ENERGY ASSESSMENT REPORT
Stage 3

Barnes School

London Borough of Richmond upon Thames

DICEMBER 2020

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INTERNAL APPROVALS

This document prepared, reviewed and approved by:

Version	Date	Prepared By	Reviewed By	Approved By
P1	30/11/2020	Claudia Cioli	Rolfe Jackson	Rolfe Jackson
Signature for and on behalf of McBains Ltd		Claudia Cioli		

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Suitability	Revision	Version Date	Summary of Changes	Changes Marked
S4	P1	30/11/2020	Issued for Planning	
S4	P2	04/12/2020	'Be Clean' paragraph added	

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Contents

1.0 EXECUTIVE SUMMARY

This Energy Statement report has been prepared by McBains Ltd for the new Specialist Resource Provision (SRP) for Barnes Primary School. This document has been prepared as part of a series of documents to support the application, in conjunction with which it should be read, and addresses requirements related to energy use and carbon dioxide emissions reduction in accordance with local and national policy.

It responds to the relevant policies contained within the Greater London Authority (GLA) London Plan (2015) and policies of the approved London Borough of Richmond upon Thames Local Plan (2018). Reference has also been made to the new draft London Plan, due to be published next year.

Richmond's policy does state that all non-residential buildings over 100sqm should achieve a 35% reduction and to meet BREEAM 'Excellent' standards.

The energy strategy demonstrates that the new educational buildings has been designed as sustainable as possible, with the aim to reduce its carbon footprint and energy use. The proposed building is expected to achieve a **32.3%** reduction in regulated CO2 emissions beyond the requirements of the Building Regulations Part L (2013) so it does not fully meet the requirements.

This report demonstrates that all the possible measures have been incorporated in the design to improve energy conservation and efficiency as well as contributions to renewable energy generation. Substantial site constraints have affected the BREEAM score and the predicted carbon savings:

- Insulation: mineral wool material needs to be specified for acoustic reasons. The higher thermal conductivity of this insulation material compared with other on the market would lead to a lower thermal performance of the building fabric;
- Photovoltaics: there is no available space on the roof for the installation of a PV array due to the number of rooflights which have been incorporated to provide optimum daylight levels to the spaces below;
- Green roof not suitable because of the pitched roof;
- Cost: triple glazed windows have not been allowed for because of the cost constraints of the project;
- Small-scale project: the development should be treated more like a 'residential' building. For this reason some features and studies usually associated to non-domestic have not been provided because not necessary, e.g. EV charging points, improvement with transport links; reduction of existing noise levels, air quality impact assessment, plan to remediate contamination, drainage measures;
- Rainwater harvesting or grey water systems are not suitable for this building, given the low water demand associated to it.

The Council's Sustainable Construction Checklist SPD has been provided to confirm all the sustainable measures that have been considered in the BREEAM Assessment. For the reasons listed above the checklist does not achieve the minimum score.

This document sets out how the expected energy demands of the proposed development have been analysed and forms the site-wide energy strategy in accordance with the London Plan's Energy Hierarchy:

Be Lean: Passive design is to play a key role in minimising the energy requirements of the building. Passive measures have been incorporated in the design to reduce the energy demand, e.g. overhangs, fabric U-values, air-tightness and reduced thermal bridges.

Be Clean: The new proposed design solution does not include a connection to a District Heating Network nor the installation of an on-site CHP system, given that the carbon savings from gas engine CHP are now declining as a result of national grid electricity decarbonising.

Be Green: To further reduce the carbon dioxide emissions of the proposed development, an assessment of potential low and zero carbon technologies has been undertaken. The new proposal would be to use an ASHP providing heating. No space has been currently allowed on the roof to install a PV array.

The proposed energy efficiency measures to deliver the above performance are summarised below:

- Construction of good insulated fabric and low air tightness
- Installing high-performance heat pump system to provide heating to the building
- Mechanical Ventilation with Heat recovery
- Provision of lamps/luminaires with high efficacy and efficient lighting controls
- Provision of efficient air source heat pumps (ASHP) systems.

Table 1: CO_2 emissions after each stage of the Energy Hierarchy

Carbon dioxide emissions from proposed measures (tonnes CO_2/annum)	Regulated	Unregulated
Baseline: Part L 2013 compliance	2.6	3.2
After Be Lean measures	2.1	3.2
After Be Clean measures	2.1	3.2
After Be Green measures	1.7	3.2

Table 2: Combined Regulated CO2 savings from each stage of the Energy Hierarchy

Regulated carbon dioxide emissions savings from proposed measures	(tnCO2/annum)	(%)
Savings from Be Lean measures	0.5	19.5%
Savings from Be Clean measures	-	0.0%
Savings from Be Green measures	0.3	12.8%
Cumulative on-site savings	0.8	32.3%

2.0 INTRODUCTION

2.1 The Site

The building subject to this analysis is in Richmond, close to the Barnes Bridge station. The existing site has a frontage onto Cross Street, and backs onto Barnes Primary School.

