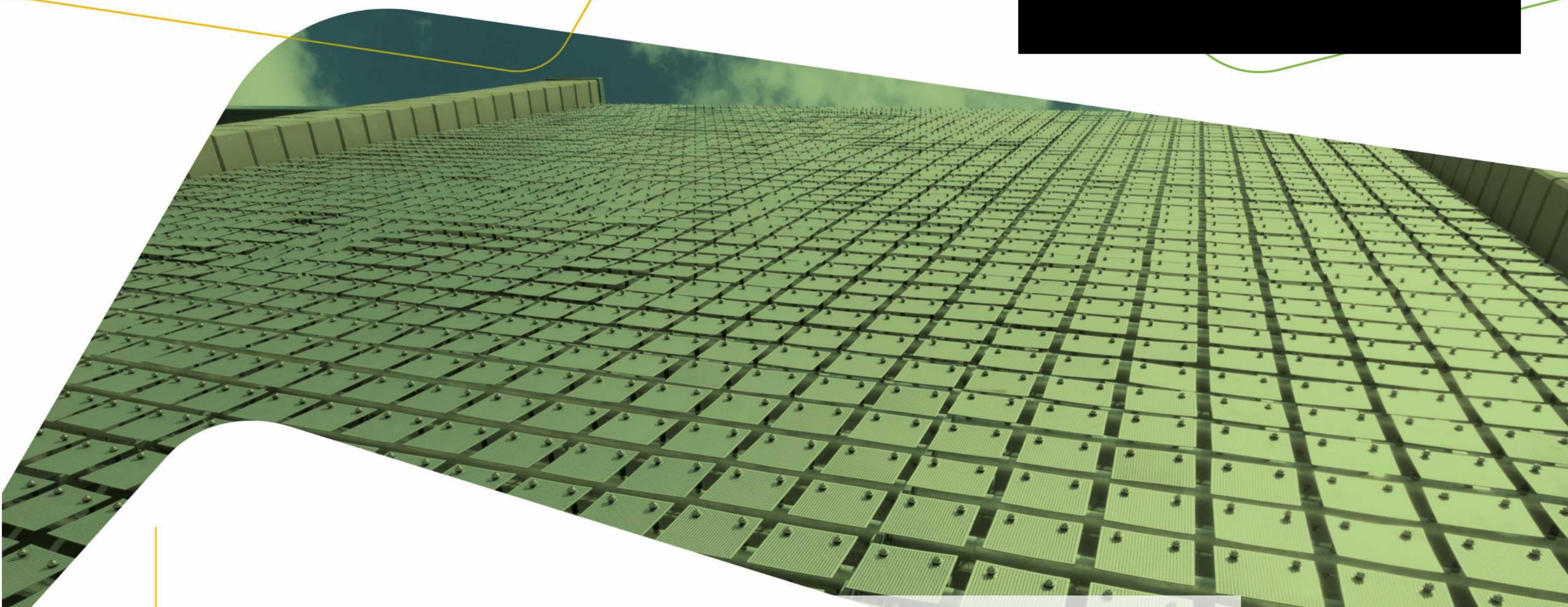
Sustainability & Engineering Consultants

sdsolution.co.uk

[redacted]



COMMUNITY DIAGNOSTIC CENTRE

Building Modelling Simulation

ADL2 Report

SECURITY CLASSIFICATION: UNCLASSIFIED

-Front Page -

LOW CARBON CONSULTANTS

ace consultancy engineering business environment

BSRIA

bmtrada SYSTEM CERTIFICATION ISO 9001 CERTIFICATION

bmtrada SYSTEM CERTIFICATION ISO 9001 CERTIFICATION

bmtrada SYSTEM CERTIFICATION ISO 9001 CERTIFICATION

UKAS MANAGEMENT SYSTEMS 0012

COMMUNITY DIAGNOSTIC CENTRE

Building Modelling Simulation

ADL2 Report

Document Number: CDC-SDS-ZZ-ZZ-RP-BP-907282

Current Status: S2–P01

Date of Issue: 15/12/2023

Prepared By: S. Deacon

Suitability	Revision	Date	Description	Author	Checked
S2	P01	15/ 12/ 2023	First Issue. Suitable for Information.	SD	MJ/ JB
			-		
			-		
			-		

EXECUTIVE SUMMARY

University Hospitals Plymouth have appointed Services Design Solution Ltd to undertake a dynamic simulation study of the proposed Community Diagnostic Centre, Plymouth to assess whether the proposed building design meets the requirements of AD Part L of the Building Regulations and BREEAM emission standards (Ene 01).

The current SBEM calculation shows the building design achieves 23.3% improvement on the Part L 2021 building regulation. This is through efficient thermal envelope performance, building services and onsite energy generation.

The onsite generation is provided by a 79.98kWp photovoltaic system.

The proposed building is predicted to achieve an EPRnc of 0.428 and this is equivalent to 4 BREEAM Ene 01 credits, this achieves mandatory requirement for BREEAM Excellent rating.

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

This report has been prepared to provide an overview of the dynamic SBEM computer simulation modelling inputs.

Part L2 is main compliance obligations for new build, extension, and refurbishment schemes in the UK. This requirement is determined by Building Control.

1.1 Approved Document Part L

Part L is broken down into 2 parts;

- AD Part L1 (conservation of fuel and power in dwellings)
- AD Part L2 (conservation of fuel and power in buildings other than dwellings)

The approved documents in conjunction the Standard Assessment Procedure (SAP), SBEM and National Calculation Methodology (NCM) give minimum standards for building emissions, fabric performance, building service efficiencies and solar gain.

These standards put together also allow production of the Energy Performance Certificate (EPC).

1.2 Local planning policy DEV32

Local planning policy DEV32 states:

“All major development proposals should incorporate low or renewable energy generation to achieve regulated carbon emissions levels of 20% less than that required to comply with Building Regulations Part L.”

1.3 Location and Land Use

The proposed building is located within existing Colin Campbell Court of Plymouth City Centre. The site is predominately multi storey commercial and residential buildings. Building location shown in red below.

