HOARE LEA

Advanced Scanning & Imaging Centre Development. Manchester.

The Christie NHS Foundation Trust.

SUSTAINABILITY
PART L2 COMPLIANCE REPORT

REVISION 03 – 25 SEPTEMBER 2023

STAGE 3

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
01	30/03/2023	Stage 2 Issue.	J. Daoud	R. Palmer	J. Ford
02	12/09/2023	Stage 3 Issue.	J. Daoud	G. Papachristou	J. Nuttall
03	25/09/2023	Revised Stage 3 Issue.	J. Daoud	G. Papachristou	J. Nuttall

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Executive Summary.

This assessment report has been developed on behalf of The Christie NHS Foundation Trust, in support of the proposed Advanced Scanning & Imaging Centre Development demolition and reconstruction. The new construction will be assessed against new build requirements.

This report demonstrates a proposed route to compliance with Approved Document L, Conservation of fuel and power, Volume 2, stated within this report.

Scope of Works.

The proposed works will involve the demolition of the existing two storeys which will be reconstructed along with the addition of two more storeys.

The entire proposed development will be assessed against the Part L 2021 Schedule 1 requirements.

Proposed Development.

The Proposed Development, called Christie's Radiology Village, involves the demolition of the existing two-story advanced scanning and imaging department. The reconstruction will include two more storeys which will host support spaces and plantrooms. The development is connected to the wider hospital development on the West elevation from the basement floor up to the third storey. The final development will comprise of 5 storeys of advanced scanning and imaging, consultation, treatment rooms and 24/7 bedrooms with ancillary inpatient facilities.

Assessment Drivers.

The Proposed Development will have a reduced effect on climate change by reducing CO_2 emissions associated with energy use in line with national and local policy as stated within Building Regulations Part L (2021).



Figure 1 - Satellite Image of Christie's Radiology Village site location

Part L2 Assessment Results.

This assessment report demonstrates that building regulations and policy compliance is achieved by the proposals, care should be taken going forward to ensure design stage and post-construction certificates can be delivered to maintain the following:

- Compliance with Part L2 2021
- Manchester Core Strategy

Through use of passive design principles combined with low carbon Air Source Heat Pump (ASHP) technology and an annual yield of 84,692 kWh of electricity generated on-site by Photovoltaic Panels, the proposed development achieves a **2.70%** reduction in annual regulated carbon emissions when compared to the Part L2 2021 baseline. This meets the Part L reduction policy of the Manchester Core Strategy.

Table 1 - Part L compliance results.

Part L 2021	**BER** (TonnesCO_2/year)	**TER** (TonnesCO_2/year)	Percentage Betterment
	13.56	13.94	**2.70%**
	BPER (kWh/m^2/year)	**TPER** (kWh/m^2/year)	Percentage Betterment
	147.67	152.33	**3.05%**

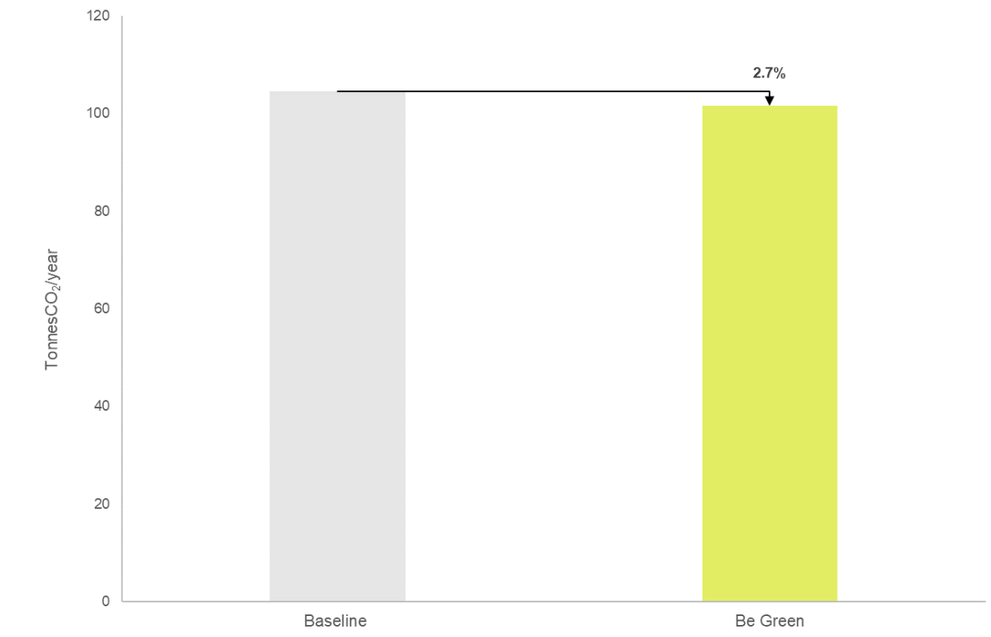


Figure 2 – Part L results demonstrating compliance.