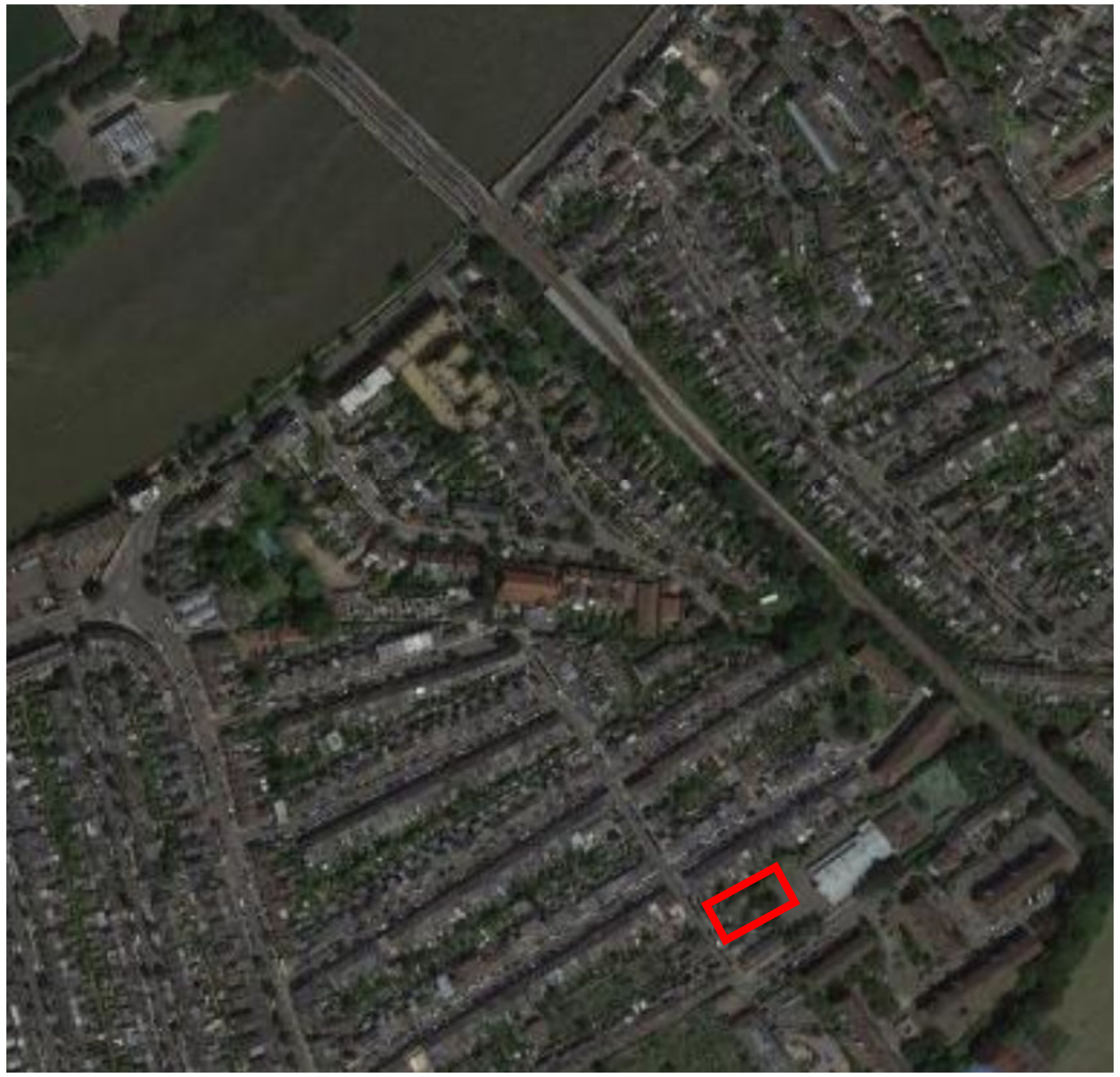


Figure 1: Google map view of the site

2.2 The Proposed Scheme

The new school building will provide a headquarters building for the for Special Resource Provision Unit will include:

- Two classrooms at first floor
- Therapy room and Group room
- Sensory room and Quiet room
- One office at ground floor
- WC and shower facilities

Figure 2 shows the proposed floor plans layout.