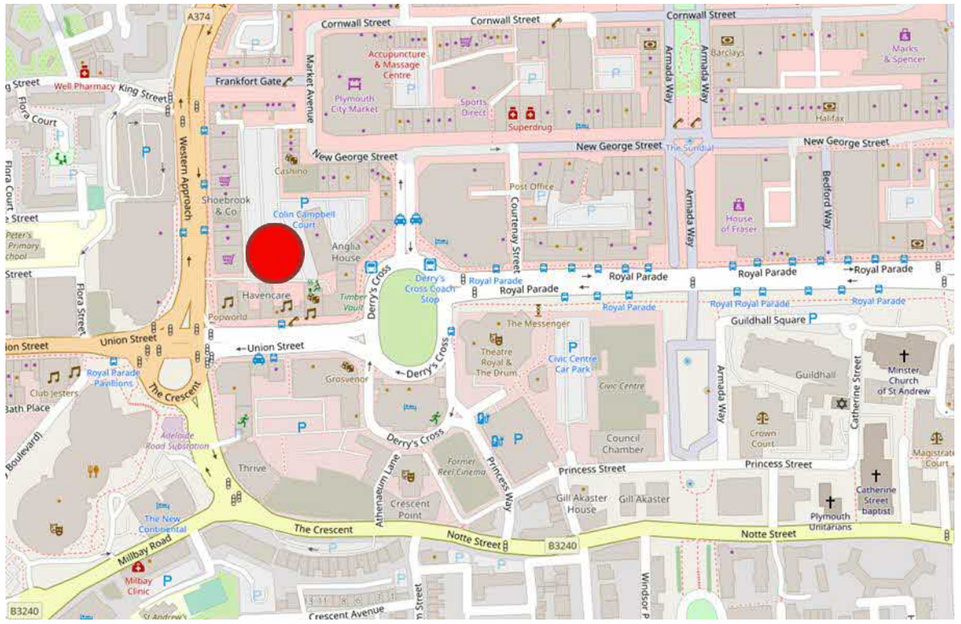


Figure 1 – Location map

1.4 Limitations

This report is for the purposes of the interested parties relating to the project only and any third party that wishes. The specification and detail included throughout this report should be closely followed to maintain the integrity of the results.

2 THE BUILDING

2.1 Description

The proposed Community Diagnostic Centre includes;

- Ground floor with mixture of utility, store, wc's, circulation, MRI scanner, ultrasound and waiting.
- First floor with mixture of CT scanner, X-Ray scanner, Echo, ECG, Store, Offices/Reporting, Interview, Utility and WC.
- Second floor with mixture of Office, Treatment, Audiology, Staff rest, Staff change, Store and WC.
- Third floor consists of Stairs, Lift/Lobby and Internal Plant

The Part L2 IES model gross internal floor area of the building is circa 2,643m². This is based on dynamic SBEM methodology and reflects the area shown in the BRUKL report.

2.2 Scheme Design

The gross internal floor area of the building is circa 2,643m².

The modelling has been based upon drawings as created by KTA Architects.

Table 1 –Drawing Register

Drawing/ Revit	Revision	Date Received
2258-KTA-BM-XX-M3-A-P5-CDC (Revit model)	P5	16.11.23

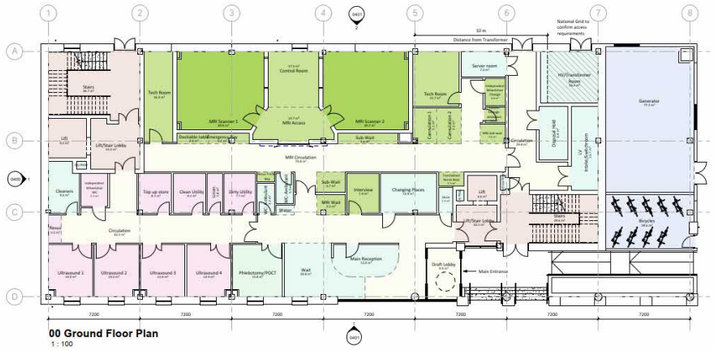
2.3 Geometry and Shading

Solar shading has been calculated for the building to take account of any shading devices, overhangs, surrounding buildings, and topography.

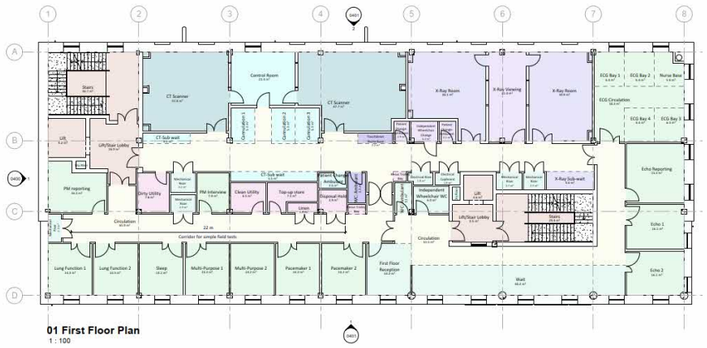
Space	Internal Shading	External Shading
Building	No internal blinds or curtains	None

Table 2 - Shading Devices

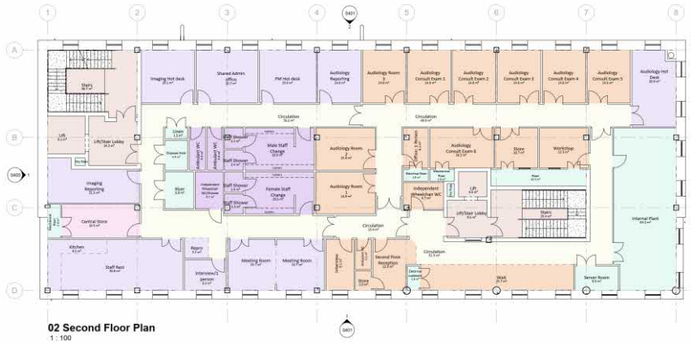
Ground floor



First floor



Second floor



Third floor

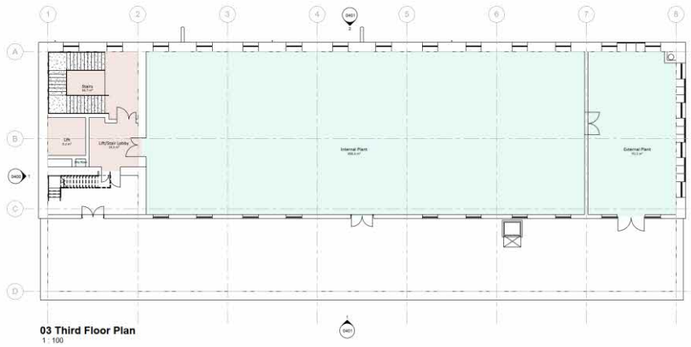


Figure 2 - Images of proposed architect general arrangement plans.

Images of the proposed building taken from IES energy model.