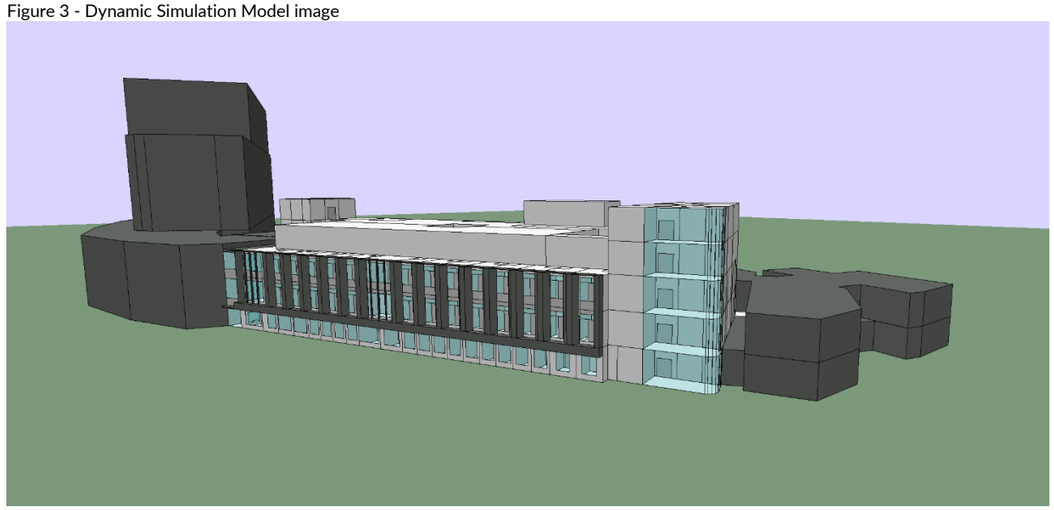
1. Introduction.

This assessment report has been developed on behalf of The Christie NHS Foundation Trust hereafter referred to as 'the Client' in support of the proposed Advanced Scanning & Imaging Centre Development demolition and reconstruction, hereafter referred to as 'the Proposed Development'.

1.1 Proposed Development.

The Proposed Development, called Christie's Radiology Village, involves the demolition of the existing two-storey advanced scanning and imaging department. The reconstruction will include two more storeys which will host support spaces and plantrooms. The development is connected to the wider hospital development on the West elevation from the basement floor up to the third storey. The final development will comprise of 5 storeys of advanced scanning and imaging, consultation, treatment rooms and 24/7 bedrooms with ancillary inpatient facilities.

Figure 3 - Dynamic Simulation Model image



1.2 Approach to assessment.

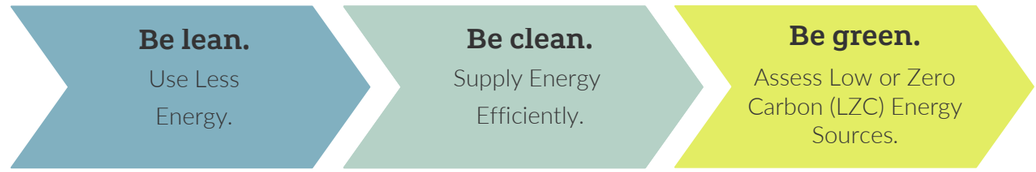
The following assessment report considers the approach to reducing carbon dioxide (CO_2) emissions and optimising energy efficiency within the development and sets out how it will address and achieve the relevant targets.

As such it demonstrates a proposed route to compliance with Approved Document Part L2 (2021), conservation of fuel and power, based upon the performance parameters stated within this report.

The Proposed Development is modelled in a Dynamic Simulations Modelling (DSM) software package (see Appendix A) with the assigned parameters and then tested against Part L2 methodology.

1.2.1 Part L2 compliance discussion.

The assessment has used the energy hierarchy as part of the design strategy that prioritises passive design in a Be Lean, Be Clean and Be Green approach:



1.2.1.1 Definitions and limitations.

Definitions:
The following definitions should be understood throughout this statement:

- **Energy demand:** the 'room-side' amount of energy which must be input to a space to achieve comfortable conditions. In the context of space heating, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- **Energy requirement:** the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. the energy demand).
- **Regulated CO_2 emissions:** the CO_2 emissions emitted as a result of the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated sources (those controlled by Part L of the Building Regulations).