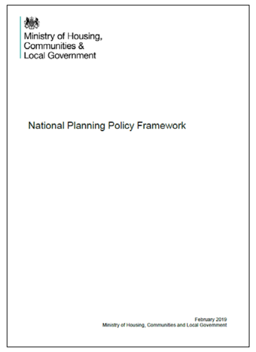
Figure 2: Ground and First floor plans

3.0 PLANNING POLICY

In order to address the issue of climate change, policy, guidance and regulations have been developed at national, regional and local level, in relation to which the development proposals have been considered. The most relevant to this scheme, in terms of energy and sustainability, are summarised below:

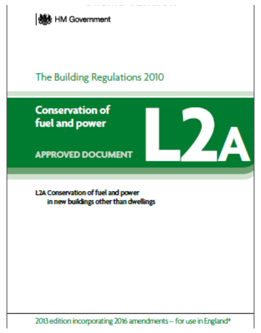
National level

National Planning Policy Framework



The National Planning Policy Framework (NPPF) was first introduced in 2012, superseding all Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) documents, with the exception of PPS10 (Waste). The NPPF sets out the Government's strategy on the delivery of sustainable development through the planning system in a more simplified approach. In July 2018 the Government published a revised version restating the committed to halve the energy usage of new buildings by 2030.

Building Regulations Part L



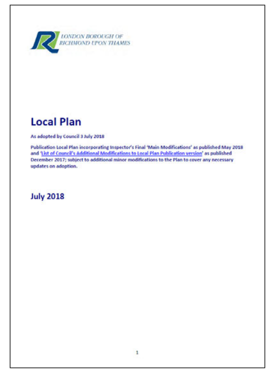
The Approved Document Part L sets minimum requirements in terms of a building's energy performance (and associated CO_2 emissions) in residential dwellings (Part L1A) and non-domestic buildings (Part L2A). This document highlights the different criteria for demonstrating building regulation compliance, both at design stage and after the building is built.

Criterion One of the Building Regulations Part L (2013) requires that a property to achieve a Building Emission Rate (BER) equal to or lower than the Target Emission Rate (TER) calculated in accordance with the approved National Calculation Methodology (NCM).

Criterion Two places limits on the minimum standards for controlled fittings and services.

Criterion Three requires that spaces are not subject to excessive solar gains in the case of non-dwellings.

Local level



The following extracts summarises the relevant London Borough of Richmond upon Thames Local Plan requirements (at time of writing) in terms of carbon reduction:

Policy LP 22 - Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.

(…)

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

(…)

2. All other new residential buildings should achieve a 35% reduction.

Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.

C. This should be achieved by following the Energy Hierarchy:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

4.0 METHODOLOGY

4.1 The Accredited Software

In order to develop the Simplified Building Energy Model (SBEM) for the non-domestic elements of the development, for this calculation Tas v9.5 has been used. This is a Dynamic Simulation Modeller which gives a highly accurate representation of the building energy use, calculating the building demand, consumption and CO_2 emissions for every hour of the year. This version of the software has been accredited by the CLG for Part L2A and the production of EPC certificates for all levels of buildings.

4.2 The Approach

This strategy outlines how the Development will have a reduced impact on climate change by reducing CO2 emissions associated with energy use in buildings.
The Energy and CO2 appraisal is based on the following approach, in line with the GLA policy:

Be Lean	Reduce the building's energy requirements by incorporating passive design measures and reduce the building's energy consumption through the use of energy efficient mechanical and electrical engineering systems.
Be Clean	Reduce the building's carbon dioxide emissions by supplying energy more efficiently, i.e. by CHP or district heating network.
Be Green	Reduce the building's carbon dioxide emissions through the use of renewable technologies.

Following preliminary calculations it is expected that overall regulated carbon dioxide emissions will be reduced by at least 32.3% across the development compared to Part L 2013 through the Lean, Clean and Green measures.

The appraisals within this strategy are based on the Building Regulations Part L 2013 calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise.

5.0 THE BASELINE

The energy strategy for the new school building aims to minimise CO_2 emissions associated with the fabric and operation of the building.

The Building Emission Rate (BER) of the development and the Target Emission Rates (TER) of the corresponding notional buildings were calculated using SBEM in accordance with Building Regulations Part L 2013 to estimate the associated energy demand and regulated carbon dioxide emissions.
To assess the performance of the proposed building, the following parameters summarised in Table 3 were applied to the SBEM model.

Table 3: Fabric Energy Performance

Fabric Element	Unit	Barnes School	Notional building (Part L2A 2013)	Limiting Values (Part L2A 2013)
Front and Rear Walls - U value	W/m^2K	0.25	0.26	0.35
Side External Walls - U value	W/m^2K	0.22	0.26	0.35
Ground Floor - U value	W/m^2K	0.18	0.22	0.25
Roof - U value	W/m^2K	0.13	0.18	0.25
Windows, Curtain wall				
U value (pane)	W/m^2K	1.1	n/a	2.2
g value	-	0.4	0.4	-
U-value (frame)		2.0	n/a	-
Frame factor	%	10	10	
Rooflights				
U value	W/m^2K	1.7	1.8	2.2
g value	-	0.55	0.55	-
U value (frame)	W/m^2K	2.3	-	-
Air tightness	$m^3/hr/m^2$	3	5	10
Thermal bridging (Y-value)		Accredited Construction Details		

