0.8	0.58
Auxiliary	2.9	3.01
Lighting	8.07	14.48
Hot water	3.08	3.91
Equipment*	22.6	22.6
TOTAL**	**17.24**	**26.26**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	51.43	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	27.7	34.42
Primary energy* [kWh/m²]	51.6	74.58
Total emissions [kg/m²]	-18	12.9

* 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 - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	19.8	0	5.5	0	0	1	0	1	0
	Notional	40.9	0	13.2	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	18.5	0	5.1	0	2.6	1	0	1	0
	Notional	17.3	0	5.6	0	2.3	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	42.3	0	11.7	0	17.8	1	0	1	0
	Notional	47	0	15.2	0	20.3	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	36.8	56.6	2.6	5.5	2	3.89	2.84	4.17	4
	Notional	47	54.5	5.1	4	1.7	2.56	3.79	----	----
[ST] Other local room heater - fanned, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	10.2	0	0.9	0	3	3.34	0	4.17	0
	Notional	14.6	0	1.6	0	3.5	2.56	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	80.8	88.9	5.8	8.7	0	3.89	2.84	4.17	4
	Notional	96.5	86.6	10.5	6.4	0	2.56	3.79	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	49.8	0	13.8	0	0.3	1	0	1	0
	Notional	56.3	0	18.1	0	0	0.86	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	1.2	0	0.1	0	10.3	3.73	0	4.17	0
	Notional	0.7	0	0.1	0	7.3	2.56	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	135.2	0	37.6	0	2.5	1	0	1	0
	Notional	67.1	0	21.6	0	1.3	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	86.4	0	24	0	14.3	1	0	1	0
	Notional	78.7	0	25.4	0	16.4	0.86	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	31.9	0	2.4	0	5.1	3.73	0	4.17	0
	Notional	45.3	0	4.9	0	4.4	2.56	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 (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	00000000:Surf[3]
Floor	0.2	0.12	00000000:Surf[0]
Roof	0.15	0.12	00000032:Surf[2]
Windows, roof windows, and rooflights	1.5	0.8	00000032:Surf[1]
Personnel doors	1.5	2.2	0000003A:Surf[4]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

4.3 Energy Performance Certificate

Energy Performance Certificate

Non-Domestic Building

HM Government

Whitworth High School
Address 3
Address 4

Certificate Reference Number:
4501-0703-2076-8615-0419

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

-40 **This is how energy efficient the building is.**

Net zero CO_2 emissions

A 0-25
B 26-50
C 51-75
D 76-100
E 101-125
F 126-150
G Over 150

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Heating and Mechanical Ventilation
Total useful floor area (m^2):	5077.509
Building complexity:	Level 5
Building emission rate ($kgCO_2/m^2$ per year):	-17.97
Primary energy use (kWh/m^2 per year):	51.6

Benchmarks

Buildings similar to this one could have ratings as follows:

29 If newly built

77 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.13 using calculation engine ApacheSim v7.0.13
Property Reference:	UPRN-000000000000
Assessor Name:	Nathan Evans
Assessor Number:	LCEA138924
Accreditation Scheme:	CIBSE Certification Limited
Assessor Qualifications:	NOS5
Employer/Trading Name:	Trading Name
Employer/Trading Address:	Trading Address
Issue Date:	11 Mar 2021
Valid Until:	10 Mar 2031 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 3884-7138-1448-4619-2413

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

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Engineering a better environment

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