Limitations:
The appraisals within this statement are based on Part L calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise. Occupants may operate their systems differently, and / or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

2. Assessment Drivers.

2.1 Planning and Regulatory.

The following section outlines the national and local policies and drivers.

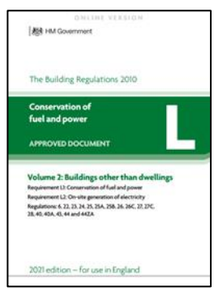
2.1.1 Building Regulations Part L2 (2021).

Approved Document Part L (2021, England edition) is the Building Regulations relating to the conservation of fuel and power in buildings. The Approved Document is separated into two sections: Volume 1 and Volume 2:

- Part L Vol.1 relates to dwellings specifically, with individual criteria for this building-use type
- Part L Vol.2 relates to buildings other than dwellings 'Conservation of fuel and power in buildings other than dwellings' and sets out specific criteria for this building use type.

Schedule 1: Conservation of Fuel and Power.

Schedule 1 of the Building Regulations Part L states that reasonable provisions shall be made for:



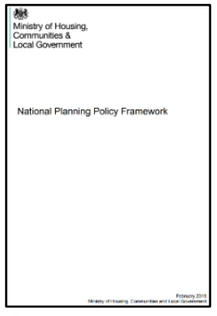
- Limiting Heat Gains and Losses through;
  - Thermal elements and other parts of the building fabric; and;
  - Pipes, ducts and vessels used for space heating, space cooling and hot water services.
- Providing fixed building services which are:
  - Energy Efficient;
  - Have effective controls; and;
  - Are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power then is reasonable in the circumstances

Developments should aim to at least meet the limiting values for system and fabric requirements in order to better the Building Emission Rate set by a notional building which uses standardised inputs based on the system and fabric design of each building.

Part L (2021) Conservation of Fuel and Power

Part L 2021 came into force on 15 June 2022. The proposed development will be assessed in accordance to criteria set out in Part L2 for the non-domestic elements.

2.1.2 National Planning Policy Framework.



The latest National Planning Policy Framework (NPPF) was published in September 2023 and has superseded all Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) documents. The NPPF sets out the Government's strategy on the delivery of sustainable development.

The NPPF places responsibility for policy making with the Local Planning Authority, who shall communicate their policies through Local Plans and facilitate the creation of Neighbourhood Plans. The NPPF states that there is a presumption in favour of sustainable development.

The following is extracted from paragraph 11 of the NPPF:

"Plans and decisions should apply a presumption in favour of sustainable development.

For plan-making this means that:

a) plans should promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects;
b) strategic policies should, as a minimum, provide for objectively assessed needs for housing and other uses, as well as any needs that cannot be met within neighbouring areas , unless:
  i. the application of policies in this Framework that protect areas or assets of particular importance provides a strong reason for restricting the overall scale, type or distribution of development in the plan area; or
  ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.

For decision-taking this means:

c) approving development proposals that accord with an up-to-date development plan without delay; or
d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:
  i. the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or
  ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole."

In respect of energy policy contained within the NPPF, paragraph 155 sets out that:

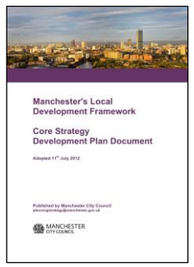
"To help increase the use and supply of renewable and low carbon energy and heat, plans should:

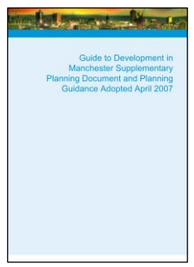
a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers."

2.1.3 Manchester City Council Core Strategy.





Manchester City Council (MCC) documentation:

– Core Strategy (CS) (July 2012)
– Supplementary Planning Documentation and Planning Guidance (SPDPG) (April 2007)

This strategy summarises the response of the proposed development's design to the policy framework of the MCC Adopted Core Strategy, and SPDPG documentation that together form the city's policy landscape. The CS documentation supersedes the SPDPG and therefore the CS documentation will take precedence.

The Manchester Core Strategy Policy EN6 states that for all developments over 1,000m^2 will be expected as a minimum to meet the following targets (*unless this can be shown not to be viable*):

Target	% Minimum Requirement
Target 1; Network Development Area	CHP / District heating anchor or connection or where not feasible a 15% increase on Part L 2010
Target 2; Electricity Intense Buildings	+ 10% increase on Part L 2010
Target 3; Micro Generation Area	+ 15% increase on Part L 2010

Table 2 CO_2 Emission Reduction Targets, Manchester Core Strategy

Each of the above targets require above a 15% increase (increase is understood to be a reduction over the target) on Part L 2010 emission rates. Between the Part L 2010 Building Regulations and the Part L 2013 Building Regulations the target emission rates were improved by the following levels;

- Non-Domestic building 9% improvement from 2010 to 2013
- Non-Domestic building 27% improvement from 2013 to 2021

In brief, the changes present in the Part L 2021 target building have made it increasingly difficult to achieve substantial improvement above the target building. The metric used to report the results in Part L 2021 are different to that reported in previous editions of the Approve Document L and therefore it is not possible to make a direct comparison between both outputs. However, it is understood that Part L targets offer a 27% improvement above Part L 2013 which means that although meeting the standards is becoming progressively difficult, ultimately, the regulations are enforcing better performing buildings.