Table 4: Building Services Specification

Building Services	Unit	Description
Heating		
Main heating system	-	Air Source Heat Pump
Efficiency (SCOP)	-	3.41
Distribution Losses (assumed)	%	5
HVAC type		Underfloor heating
Domestic Hot Water		
DHW	-	Electric point of use (Classroom sinks from ASHP)
Hot Water Cylinder	L	Not present
Distribution losses	%	0 (direct electric)
Ventilation		
Heat Recovery Efficiency	%	80
HR Type	-	Thermal wheel (Toilets Extract only)
Supply SFP		0.6
Extract SFP	W/l/s	0.5
Demand control	-	Based on gas sensors
Air flow regulation		Damper control
Cooling		
Efficiency (SEER)	-	No cooling
Lighting		
Electricity Power Factor	-	>0.95
Efficacy	lm/circW	
Classrooms/Office/Circulation		100
Toilets/Store/Plant R		90
Presence Detection:	-	
Classrooms/Office/ Circulation		Manual ON/Dimmed Manual ON/Auto OFF
WC/Showers		Auto ON/ Auto OFF
Store		No occupancy control
Daylight control:		
Classrooms/ Office	-	Photocell control - Dimming
Design room illuminance	Lux	Offices - 400 lux Classrooms - 300 lux Circulation - 100 lux WC/Shower - 200 lux Store - 50 lux Therapy, Sensory and Soft room -300 lux

6.0 IMPROVEMENT FROM REDUCING ENERGY DEMAND

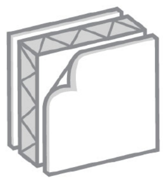
The proposed building will be designed using a 'fabric first' approach, maximising the performance of the components that make up the building fabric itself before considering the use of mechanical or electrical building services systems. Focusing on the building fabric is more sustainable than relying only on efficient mechanical systems or renewable technologies.

Passive design plays a key role in minimising the operational costs and carbon emissions of a development and it needs to be evaluated since the very early design stage of the project. This paragraph analyses the key design aspects to reduce the energy demand and carbon emissions associated to the building.

It is estimated that a regulated carbon dioxide emissions reduction of 19% over Part L 2013 across the development as a whole through 'lean' measures alone can be achieved.

The following passive design strategies have been implemented within the development. The project is targeting BREEAM credit Ene 04 which asks for a 5% reduction in total heating, cooling, mechanical ventilation and lighting loads and energy consumption due to the implementation of passive design solutions.

6.1 Building Fabric Improvements and Overheating



Proposed U-values for all envelope elements are listed in Table 3.

External wall U-values of 0.22 – 0.25 W/m^2K have been selected for the new building. Furthermore, windows with a U-value of 1.1 W/m2K are proposed. This will help to minimise excessive heat loss in winter and solar gain in the summer, reducing the associated heating load in winter and the risk of overheating in summer.

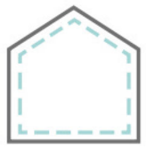
6.2 Solar shading

Shading devices help cutting the direct sun and achieve diffused daylight for visual comfort of the occupant and they play a crucial role in decreasing the energy consumptions.

The projecting roof canopy to the main entrance and to the rear work as an external shading to provide visual appeal as well as reducing solar gains to the internal spaces.

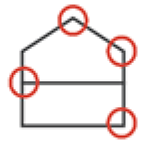
Additional internal blinds can be included to further reduce the risk of overheating in summer.

6.3 Air Tightness Improvements



An improvement upon the minimum requirements of the Part L 2013 will be targeted with $3m^3/m^2hour$ at 50 Pa pressure. The Contractor will incorporate suitable construction details into the design and adopt best practice construction practices in order to achieve these figures.

6.4 Thermal Bridging



Thermal bridging will be carefully considered to improve upon the minimum default y value of 0.15. Thermal bridges at all window junctions (sills, jambs and lintels) will be designed with Accredited Construction Details to ensure that heat transferred through to the building is reduced. Particular attention will also be paid to the balconies, which are one of the highest risk areas to cause thermal bridging due to construction method and detailing.

6.5 Luminaires and Controls

Low energy lighting has become an essential feature of building design. Advances in lamp and ballast design have led to higher efficiency luminaires with control measures having become standard in most new developments in order to respond to changes to standards such as Part L of the Building Regulations and sustainability assessment methods such as BREEAM.

Lighting controls can consist of simple presence detection which when combined with daylight control can switch luminaires on/off automatically or regulate the lighting levels in accordance with the outside conditions. These systems are proposed for use in conjunction with each other for the most energy efficient installation. Daylight control is intended for use to control external lighting.

6.6 Ventilation

Due to the high performance of the building fabric and the location of the development, relying solely on natural ventilation is not considered an appropriate strategy and a balanced mechanical ventilation strategy with mechanical extract is proposed. This will ensure minimum fresh air requirements, moisture and odour removal from the kitchen and toilet areas and allow for a boost / purge facility to increase the volume of air flow controlled. In order to optimise the energy performance of the system, each unit will incorporate heat recovery.