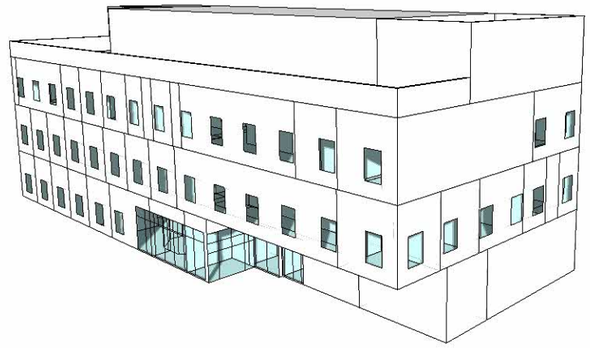


Figure 3 - South-west View

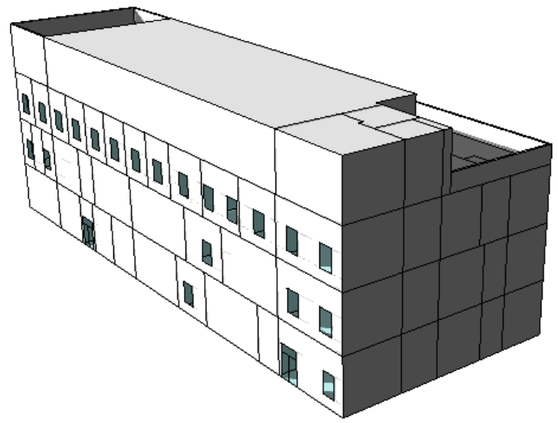


Figure 4 - North-east view

2.4 Fabric Performance

The table below shows the enhanced fabric performance used for the assessment of building carbon dioxide emissions and energy demand.

Table 3 – Fabric Performance

Construction Type	U-Value (W/m²K)	Thermal Mass
External Wall	0.12	Lightweight
Internal Wall	-	Lightweight
Ground Floor	0.10	Mediumweight
External Roof	0.12	Lightweight
Windows East, South and West (frame and glass)	1.00	(G = 0.35, LT = 70%)
Windows North (frame and glass)	1.00	(G = 0.40, LT = 70%)
External Glazed Door (frame and glass)	1.20	(G = 0.35, LT = 70%)
External solid door	1.20	-
Air permeability	2 m^3/hour per m^2 @ 50 pa	-

G = G-value (solar gain through glass)

LT = Light Transmission (daylight through glass).

Table 4 provides a predicted level of thermal mass for each element. This is to provide an indication only. This building is thought to be generally of a lightweight construction, and light thermal mass.

3 Building Services

3.1 Heating

Electric heat pump heating through ventilation system.

Main heating heat pump with SCoP 4 and secondary reversible heat pump with SCoP 2.9.

Total heat pump SCoP 3.462.

Please refer to SDS design report for further information.

3.2 Cooling

Electric heat pump cooling through ventilation system.

Heat pump cooling SEER 4.2 and EER 2.7 .

Please refer to SDS design report for further information.

3.3 Ventilation

Mixture of hybrid ventilation and central ventilation systems providing fresh air for optimal indoor air quality and thermal comfort.

Ventilation system performance show in tables below

Table 4: Ventilation Performance – Central system

Central System – Air Handling Unit (AHU)	
Specific fan power (W/(l/s))	1.8
Ductwork leakage test	CEN classification A
AHU leakage standards	Class L2
Control	System has metering and provision for warning out of range values
Heat Recovery	80% Plate heat exchanger

Table 5: Ventilation Performance – Central system plus Fan Coil

Central System - Air Handling Unit (AHU) plus Fan Coil	
AHU Specific fan power (W/(l/s))	1.8
Ductwork leakage test	CEN classification A
AHU leakage standards	Class L2
Control	System has metering and provision for warning out of range values
Heat Recovery	80% Plate heat exchanger
Fan coil (W/ (l/ s))	0 .3
Fan coil pump type	Variable speed differential sensor across the pump

Table 6 - Ventilation Performance – Hybrid Ventilation With Cooling

Hybrid Ventilation plus Fan Coil	
Specific fan power (W/(l/s))	0.2
Ductwork leakage test	Default
AHU leakage standards	Default
Control	System has metering and provision for warning out of range values
Heat Recovery	80% Plate heat exchanger

Local smoke extract ventilation system serving the Stairwell are not modelled in the Part L2 calculation as they not be in continuous operation for occupant comfort and health. These spaces are modelled as naturally ventilated.

The floorplan images shown below and on the next page show ventilation system for each space.

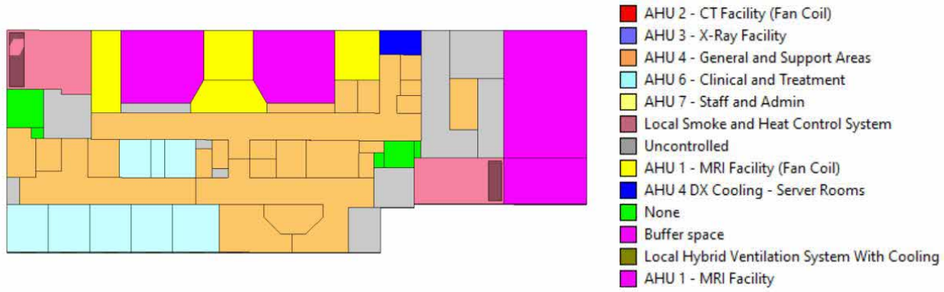


Figure 5 - Ground floor ventilation system

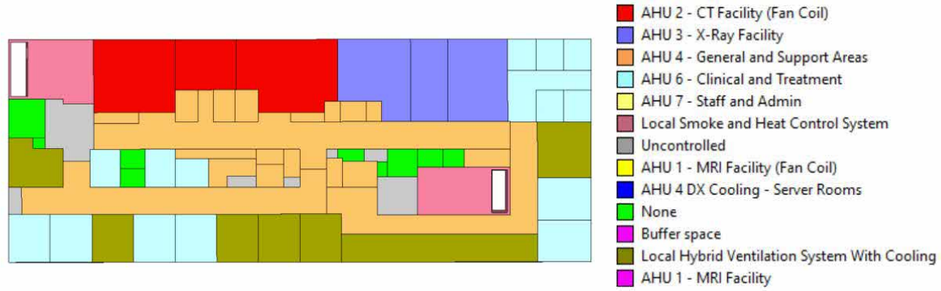


Figure 6 - First floor ventilation system

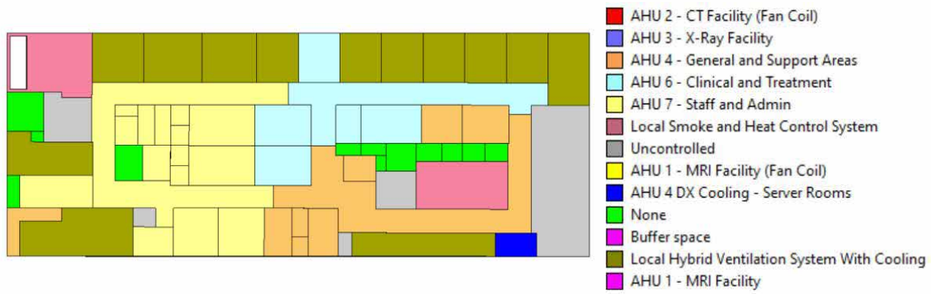


Figure 7 - Second floor ventilation system

Figure 8 - Third floor ventilation system

Please refer to SDS design report and drawings for further information.