2.2 Grid Decarbonisation.

The national grid is continually decarbonising which makes the use of gas systems less preferential over electrically fuelled systems. Considering increasing ambition for zero-carbon developments – utilising an all-electric engineering strategy could help achieving this target. The chart (**Figure 4**) illustrates the current and predicted carbon intensities of the national grid from 2005 up to 2050.

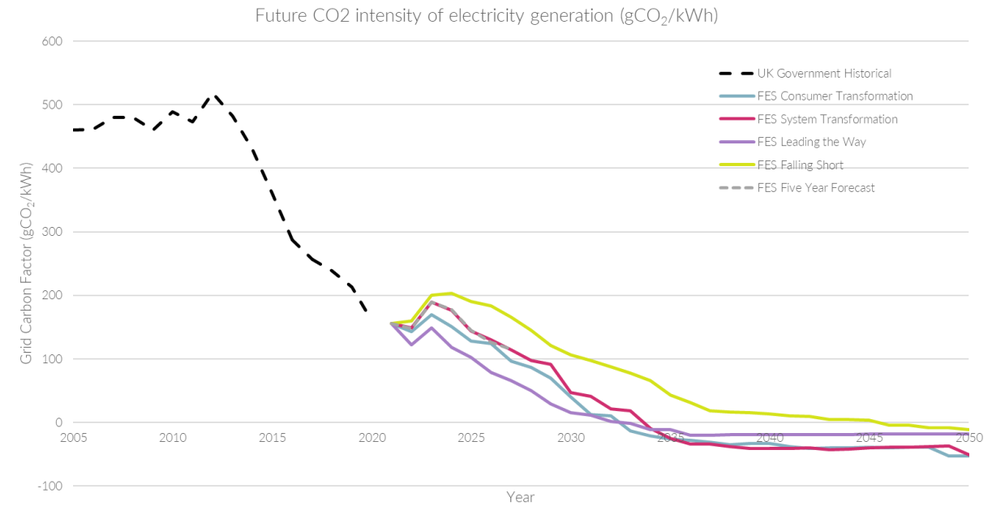


Figure 4 - National Grid Decarbonisation

As the national mix of electricity generation methods progresses towards greener solutions, the Building Regulations Part L 2021 value of the National Grid carbon factor has been shown to be substantially closer to how the grid is performing in reality.

Whilst the current Manchester planning policy calls for carbon emission reductions against Part L of the Building Regulations 2010, this energy strategy demonstrates the potential carbon emission reduction using the SAP 10.1 carbon emission factor of 0.136 as implemented in Part L2 (2021).

2.3 Summary.

The Proposed Development will have a reduced effect on climate change by a **2.70%** in CO_2 emissions associated with energy use compared to the Part L 2021 baseline. The proposed development inherently meets compliance with local policy by providing a betterment beyond Part L 2021 targets.

3. Assessment Methodology.

The Proposed Development has been assessed using The National Calculation Methodology to demonstrate compliance with Approved Document Part L2 (2021). The following is a summary of the data used and inputs/assumptions made.

3.1 Site context.

The images below show the Dynamic Simulation Model (DSM) and the satellite image of the site location.