7.0 IMPROVEMENT FROM SUPPLYING ENERGY EFFICIENTLY ('Be Clean')

7.1 District Heating Network

Once demand for energy has been minimised, all planning applications must demonstrate how their energy systems will exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly to reduce CO_2 emissions, by following the heating hierarchy in London Plan Policy SI 3. Heat networks offer an efficient and competitive solution for heating buildings in urban areas with high heat density and provide the added benefit of enabling the use of secondary energy or waste heat sources.

As can be seen from the extract below of the London Heat Map, the proposed development is inside a Heat Network Priority Area (HNPA); however is not located in close proximity to any planned or existing networks, so the connection to an existing heat network is not viable.

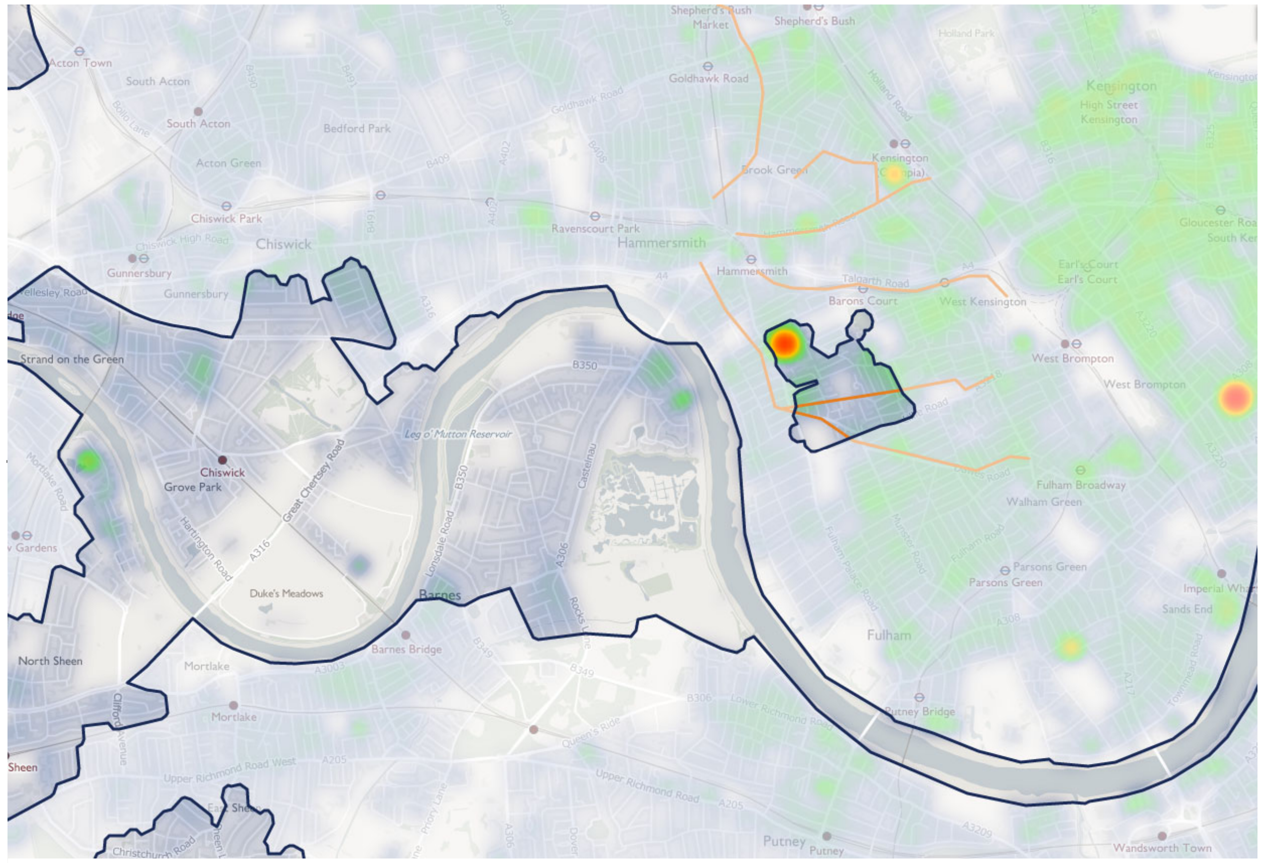


Figure 3: London Heat Map showing Heat Network Priority Area, heat density and District Heating Networks (red lines)

7.2 Combined Heat and Power (CHP)

In the Decarbonised gas scenario, the London Plan limits the role of CHP to low-emission CHP and only in instances where it can support the delivery of an area-wide heat network at large, strategic sites.

This develoment contains a small educational unit (with a total area <500m²). For these unit types the installation of a communal system is encouraged, but not mandated due to the small benefit in terms of carbon reduction in these circumstances.