3.4 Lighting

Proposed design incorporates high efficiency LEDs with a mixture of controls including occupancy sensing control.

The following tables detail the lighting setup and efficiencies proposed.

Table 7 – Lighting Lux and Power Density

Space type	Design lux	Power density (W/ m²/ 100lux)
Interview	525	2
Utility	525	2
Store	225	2
Toilet	225	2
Diagnostic Imaging	325	2
Office	525	2
Reception	225	2
Treatment	525	2
Changing	525	2
Plantroom	225	2
Circulation	225	2
Changing/ Shower	225	2
Server	125	2
Bedroom/ Sleep	325	2
Office/Open plan/Hot desk	525	2
Waiting	225	2

Please refer to SDS lighting strategy drawings for further information.

Table 8 - Lighting control strategy and parasitic power

Space type	Daylight dimming	Daylight parasitic power (W/ m²)	Lighting Control	Lighting control parasitic power (W/ m²)
Interview	No	-	Absence detection	0.1
Utility	No	-	Presence detection	0.1
Store	No	-	Presence detection	0.1
Toilet	No	-	Presence detection	0.1
Diagnostic Imaging	No	-	Presence detection	0.1
Office	No	-	Absence detection	0.1
Reception	No	-	Presence detection	0.1
Treatment	No	-	Presence detection	0.1
Changing	No	-	Presence detection	0.1
Plantroom	No	-	None	0.1
Circulation	No	-	Presence detection	0.1
Changing/ Shower	No	-	Presence detection	0.1
Server	No	-	Absence	0.1
Bedroom/ Sleep	No	-	None	0.1
Office/Open plan/Hot desk	No	-	Presence detection	0.1
Waiting	No	-	Presence detection	0.1

Please refer to SDS lighting strategy drawings for further information.

3.5 Hot Water

Hot water provided via the main electric heat pump and heat interface units.

There is no associated domestic hot water storage or circulating return pipework for additional losses. The calculation assumes a generic 90% delivery efficiency to account for domestic hot water system losses.

Please refer to SDS design report and SDS drawings for further information.

3.6 Building Controls and Metering

HVAC and lighting separately sub-metered.

Lighting and HVAC monitoring and targeting control.

Building electric power factor correction greater than 0.95.

Please refer to SDS design report for further information.

4 Proposed LZC Technology Assessment

4.1 Photovoltaic panel proposal

Based on the review of available LZC technologies, photovoltaic panels are recommended as a viable renewable technology.

It is recommended that the plant room roof of the building is utilised for the installation of Photovoltaic panels to provide an unobtrusive solution, with minimal shading effects from adjacent obstructions.

The indicative roof area for the allocation of photovoltaic panels has been highlighted green in the figure below. This area is approximately equal to 186 panels.

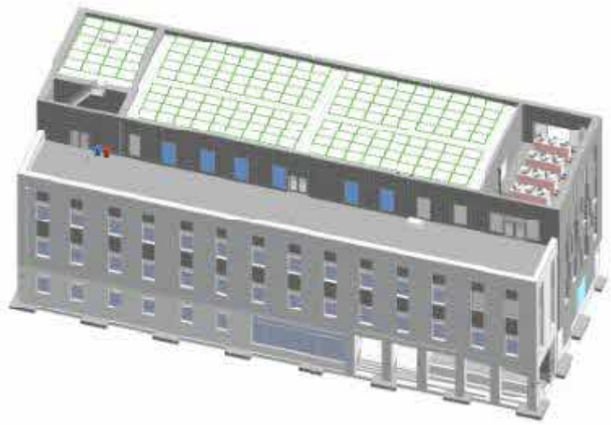


Figure 9 - Indicative location for PV installation

4.2 Data Inputs

Using the Photovoltaic Geographical Information System (PVGIS) energy calculator the electricity generation of the proposed PV system has been predicted using empirical climate data for the site. The data inputs are as follows:

Table 9 - PV Performance

Description	Data Input	Comment
	50.371 (Lat), -4.148 (Lon)	Plymouth
	35°	Fixed angle on mounted system
	0	South Facing
	PVGIS-SARAH	Proprietary database
	79.98 kWp	Crystalline silicon panel type
	Roof Mounted	-
	-23.75%	System losses and overshading adjacent from adjacent buildings

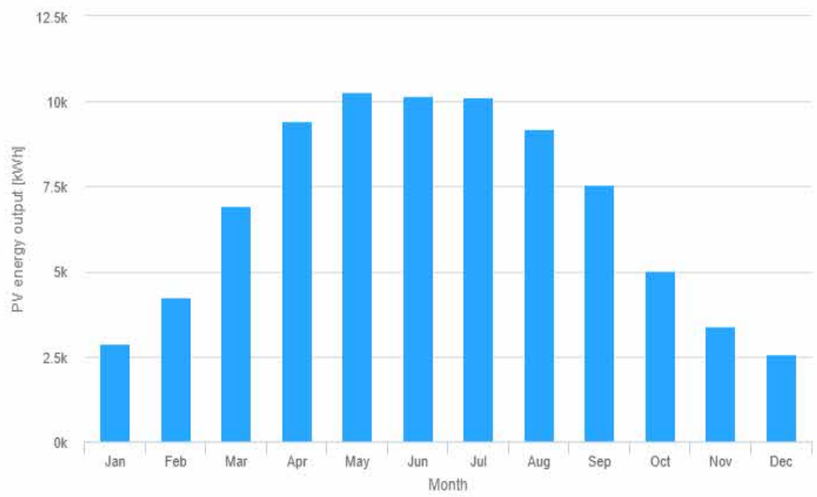
Table 10 - PV systems assumptions

Description	Data Input	Comment
Panel area	1.77m²	Indicative size
Panel performance	0.43 kW	Assumed
Number of panels	186	-
Panel array size	329m²	Excludes support system

4.3 Results

Using the data inputs for the proposed PV installation the daily and yearly electricity production is predicted and tabulated in Table 13.

Graph 1-PV energy production



From the above output data, the predicted annual yield for a nominal 79.98 kWp PV system is predicted as **81,706 kWh**.