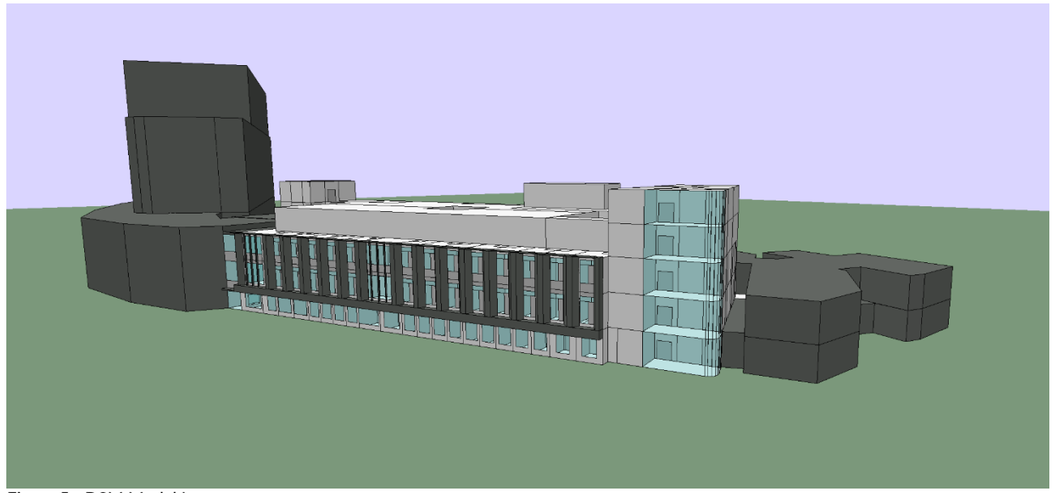


Figure 5 - DSM Model Image



Figure 6 - Satellite Image of Site Location

3.2 Architectural drawings.

The geometry used to assess Proposed Development was determined by the following information received on 12/09/2023.

Table 3 Architectural Information

Source	Data Type	Description
DAY Architects	Revit Model	DETACHED 08-09-2023 CASICD-DAY-XX-ZZ-M3-A-000001_Architectural Model R-2023

3.3 Site location and weather data.

A building's thermal performance is it's response to external environmental conditions. The more dependant a building is on passive features to achieve acceptable internal comfort, the more important the use of external weather information becomes.

Climate data is assigned to the virtual environment of the dynamic model to simulate external weather conditions that are likely to occur. Thermal comfort calculations require the simulation to be tested against CIBSE Design Summer Year (DSY) climate data.

The UK Meteorological Office (MO) collects weather data at stations across the UK. Climate variables measured at hourly intervals include air temperatures, wind speed and direction and air pressure etc.

CIBSE licenses the historic weather data from the MO for 14 locations in the United Kingdom: Belfast, Birmingham, Cardiff, Edinburgh, Glasgow, Leeds, London (3 sites), Manchester, Newcastle, Norwich, Nottingham, Plymouth, Southampton and Swindon.

The weather variables are synthesised into 2 types of CIBSE weather file type both the current and future climate:

- Design Summer Year (DSY): 2006 and 2016

  The DSY is a single continuous year rather than a composite one made up from average months. The DSY is used for overheating analysis.

- Test Reference Year (TRY): 2006 and 2016

  The TRY is composed of 12 separate months of data each chosen to be the most average month from the collected data. The TRY is used for energy analysis and for compliance with the UK Building Regulations (Part L).

The closest CIBSE weather file location for the proposed development is the Manchester TRY (2016).

3.4 Building Fabric Specification.

Optimising the development's fabric is seen to be the most robust and effective way to improve energy efficiency and in turn reduce carbon emissions whilst also impacting thermal comfort. The performance of the envelope i.e. material performance is unlikely to deteriorate significantly with time and therefore the benefits of these measures will continue at a similar performance for the duration of their installation.

The performance of the glazing has also been carefully considered to maximise natural daylight penetration to reduce the reliance of artificial lighting whilst also allowing a controlled amount of passive solar heating.

Useful solar heat gain reduces heating demand in winter but with careful consideration to the glazing specification, this will help limit solar gain in the summer which would therefore reduce the potential risk of glare and overheating.

The target building fabric performance is detailed below:

Table 4 - Fabric and Construction Parameters

Parameter	Value
Fabric Air Permeability ($m^3/m^2.h$ at 50Pa)	3.00
External Wall U-value ($W/m^2.K$)	0.12
Spandrel Panel U-value ($W/m^2.K$)	1.20
Ground Floor U-value ($W/m^2.K$)	0.10
Roof U-value ($W/m^2.K$)	0.11
Glazing U-value ($W/m^2.K$) (glazed door & windows)	1.20
Glazing g-value	0.40
Glazing light transmittance	71 %
Personnel Door U-value (W/m^2K) – Solid / Glazed	2.20 / 1.60

4. Part L Assessment.

The proposed development has been assessed against the most current version of Part L which is 2021.

4.1 Part L2 assessment results.

Table 5 and Figure 7 how the results for the Building Emission Rate (BER) in comparison to the Target Emission Rate (TER) for the Be Lean scenario.

4.1.1 Renewable Energy (Be Green).

The Manchester Core Strategy Plan requires a reduction in emissions over the Part L notional baseline for all proposed developments. The following table demonstrates the impact of energy efficiency measures on the compliance margin when all proposed energy efficiency measures, systems and renewable energy sources are assessed. This includes low carbon electrically led air source heat pumps as well as PV panels that generates an annual yield of 84,692 kWh/year required for compliance which equates to a ~755m^2 array dependant on panel area, orientation and efficiency.

Table 5 - Compliance Results for Energy Efficiency Measures.