The installation of a stand-alone air source heat pump is considered more economic and suitable to meet the small heating demands of the new proposed building.

For this reason the inclusion of a CHP plant has not been developed as such no benefit in terms of carbon dioxide reduction are offered in this part of the Energy Hierarchy.

8.0 IMPROVEMENT FROM INTRODUCING RENEWABLE ENERGY TECHNOLOGIES ('BE GREEN')

Be Green measures are those which serve to reduce the overall emissions of the development through the inclusion of renewable technologies.

A renewable and low carbon technology feasibility study has been carried out to investigate the most suitable solutions and the contribution that on-site generation from renewable energy technologies could make to further reduce the carbon dioxide emissions in the proposed development. Table 5 shows the list of renewable and low carbon technologies have been assessed in terms of their technical feasibility and potential CO_2 emissions savings.

To reflect the rapid decarbonisation of the grid, the heat pump system has been considered the most carbon efficient and cost effective solution. It is estimated that the contibution of this renewable technology could reduce CO2 emissions by almost 13% beyond the Building Regulations Part L (2013) 'Baseline', i.e. 0.5 tonnes per annum.

9.0 OVERHEATING

A number of strategies have been employed in order to reduce the internal heat generation and prevent the risk of overheating in summer:

- External solar shading have been incorporated in the design of the façade to minimise solar heat gains in summer months
- Provision of double glazed windows with solar control (i.e. low g-value of 0.4) and high light transmittance in line with facade orientation and solar exposure
- Internal heat gains minimised by specifying energy efficient lighting with low heat output throughout, such as LED
- Equipment will be selected in accordance with the Energy Rating where possible

In addition to the passive measures listed above, the building will incorporate highly efficient mechanical ventilation to all areas.

Table 5: Renewable technologies

Renewable Technology	Feasibility	Notes
Ground source heat pump	Not feasible	Air Source Heat Pumps (ASHP) and Ground Source Heat Pumps (GSHP) work to extract heat from the air or the ground. Generally, GSHPs are more efficient as the ground temperature is more stable over the course of the year relative to air temperature. All ground source heat pump systems require a significant site area to install an efficient or adequately sized system which is not considered to be available within the boundary of this development therefore a ground source heat pump system is not proposed for inclusion within the energy strategy.
Air source heat pump	Feasible	Air source heat pumps (ASHPs) are proposed as fit-out equipment of the new educational building. In heating mode, the external air is the heat source and ASHPs are considered a renewable technology.
Photovoltaics	Not feasible	PVs are one of the most suitable LZC carbon technologies for the development. Due to the very limited space on the pitched roof a photovoltaic panels array has not been allowed for in the energy strategy.
Solar Hot Water systems	Not feasible	Due to the educational use of the new development, a very high hot water demand is not predicted, so the installation of solar thermal panels has not been considered the most suitable solution for this building.
Biomass heating	Not feasible	Given the frequent supply and delivery of biodiesel required on site and the lack of a large storage tank space, a communal biomass boiler would be unsuitable for the new development.
Wind turbines	Not feasible	Wind turbines have a significant visual impact. Additionally, they can create noise and vibration problems. Considering also the maintenance costs and the reliance on wind speed throughout the year, wind turbines are therefore not proposed for the development.

10.0 CONCLUSIONS

This Energy Strategy has demonstrated that through the implementation of passive design measures and the installation of high efficient and low carbon technologies, the new building is estimated to achieve 32.3% reduction in regulated CO_2 emissions compared with the Building Regulations Part L 2013 Baseline.

The expected contributions from each step of the hierarchy of the whole development are shown graphically below. For the BRUKL results please refer to Appendix A.