5 Results

5.1 Part L

The carbon emissions associated with this scheme have been based upon the currently proposed drawings and design, which has been modelled using IES dynamic simulation software. The regulated carbon emission figures for the building are as follows:

Table 11 – Primary Energy

Regulated Carbon Emission	
Target Primary Energy Rate(kWh/ m2)	99.28
Building Primary Energy Rate (kWh/m2)	75.6 8
Percentage improvement better than the 2021 Part L2 Building Regulations Target	23.7%

Table 12 – Carbon Emissions

Regulated Carbon Emissions	
Target Emission Rate(kg.CO_2/ m2)	9.0 4
Building Emission Rate (kg.CO_2/m2)	6 .93
Percentage improvement better than the 2021 Part L2 Building Regulations Target	23.3%

Appendix A includes copy of the BRUKL Output Document.

5.2 BREEAM

The Community Diagnostic Centre building needs to meet mandatory requirements set out in BREEAM 2018 New Construction. One of the most significant “credit heavy” sections in this is the energy section, specifically ENE01 .

For the building as designed to achieve the BREEAM “Excellent” score (with over 70%), it must achieve certain mandatory credits, of which ENE01 is key.

The compliance scores were run through the BREEAM Version 6.1calculator, and the following results obtained:

Table 13 – BREEAM 2018 Hea04 credits

BREEAM Ene01 Reduction of energy use and carbon emissions	Credits achieved
Energy Performance (EPRnc = 0.428)	4

6 Conclusions and Recommendations

We conclude that the Part L2 modelling results for the Community Diagnostic Centre shows compliance with Building Regulations Part L2 2021

The chart below shows the major contributors of the regulated building carbon emission are lighting, auxiliary (fans, pumps, and controls) and cooling.

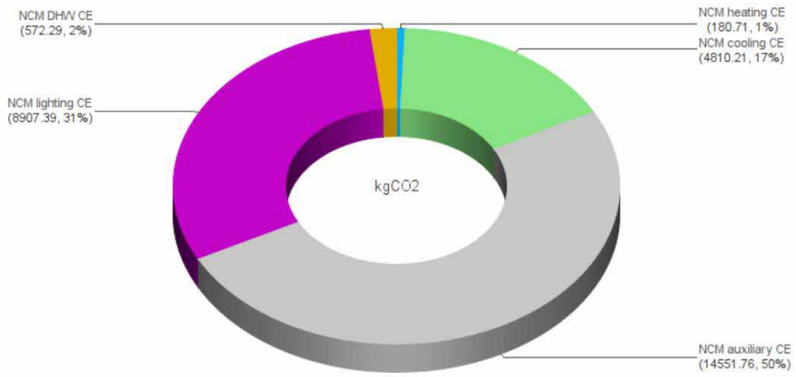


Figure 10 - Carbon emission distribution ($kgCO_2$) per annum

Knowing the major contributors towards carbon emissions at this stage of the project will allow future optimisation to improve energy efficiency and reduce carbon emissions in the detailed design stage of design.

The photovoltaic system is currently sized to suit available roof space above the Third-floor plantroom. This helps achieve a 23% improvement on Part L 2021 building regulation.

The building achieves local planning policy DEV 32.5 where 20% carbon saving is required through onsite renewable energy generation.

The building also achieves mandatory Ene01 requirements for BREEAM excellent score. The BREEAM Version 6.1 calculation tool calculates EPRnc 0.428 which equates to 4 credits.

Achieving BREEAM excellent is heavily dependent on photovoltaic system size and associated energy generation.

7 REFERENCES

The Building Regulations 2010: Conservation of Fuel and Power Part L2A. Conservation of fuel and power (New buildings other than dwellings) (2021 edition incorporating 2023 amendments – for use in England). HM Government. ISBN 978-1-914124-79-2.

The Building Regulations 2010: Conservation of Fuel and Power Approved Document L, Volume 2: Buildings other than dwellings (2021 edition incorporating 2023 amendments). ISBN 978 1 91412479 2.

SBEM Technical Manual: Simplified Building Energy Model (Part of the National Calculation Methodology: SBEM for assessing the Energy Performance of Non-domestic Buildings). A Technical Manual for SBEM, UK Volume,6.1.e, 19th December 2023.

Thermal simulation software: IES Virtual Environment – Version 2023.2.0.0.

National Calculation Methodology, 2021 Edition: NCM Modelling Guide (for buildings other dwellings in England).

CIBSE AM11. Building Performance Modelling. Chartered Institute of Building Services Engineers, London, 2015. ISBN 978-1-906846-67-1.

Ofgem 2017. Making a positive difference for energy consumers.

PVGis. PHOTOVOLTAIC & SOLAR ELECTRICITY DESIGN TOOLS, All right reserved 2013-2015.

BREEAM UK New Construction: Non-domestic Buildings (United Kingdom). Technical Manual SD5078: 3.0 – 2018. Issue Date: 31/07/2019.

8 APPENDICES

APPENDIX A

BRUKL Result With Renewables

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

CDC_Stage 3_P01 [79.98kWp Photovoltaic]

As designed

Date: Fri Dec 08 10:47:30 2023

Administrative information

Building Details

Address: CDC_Stage 3_P01 [79.98kWp Photovoltaic],

Certifier details

Name: Services Design Solution Ltd

Telephone number: 01752 255900

Address: Mary Seacole Road, The Millfields, Plymouth, PL1 3JY

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.23

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.23

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

Foundation area [m^2]: 667.77

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	9.04	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	6.93	
Target primary energy rate (TPER), kWh_{PE}/m^2.annum	99.28	
Building primary energy rate (BPER), kWh_{PE}/m^2.annum	75.68	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.12	0.12	01000018:Surf[0]
Floors	0.18	0.13	0.5	01000022:Surf[5]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	01000090:Surf[2]
Windows** and roof windows	1.6	1.08	2.53	0100001F:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.2	1.2	0000000A:Surf[2]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	2.53	2.53	0100001F:Surf[1]

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

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

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	2

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Heat pump/Reversible heat pump_VAV_AHU6

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.46	4.2	0	1.8	0.8
Standard value	2.5*	N/A	N/A	2^	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.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

2- Heat pump/Reversible heat pump_VAV_AHU4

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.46	4.2	0	1.8	0.8
Standard value	2.5*	N/A	N/A	2^	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.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

3- Heat pump/Reversible heat pump_Air heating_Uncontrolled ventilation

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.46	-	0.2	1.8	0.8
Standard value	2.5*	N/A	N/A	1.9^	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.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

4- Heat pump/Reversible heat pump_Radiators_Local smoke zonal extract

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.46	-	0.2	-	-
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.

5- Heat pump/Reversible heat pump_Fan coil_AHU1

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.46	4.2	0	1.8	0.8
Standard value	2.5*	N/A	N/A	2^	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.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

6- DX heating and cooling_AHU4

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.46	4.2	0	-	0.8
Standard value	2.5*	5	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.					