Part L 2021	BER (TonnesCO_2/year)	TER (TonnesCO_2/year)	Percentage Betterment
	13.56	13.94	2.70%
	BPER (kWh/m^2/year)	TPER (kWh/m^2/year)	Percentage Betterment
	147.67	152.33	3.05%

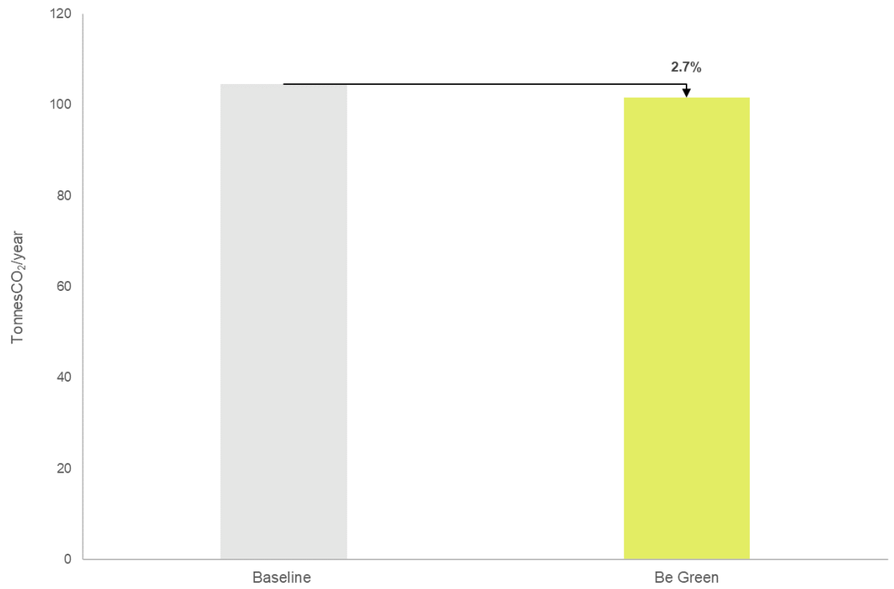


Figure 7 - Be Green Compliance

Overall, it is anticipated that the Proposed Development will achieve up to a 2.70% reduction in CO_2 emissions beyond the Building Regulations Part L 2021 'baseline' Target Emission Rate (TER) based on Part L2 (2021) carbon factors when the extension is assessed. The TER baseline is a benchmark determined by the Part L notional case and is the minimum requirement set by Part L in order to gain compliance with Building Regulations.

Appendix A: Simulation Modelling.

A dynamic simulation model was created to assess the design.

Integrated Environmental Solutions Virtual Environment (IESve) is a Dynamic Simulations Modelling (DSM) software package that has the capabilities of enabling the user to create a virtual representation of a building.

The results presented in this report were calculated using the approved compliance software IESve 2023 (v2023.1.0.0) for Part L modelling.

The IESve model for the Proposed Development was drawn based on the information received as listed in Section 3.2 Architectural drawings.

Modelling disclaimer.

It should be noted that the data generated by this work is obtained using computer simulations. These simulations are the best means of predicting the performance of the building at this stage. Full certainty can only be achieved by measuring the performance of the building and associated systems after a period of use.

The actual performance and/or energy usage for the building once occupied may vary from the calculated values submitted to Building Control. These differences will occur due to a number of variable parameters between the modelled building and the actual building. Such differences will include the hours of operation, levels of occupancy, how the plant is used and the design criteria with regards to how the rooms are environmentally controlled.

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

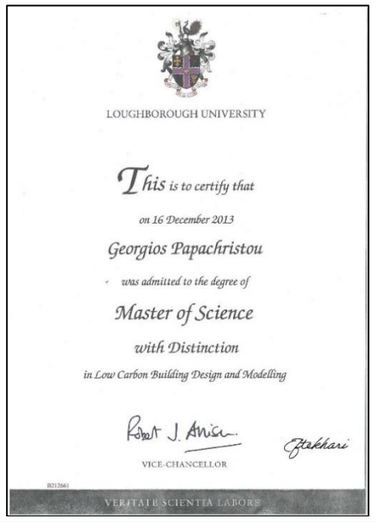
Appendix C: Suitably Qualified Energy Modeller.

This section provides details of the Suitably qualified energy modeller involved in these works.

This is defined as an individual who:

- Holds a degree or equivalent qualification in building services or a sustainability related subject
- Has a practical experience of conducting energy modelling and has appropriate knowledge of the tool being used, e.g. has attended training by independent providers.
- Is a member of a professional body such as CIBSE.