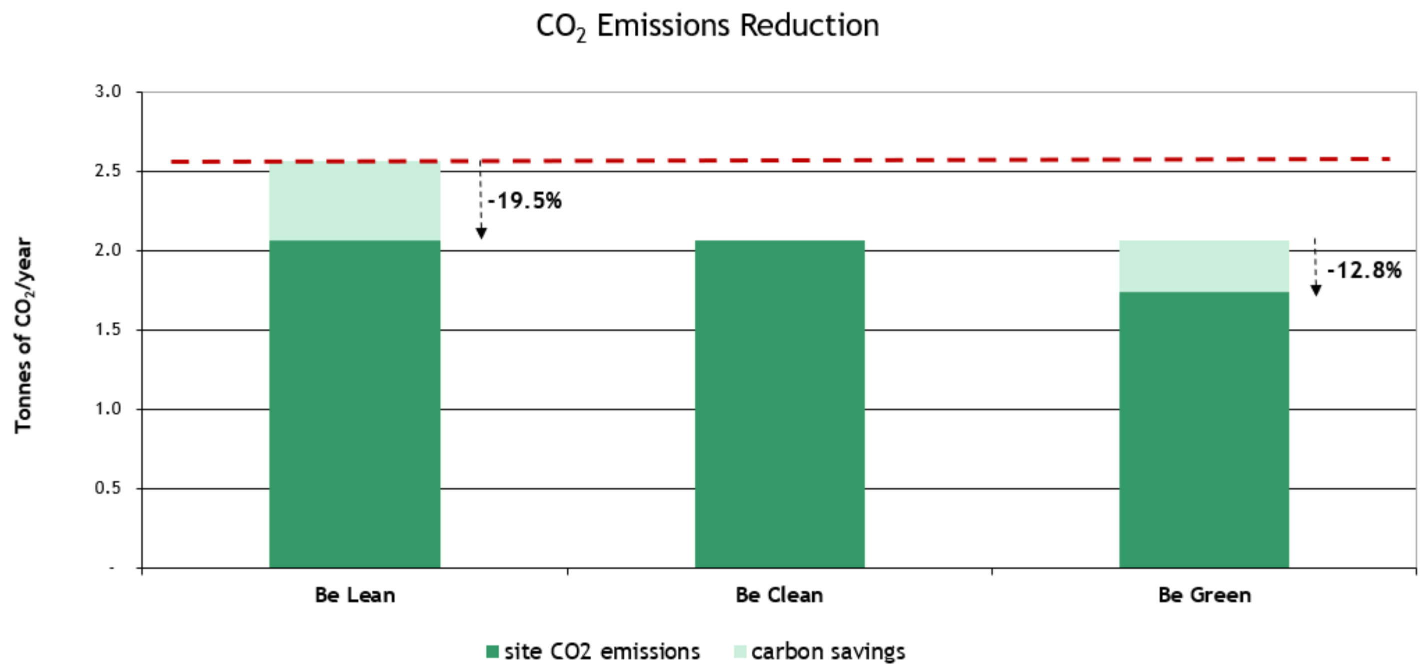


Figure 4: Carbon emissions at each step of the Energy hierarchy

APPENDIX A – BRUKL (Be Lean output)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Barnes Primary School

As designed

Date: Thu Nov 26 12:58:10 2020

Administrative information

Building Details

Address: 32 Cross Street, Barnes, London, SW13 0QQ

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Barnes School

Telephone number:

Address: , ,

Certifier details

Name: Claudia Cioli

Telephone number: 020 7786 7900

Address: 26 Finsbury Square, London, EC2A 1DS

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	13.3
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	13.3
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	10.9
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.23	0.25	External Wall i front rear
Floor	0.25	0.18	0.18	Ground Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.31	2.03	frame CW
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

* 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
m³/(h.m²) at 50 Pa	10	3

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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	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- toilets (2 Zones)

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

2- New HVAC System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	1.4	0.8
Standard value	0.91*	N/A	N/A	1.1^	0.65
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.

^ 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.

3- Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
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.

1- New HWS Circuit

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

2- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	N/A

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

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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
GF_Sensory R	-	-	-	1.4	-	-	-	-	-	-	N/A
GF_Shower	0.3	-	-	-	-	-	-	-	-	-	N/A
GF_Group R	-	-	-	1.4	-	-	-	-	-	-	N/A
GF_Therapy R	-	-	-	1.4	-	-	-	-	-	-	N/A
1F_Classroom W	-	-	-	1.4	-	-	-	-	-	-	N/A
1F_Classroom E	-	-	-	1.4	-	-	-	-	-	-	N/A
1F_Quiet R	-	-	-	1.4	-	-	-	-	-	-	N/A
1F_Toilet	0.3	-	-	-	-	-	-	-	-	-	N/A
1F_Soft R	-	-	-	1.4	-	-	-	-	-	-	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	
GF_Off	100	-	-	74
GF_Sensory R	100	-	-	67
GF_Shower	-	90	-	27
GF_Group R	100	-	-	87
GF_Therapy R	100	-	-	68
GF_St	90	-	-	4
GF_Circ	-	100	-	60
GF_Lobby	-	100	-	15
GF_Plant	90	-	-	16
1F_Classroom W	100	-	-	168
1F_Classroom E	100	-	-	172
1F_Circ	-	100	-	36
1F_Quiet R	100	-	-	44
1F_Toilet	-	90	-	21
1F_Soft R	100	-	-	76
1F_St 1	90	-	-	8
1F_St 2	90	-	-	5

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?
GF_Off	NO (-91%)	NO
GF_Sensory R	N/A	N/A
GF_Group R	NO (-89%)	NO
GF_Therapy R	NO (-83%)	NO
1F_Classroom W	NO (-18%)	NO
1F_Classroom E	NO (-45%)	NO
1F_Quiet R	N/A	N/A
1F_Soft R	N/A	N/A

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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?	NO
Are any such measures included in the proposed design?	YES

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	193	193
External area [m²]	464	464
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	5
Average conductance [W/K]	169	209
Average U-value [W/m²K]	0.37	0.45
Alpha value* [%]	21.25	21.25