7- Heat pump/Reversible heat pump_Air heating_AHU1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.46	-	-	1.8	0.8
Standard value	2.5*	N/A	N/A	1.9^	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. ^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

8- Heat pump/Reversible heat pump_Heating_Hybrid ventilation with cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.46	-	0.2	-	0.8
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

9- Heat pump/Reversible heat pump_Fan coil_AHU2

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.46	4.2	0	1.8	0.8
Standard value	2.5*	N/A	N/A	2^	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. ^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

10- Heat pump/Reversible heat pump_VAV_AHU3

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.46	4.2	0	1.8	0.8
Standard value	2.5*	N/A	N/A	2^	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. ^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

11- Heat pump/Reversible heat pump_Air heating_AHU7

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.46	-	0.2	1.8	0.8
Standard value	2.5*	N/A	N/A	1.9^	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. ^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_012 MRI Tech Room 1	-	-	-	-	-	-	-	0.3	-	-	N/A
00_039 MRI Tech Room 2	-	-	-	-	-	-	-	0.3	-	-	N/A
00_051 MRI Control Room	-	-	-	-	-	-	-	0.3	-	-	N/A
00_052 MRI Access	-	-	-	-	-	-	-	0.3	-	-	N/A
01_007 First floor Reception	0.2	-	-	-	0.2	-	-	-	-	-	N/A
01_008 Pacemaker 2	0.2	-	-	-	0.2	-	-	-	-	-	N/A
01_009 Pacemaker 1	0.2	-	-	-	0.2	-	-	-	-	-	N/A
01_016 Sleep	0.2	-	-	-	0.2	-	-	-	-	-	N/A
01_031 Wait	0.2	-	-	-	0.2	-	-	-	-	-	N/A
01_043 CT Scanner 1	-	-	-	-	-	-	-	0.3	-	-	N/A
01_044 CT Control Room	-	-	-	-	-	-	-	0.3	-	-	N/A
01_046 CT Scanner 2	-	-	-	-	-	-	-	0.3	-	-	N/A
01_063 Echo Reporting	0.2	-	-	-	0.2	-	-	-	-	-	N/A
02_009 Audiology Consult Exam 5	0.3	-	-	-	0.3	-	-	-	-	-	N/A
02_010 Audiology Consult Exam 4	0.3	-	-	-	0.3	-	-	-	-	-	N/A
02_011 Audiology Consult Exam 3	0.3	-	-	-	0.3	-	-	-	-	-	N/A
02_012 Audiology Consult Exam 2	0.3	-	-	-	0.3	-	-	-	-	-	N/A
02_013 Audiology Consult Exam 1	0.3	-	-	-	0.3	-	-	-	-	-	N/A
02_019 Audiology Hot Desk	0.2	-	-	-	0.2	-	-	-	-	-	N/A
02_020 Audiology Reporting	0.2	-	-	-	0.2	-	-	-	-	-	N/A
02_021 PM Hot Desk	0.2	-	-	-	0.2	-	-	-	-	-	N/A
02_026 Imaging Hot Desk	0.2	-	-	-	0.2	-	-	-	-	-	N/A
02_027 Shared Amin Office	0.2	-	-	-	0.2	-	-	-	-	-	N/A
02_044 Wait	0.2	-	-	-	0.2	-	-	-	-	-	N/A
02_064 Staff Rest	0.2	-	-	-	0.2	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00_001 Dirty Utility	166	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
00_002 Top up store	167	-	-
00_003 Independent Wheelchair WC	205	-	-
00_008 HV/Transformer	115	-	-
00_009 LV Intake/Switchroom	144	-	-
00_010 Stairs	102	-	-
00_011 Phlebotomy/POCT	122	-	-
00_012 MRI Tech Room 1	130	-	-
00_013 Ultrasound 1	129	-	-
00_014 Ultrasound 4	128	-	-
00_016 Domestic Services	161	-	-
00_017 Linen	227	-	-
00_018 Clean Utility	164	-	-
00_019 Circulation	118	-	-
00_020 Ultrasound 3	128	-	-
00_021 Ultrasound 2	128	-	-
00_022 Stairs	96	-	-
00_023 Lift/Stair Lobby	125	-	-
00_024 Main Reception	72	80	1.35
00_025 Wait	86	-	-
00_026 Draft Lobby	150	-	-
00_027 Ambulance WC	227	-	-
00_028 Resus Trolley Bay	227	-	-
00_029 Sub-Wait	190	-	-
00_030 Lift/Stair Lobby	141	-	-
00_032 Circulation	119	-	-
00_033 Ambulance WC	227	-	-
00_034 MRI Wait	129	80	1.35
00_035 Water	227	80	1.35
00_036 Sub wait	130	80	1.35
00_037 Interview	171	-	-
00_038 Changing Places	129	-	-
00_038 Store	227	-	-
00_038 Touchdown Nurse base	227	-	-
00_039 MRI Tech Room 2	122	-	-
00_040 Server Room	189	-	-
00_041 Independent Wheelchair Change	227	-	-
00_042 Patient Change Ambulant	227	-	-
00_043 MRI Sub-Wait	127	-	-
00_044 MRI Scanner 2	91	-	-
00_045 MRI Scanner 1	91	-	-
00_046 Cannulation 1	110	-	-
00_047 Cannulation 2	79	-	-
00_048 MRI Circulation	93	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
00_049 Dockable Table Emergency	189	-	-
00_050 Circulation	89	-	-
00_051 MRI Control Room	98	-	-
00_052 MRI Access	104	-	-
00_053 Disposal Hold	155	-	-
01_003 Electrical Cupboard	227	-	-
01_004 Circulation	114	-	-
01_005 Echo 2	123	-	-
01_006 Echo 1	122	-	-
01_007 First floor Reception	107	80	1.35
01_008 Pacemaker 2	128	-	-
01_009 Pacemaker 1	128	-	-
01_010 Multi-Purpose 2	128	-	-
01_011 Multi-Purpose 1	128	-	-
01_012 Lung Function 1	129	-	-
01_013 Lung Function 2	128	-	-
01_014 Stairs	105	-	-
01_015 Lift/Stair Lobby	144	-	-
01_016 Sleep	128	-	-
01_018 PM Reporting	125	-	-
01_019 Lift/Stair Lobby	123	-	-
01_020 Dirty Utility	170	-	-
01_023 Clean Utility	187	-	-
01_024 CT-Sub Wait	193	80	1.35
01_025 PM Interview	170	-	-
01_029 X Ray Sub Wait	140	80	1.35
01_030 Stairs	108	-	-
01_031 Wait	87	80	1.35
01_032 Ambulant Change	227	-	-
01_033 Disposal Hold	227	-	-
01_034 WC	227	-	-
01_035 WC	227	-	-
01_036 Top-up Store	217	-	-
01_037 Linen	227	-	-
01_038 Circulation	99	-	-
01_039 Independent Wheelchair WC	197	-	-
01_041 Ambulant WC	227	-	-
01_042 Resus Trolley Bay	227	-	-
01_043 CT Scanner 1	91	-	-
01_044 CT Control Room	109	-	-
01_045 X-Ray Room 1	98	-	-
01_046 CT Scanner 2	91	-	-
01_047 Cannulation 1	112	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
01_048 Cannulation 3	111	-	-
01_049 Cannulation 2	80	-	-
01_050 CT-Sub Wait	163	80	1.35
01_051 Touchdown Nurse Base	204	-	-
01_052 Ambulant Change	227	-	-
01_053 Independent Wheelchair Change	227	-	-
01_054 Ambulant Change	227	-	-
01_055 X-Ray Viewing	114	-	-
01_056 X-Ray Room 2	96	-	-
01_057 ECG (circulation)	83	-	-
01_058 ECG Bay 4	104	-	-
01_059 ECG Bay 5	80	-	-
01_060 ECG Bay 1	104	-	-
01_061 ECG Bay 2	80	-	-
01_062 ECG Bay 3	105	-	-
01_063 Echo Reporting	110	-	-
01_065 CT Scanner Circulation	90	-	-
02_001 Interview/1 Person	168	-	-
02_002 Central Store	127	-	-
02_003 Independent Wheelchair WC	205	-	-
02_007 Reprographics	138	-	-
02_008 Second Floor Reception	106	80	1.35
02_009 Audiology Consult Exam 5	127	-	-
02_010 Audiology Consult Exam 4	127	-	-
02_011 Audiology Consult Exam 3	127	-	-
02_012 Audiology Consult Exam 2	127	-	-
02_013 Audiology Consult Exam 1	127	-	-
02_014 Audiology Room 3	127	-	-
02_015 Stairs	106	-	-
02_016 Lift/Stairs Lobby	144	-	-
02_017 Stairs	111	-	-