George Papachristou


LOUGHBOROUGH UNIVERSITY

This is to certify that

on 16 December 2013

Georgios Papachristou

was admitted to the degree of

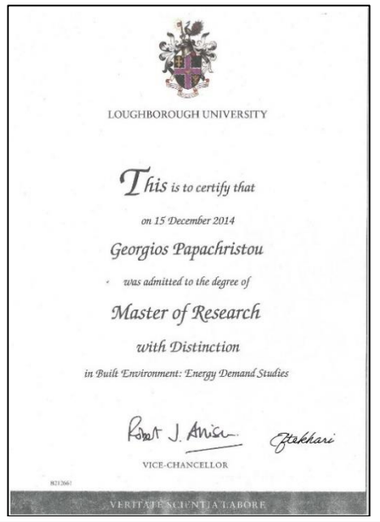
Master of Science

with Distinction

in Low Carbon Building Design and Modelling

VICE-CHANCELLOR

VERITATE SCIENTIA LABORE


LOUGHBOROUGH UNIVERSITY

This is to certify that

on 15 December 2014

Georgios Papachristou

was admitted to the degree of

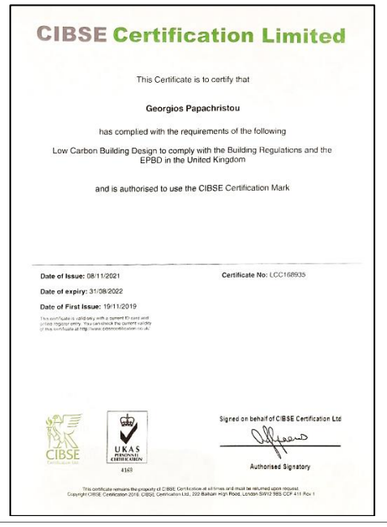
Master of Research

with Distinction

in Built Environment: Energy Demand Studies

VICE-CHANCELLOR

VERITATE SCIENTIA LABORE


CIBSE Certification Limited

This Certificate is to certify that

Georgios Papachristou

has complied with the requirements of the following

Low Carbon Building Design to comply with the Building Regulations and the EPBD in the United Kingdom

and is authorised to use the CIBSE Certification Mark

Date of Issue: 08/11/2021

Certificate No: LCC168935

Date of expiry: 31/08/2022

Date of First Issue: 19/11/2019

Signed on behalf of CIBSE Certification Ltd

Authorised Signatory


CIBSE Certification Limited

This Certificate is to certify that

Georgios Papachristou

has complied with the requirements of the following

Low Carbon Energy Assessor Level 5 for the production of Energy Performance Certificates to meet the requirements of the Energy Performance of Buildings Regulations in England, Wales and Northern Ireland AND Low Carbon Building Design to comply with the Building Regulations and the EPBD in the United Kingdom AND Computer Software for the Simulated Evaluation of Environmental Performance of Buildings related to Building Regulations in the United Kingdom

and is authorised to use the CIBSE Certification Mark

Date of Issue: 15/02/2022

Date of expiry: 31/08/2022

Date of First Issue: 15/02/2022

Signed on behalf of CIBSE Certification Ltd

Authorised Signatory

Appendix B: Calculation Parameters.

Building Specification.

The target building fabric performance is detailed below:

Table 6 - Fabric and Construction Parameters

Parameter	Value
Fabric Air Permeability ($m^3/m^2.h$ at 50Pa)	3.00
External Wall U-value ($W/m^2.K$)	0.12
Spandrel Panel U-value ($W/m^2.K$)	1.20
Ground Floor U-value ($W/m^2.K$)	0.10
Roof U-value ($W/m^2.K$)	0.11
Glazing U-value ($W/m^2.K$) (glazed door / windows)	1.20
Glazing g-value	0.40
Glazing light transmittance	71 %
Personnel Door U-value (W/m^2K) – Solid / Glazed	2.20 / 1.60

System summary.