* 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	8.16	8.66
Cooling	0	0
Auxiliary	6.33	6.39
Lighting	8.43	12.97
Hot water	7.57	7.57
Equipment*	16.49	16.49
TOTAL**	**30.48**	**35.6**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	26.71	26.89
Primary energy* [kWh/m²]	63.35	77.77
Total emissions [kg/m²]	10.9	13.3

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

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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] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	0	0	0	0	9.8	0	0	0	0
	Notional	3.3	0	1.1	0	12.6	0.82	0	---	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	24	0	7.7	0	9.9	0.86	0	0.91	0
	Notional	22.9	0	7.8	0	9.8	0.82	0	---	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	34.3	0	11	0	0.8	0.86	0	0.91	0
	Notional	36.1	0	12.3	0	1.1	0.82	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

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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-Typ}	U_{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.22	External Wall
Floor	0.2	0.18	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.12	Lobby CW
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

U_{i-Typ} = Typical individual element U-values [W/(m²K)] U_{i-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

BRUKL (Be Green output)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Barnes Primary School As designed

Date: Thu Nov 26 12:50:33 2020

Administrative information

Building Details

Address: 32 Cross Street, Barnes, London, SW13 0QQ

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Barnes School

Telephone number:

Address: , ,

Certifier details

Name: Claudia Cioli

Telephone number: 020 7786 7900

Address: 26 Finsbury Square, London, EC2A 1DS

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	12.6
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	12.6
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	9
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.23	0.25	External Wall i front rear
Floor	0.25	0.18	0.18	Ground Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.31	2.03	frame CW
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

* 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
m³/(h.m²) at 50 Pa	10	3

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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	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- toilets (2 Zones)

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

2- Mech vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.41	-	-	1.1	0.8
Standard value	2.5*	N/A	N/A	1.5^	0.65
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.

3- Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.41	-	-	-	-
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.

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.41	0
Standard value	N/A	N/A

2- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	N/A

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

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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
GF_Sensory R	-	-	-	1.1	-	-	-	-	-	-	N/A
GF_Shower	0.3	-	-	-	-	-	-	-	-	-	N/A
GF_Group R	-	-	-	1.1	-	-	-	-	-	-	N/A
GF_Therapy R	-	-	-	1.1	-	-	-	-	-	-	N/A
1F_Classroom W	-	-	-	1.1	-	-	-	-	-	-	N/A
1F_Classroom E	-	-	-	1.1	-	-	-	-	-	-	N/A
1F_Quiet R	-	-	-	1.1	-	-	-	-	-	-	N/A
1F_Toilet	0.3	-	-	-	-	-	-	-	-	-	N/A
1F_Soft R	-	-	-	1.1	-	-	-	-	-	-	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	
GF_Off	100	-	-	74
GF_Sensory R	100	-	-	67
GF_Shower	-	90	-	27
GF_Group R	100	-	-	87
GF_Therapy R	100	-	-	68
GF_St	90	-	-	4
GF_Circ	-	100	-	60
GF_Lobby	-	100	-	15
GF_Plant	90	-	-	16
1F_Classroom W	100	-	-	168
1F_Classroom E	100	-	-	172
1F_Circ	-	100	-	36
1F_Quiet R	100	-	-	44
1F_Toilet	-	90	-	21
1F_Soft R	100	-	-	76
1F_St 1	90	-	-	8
1F_St 2	90	-	-	5

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?
GF_Off	NO (-91%)	NO
GF_Sensory R	N/A	N/A
GF_Group R	NO (-89%)	NO
GF_Therapy R	NO (-83%)	NO
1F_Classroom W	NO (-18%)	NO
1F_Classroom E	NO (-45%)	NO
1F_Quiet R	N/A	N/A
1F_Soft R	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?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	193	193
External area [m²]	464	464
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	5
Average conductance [W/K]	169	209
Average U-value [W/m²K]	0.37	0.45
Alpha value* [%]	21.25	21.25

* 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	2.18	2.92
Cooling	0	0
Auxiliary	5.24	6.39
Lighting	8.41	12.97
Hot water	2.02	2.55
Equipment*	16.49	16.49
TOTAL**	**17.85**	**24.84**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	26.82	26.89
Primary energy* [kWh/m²]	53.43	74.34
Total emissions [kg/m²]	9	12.6

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

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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] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	9.8	0	0	0	0
	Notional	3.3	0	0.4	0	12.6	2.43	0	---	----
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	24.1	0	2.1	0	7.9	3.24	0	3.41	0
	Notional	22.9	0	2.6	0	9.8	2.43	0	---	----
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	34.4	0	3	0	0.8	3.24	0	3.41	0
	Notional	36.1	0	4.1	0	1.1	2.43	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

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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-Typ}	U_{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.22	External Wall
Floor	0.2	0.18	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.12	Lobby CW
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

U_{i-Typ} = Typical individual element U-values [W/(m²K)] U_{i-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

END OF REPORT