02_018 Male Staff Change	116	-	-
02_019 Audiology Hot Desk	112	-	-
02_020 Audiology Reporting	127	-	-
02_021 PM Hot Desk	114	-	-
02_022 Audiology Room 2	122	-	-
02_024 Lift/Stair Lobby	125	-	-
02_025 Imaging Reporting	120	-	-
02_026 Imaging Hot Desk	116	-	-
02_027 Shared Amin Office	112	-	-
02_028 Ambulant WC	227	-	-
02_029 Ambulant WC	227	-	-
02_030 Disposal Hold	227	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
02_031 Linen	227	-	-
02_032 Independent Wheelchair WC/Shower	185	-	-
02_034 Shower	227	-	-
02_035 Shower	227	-	-
02_036 Shower	227	-	-
02_037 Shower	227	-	-
02_038 Audiology Room 1	123	-	-
02_039 Female Staff Change	118	-	-
02_040 Circulation 1	127	-	-
02_041 Circulation 2	135	-	-
02_042 Internal Plant	89	-	-
02_043 Server Room	194	-	-
02_044 Wait	95	80	1.35
02_045 Electrical Cupboard	227	-	-
02_046 Interview Room	161	-	-
02_047 Ambulant WC	227	-	-
02_048 Store	227	-	-
02_049 Meeting Room 2	101	-	-
02_050 Meeting Room 1	101	-	-
02_058 1 Person Office	194	-	-
02_059 Workshop	135	-	-
02_060 Store	143	-	-
02_061 Audiology Consult Exam 6	123	-	-
02_062 Circulation 3	102	-	-
02_063 Staff Rest (Kitchen)	140	-	-
02_064 Staff Rest	89	-	-
03_003 Stairs	107	-	-
03_005 Lift/Stair Lobby	227	-	-
03_005 Lift/Stair Lobby	129	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_001 Dirty Utility	N/A	N/A
00_002 Top up store	N/A	N/A
00_003 Independent Wheelchair WC	N/A	N/A
00_011 Phlebotomy/POCT	NO (-58.9%)	NO
00_012 MRI Tech Room 1	N/A	N/A
00_013 Ultrasound 1	NO (-78.4%)	NO
00_014 Ultrasound 4	NO (-53.7%)	NO
00_016 Domestic Services	N/A	N/A
00_017 Linen	N/A	N/A
00_018 Clean Utility	N/A	N/A
00_019 Circulation	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_020 Ultrasound 3	NO (-53.7%)	NO
00_021 Ultrasound 2	NO (-54.1%)	NO
00_024 Main Reception	NO (-6.8%)	NO
00_025 Wait	NO (-24.9%)	NO
00_027 Ambulance WC	N/A	N/A
00_029 Sub-Wait	N/A	N/A
00_033 Ambulance WC	N/A	N/A
00_034 MRI Wait	YES (+32.3%)	NO
00_035 Water	YES (+105%)	NO
00_036 Sub wait	N/A	N/A
00_037 Interview	N/A	N/A
00_038 Changing Places	N/A	N/A
00_038 Store	N/A	N/A
00_038 Touchdown Nurse base	N/A	N/A
00_039 MRI Tech Room 2	N/A	N/A
00_040 Server Room	N/A	N/A
00_041 Independent Wheelchair Change	N/A	N/A
00_042 Patient Change Ambulant	N/A	N/A
00_043 MRI Sub-Wait	N/A	N/A
00_044 MRI Scanner 2	N/A	N/A
00_045 MRI Scanner 1	N/A	N/A
00_046 Cannulation 1	N/A	N/A
00_047 Cannulation 2	N/A	N/A
00_048 MRI Circulation	N/A	N/A
00_049 Dockable Table Emergency	N/A	N/A
00_050 Circulation	YES (+147.2%)	NO
00_051 MRI Control Room	NO (-71.8%)	NO
00_052 MRI Access	NO (-83.4%)	NO
00_053 Disposal Hold	N/A	N/A
01_003 Electrical Cupboard	N/A	N/A
01_004 Circulation	N/A	N/A
01_005 Echo 2	NO (-61.8%)	NO
01_006 Echo 1	NO (-58.9%)	NO
01_007 First floor Reception	NO (-58.6%)	NO
01_008 Pacemaker 2	NO (-53.7%)	NO
01_009 Pacemaker 1	NO (-53.7%)	NO
01_010 Multi-Purpose 2	NO (-53.7%)	NO
01_011 Multi-Purpose 1	NO (-53.7%)	NO
01_012 Lung Function 1	NO (-78.4%)	NO
01_013 Lung Function 2	NO (-54.1%)	NO
01_016 Sleep	NO (-53.7%)	NO
01_018 PM Reporting	N/A	N/A
01_020 Dirty Utility	N/A	N/A
01_023 Clean Utility	N/A	N/A
01_024 CT-Sub Wait	N/A	N/A
01_025 PM Interview	N/A	N/A
01_029 X Ray Sub Wait	N/A	N/A
01_031 Wait	NO (-73.1%)	NO
01_032 Ambulant Change	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01_033 Disposal Hold	N/A	N/A
01_034 WC	N/A	N/A
01_035 WC	N/A	N/A
01_036 Top-up Store	N/A	N/A
01_037 Linen	N/A	N/A
01_038 Circulation	NO (-49.6%)	NO
01_039 Independent Wheelchair WC	N/A	N/A
01_041 Ambulant WC	N/A	N/A
01_043 CT Scanner 1	N/A	N/A
01_044 CT Control Room	NO (-69.9%)	NO
01_045 X-Ray Room 1	N/A	N/A
01_046 CT Scanner 2	N/A	N/A
01_047 Cannulation 1	N/A	N/A
01_048 Cannulation 3	N/A	N/A
01_049 Cannulation 2	N/A	N/A
01_050 CT-Sub Wait	N/A	N/A
01_051 Touchdown Nurse Base	N/A	N/A
01_052 Ambulant Change	N/A	N/A
01_053 Independent Wheelchair Change	N/A	N/A
01_054 Ambulant Change	N/A	N/A
01_055 X-Ray Viewing	N/A	N/A
01_056 X-Ray Room 2	N/A	N/A
01_057 ECG (circulation)	NO (-28.8%)	NO
01_058 ECG Bay 4	NO (-58.2%)	NO
01_059 ECG Bay 5	NO (-57.7%)	NO
01_060 ECG Bay 1	NO (-56%)	NO
01_061 ECG Bay 2	NO (-78.2%)	NO
01_062 ECG Bay 3	NO (-65.3%)	NO
01_063 Echo Reporting	NO (-37.7%)	NO
01_065 CT Scanner Circulation	N/A	N/A
02_001 Interview/1 Person	NO (-52.5%)	NO
02_003 Independent Wheelchair WC	N/A	N/A
02_007 Reprographics	N/A	N/A
02_008 Second Floor Reception	NO (-54.2%)	NO
02_009 Audiology Consult Exam 5	NO (-55.9%)	NO
02_010 Audiology Consult Exam 4	NO (-55.9%)	NO
02_011 Audiology Consult Exam 3	NO (-55.9%)	NO
02_012 Audiology Consult Exam 2	NO (-55.9%)	NO
02_013 Audiology Consult Exam 1	NO (-55.9%)	NO
02_014 Audiology Room 3	NO (-55.9%)	NO
02_018 Male Staff Change	N/A	N/A
02_019 Audiology Hot Desk	NO (-53.6%)	NO
02_020 Audiology Reporting	NO (-55.9%)	NO
02_021 PM Hot Desk	NO (-66.5%)	NO
02_022 Audiology Room 2	N/A	N/A
02_025 Imaging Reporting	N/A	N/A
02_026 Imaging Hot Desk	NO (-64.7%)	NO
02_027 Shared Amin Office	NO (-36.9%)	NO
02_038 Audiology Room 1	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02_039 Female Staff Change	N/A	N/A
02_041 Circulation 2	N/A	N/A
02_043 Server Room	NO (-54.1%)	NO
02_044 Wait	NO (-72.8%)	NO
02_046 Interview Room	NO (-30.7%)	NO
02_047 Ambulant WC	N/A	N/A
02_048 Store	N/A	N/A
02_049 Meeting Room 2	NO (-59.2%)	NO
02_050 Meeting Room 1	NO (-56.2%)	NO
02_058 1 Person Office	N/A	N/A
02_059 Workshop	N/A	N/A
02_060 Store	N/A	N/A
02_061 Audiology Consult Exam 6	N/A	N/A
02_062 Circulation 3	NO (-64.5%)	NO
02_063 Staff Rest (Kitchen)	NO (-80%)	NO
02_064 Staff Rest	NO (-59.9%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	2642.5	2642.5
External area [m^2]	4372.4	3941.1
Weather	PLY	PLY
Infiltration [m^3/hm^2@ 50Pa]	2	3
Average conductance [W/K]	1457.07	1144.39
Average U-value [W/m^2K]	0.33	0.29
Alpha value* [%]	13.47	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
1	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
28	**Residential Institutions: Hospitals and Care Homes**
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
71	**Non-residential Institutions: Primary Health Care Building**
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
1	**Others: Miscellaneous 24hr Activities**
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

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

	Actual	Notional
Heating	0.44	1.61
Cooling	15.24	8.8
Auxiliary	40.72	26.6
Lighting	24.93	28.12
Hot water	1.6	2.42
Equipment*	161.24	161.24
TOTAL**	**82.94**	**67.56**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	30.92	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*30.92*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	170.96	162.91
Primary energy [kWh_{PE}/m^2]	75.68	99.28
Total emissions [kg/m^2]	6.93	9.04

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] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	1.2	264.3	0.1	22.3	13.3	3.22	3.3	3.46	4.2
	Notional	5.3	207.2	0.5	12.4	15.4	2.78	4.63	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	598.7	0	50.5	97.4	3.22	3.3	3.46	4.2
	Notional	0.5	527.5	0.1	31.6	95.1	2.78	4.63	----	----
[ST] Single-duct VAV, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	552.9	0	52.2	141.1	2.93	2.94	3.46	4.2
	Notional	0	508.3	0	30.5	91.1	2.78	4.63	----	----
[ST] Single-duct VAV, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	1.4	132.6	0.1	12.5	27.6	2.93	2.94	3.46	4.2
	Notional	3.9	105.7	0.4	6.3	13.9	2.78	4.63	----	----
[ST] Single-duct VAV, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0.2	420.7	0	39.7	122.5	2.93	2.94	3.46	4.2
	Notional	1.7	395.8	0.2	23.7	65.2	2.78	4.63	----	----
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	4.3	0	0.3	0	9.3	3.83	0	3.46	0
	Notional	13.3	0	1.3	0	8.4	2.78	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	34.2	0	2.9	0	1.7	3.25	0	3.46	0
	Notional	90.2	0	9	0	1	2.78	0	----	----
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	10.3	0	0.7	0	6.6	3.83	0	3.46	0
	Notional	14.3	0	1.4	0	5.1	2.78	0	----	----
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	80.9	3.83	0	3.46	0
	Notional	0	0	0	0	80.9	2.78	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1699.4	0	150.4	0	3.4	3.14	3.46	4.2
	Notional	0	1549.8	0	93	0	2.78	4.63	----	----
[ST] Other local room heater - fanned, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	3.9	0	0.4	0	0.7	2.92	0	3.46	0
	Notional	31.9	0	3.2	0	2.5	2.78	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

Sustainability & Engineering Consultants

SECURITY CLASSIFICATION: UNCLASSIFIED

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