Table 7 - System Inputs

	Constant Air Volume AHU s&e	Constant Air Volume AHU extract	Variable Air Volume s&e	FCUs – AHU s&e	FCUs – AHU extract	Radiant Panels AHU s+e	Radiant Panels AHU extract
System type	Variable fresh air rate	Variable fresh air rate	Single-duct VAV	Fan Coil Units (future tenant install)	Fan Coil Units (future tenant install)	Central heating using water: radiators	Central heating using water: radiators
Heating source	Air Source Heat Pump	Air Source Heat Pump	Air Source Heat Pump	Air Source Heat Pump	Air Source Heat Pump	Air Source Heat Pump	Air Source Heat Pump
Heating fuel	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity
Heating efficiency (COP)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Cooling System type	Air cooled	Air cooled	Air Source Heat pump	Air Source Heat pump	Air Source Heat pump	-	-
Cooling Fuel	Electricity	Electricity	Electricity	Electricity	Electricity	-	-
Cooling Seasonal Energy Efficiency Ratio (SEER)	4.43	4.43	4.43	4.43	4.43	-	-
Ductwork Leakage tested	Class B	Class B	Class B	Class B	Class B	-	-
AHU CEN Leakage Standards	Class L2	Class L2	Class L2	Class L2	Class L2	-	-
AHU Specific Fan Power	1.6 W/l/s	-	1.6 W/l/s	1.6 W/l/s	1.6 W/l/s	1.60 W/l/s	-
Pump Type	Variable speed multiple pressure sensors	Variable speed multiple pressure sensors	Variable speed multiple pressure sensors	Variable speed multiple pressure sensors	Variable speed multiple pressure sensors	-	-
System Metering	Yes	Yes	Yes	Yes	Yes	Yes (electricity metering)	Yes (electricity metering)
Out of Range warning	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ventilation Type	Centralised Balanced A/C Mech	Zonal extract system with remote fan	Centralised Balanced A/C Mech	Centralised Balanced A/C Mech	Centralised Balanced A/C Mech	Centralised Balanced A/C Mech	Zonal extract system with remote fan
Air Supply						-	-
Heat Recovery	Plate heat exchanger	Plate heat exchanger	Plate heat exchanger	Plate heat exchanger	Plate heat exchanger	-	-
Seasonal Efficiency	80%	80%	80%	80%	80%	-	-
Variable Heat Recovery Efficiency	No	No	No	No	No	No	No
System Controls	Local Temp Control	Local Temp Control	Local Temp Control	Local Temp Control	Local Temp Control	Local Temp Control	Local Temp Control
Terminal Specific Fan Power:	-	0.5 W/l/s	-	0.25 W/l/s	0.25 W/l/s	-	0.4 W/l/s
Local Extract	-	-	-	-	-	-	-
Local Extract Specific Fan Power:	-	-	-	-	-	-	-
Extract Flow Rate	-	-	-	-	-	-	-
Demand Controlled Ventilation (DCV)	-	-	-	Yes- gas sensors, speed control	Yes- gas sensors, speed control	-	-
DCV Airflow Regulation	-	-					
Zones Applicable	Scanning, imaging, consultation, preparation, recovery, and bedrooms; lab	Corridor, touchdown, changing rooms	Reception office and area, sub wait, atrium, consult/exam room, equipment bay, pantry	Office, staff rest, reception, waiting, breakout lounge, UPS room, CT scanner room	Undetermined Spaces	Utility rooms, lobbies, assisted bathroom, interventional equipment room	Store, lead gowns

Air Handling Units (AHU): Ventilation Specific Fan Powers (SFPs).

* Specific Fan Powers (SFPs) based on Manufacturer's data

Table 8 - AHU and SFP Inputs

Zones	Terminal Unit (SFP)	Extract (ACH)	Extract (SFP)
WCs, lobbies, linen	-	6	0.4 W/l/s
Reception, waiting, office, staff rest, breakout lounge, CT scanner room	0.25 W/l/s	-	-

Domestic Hot Water Systems.

Table 9 - DHW Inputs

Domestic Hot Water system		DHW Storage System	Point of Use (POU) System
	Heating fuel	Electricity	Electricity
	Heating efficiency	1.00	1.00
Storage	Storage (litres)	2,000	-
	Storage losses(kWh/l/day)	0.00220	-
Secondary Circulation	Circulation Losses (W/m)	5.00	-
	Pump Power (kW)	0.20	-
	Loop Length (m)	2500	-
	Time Switch	Yes	Yes

Lighting Parameters.

Table 10 - Lighting Inputs

Space	Storey	NCM Lux	Design Lux (if different)	Installed Power Density (W/m^2/100 lux)*	Lighting lm/W	Light Output Ratio (LOR)	Radiant Fraction	Constant illuminance control	Lighting Controls *	Photoelectric (Daylight) Control	Total Parasitic Power (W/m^2)	Time Switch	Display lamps (lm/W)
Plant rooms	Roof	200	-	2.00	-	1.0	0.45	No	Man On – Auto - Off		0.10	-	
Circulation	GF and above	200	-	1.75	-	1.0	0.45	No	Auto On – Off		0.10	-	
Store	GF and above	200	-	1.30	-	1.0	0.45	No	Man On – Auto Off		0.10	-	
WCs	GF and above	200	-	2.50	-	1.0	0.45	No	Auto On – Off		0.10	-	
Comms	GF and above	200	-	2.00	-	1.0	0.45	No	Man On – Auto Off		0.10	-	
Utility	GF and above	100	-	1.30	-	1.0	0.45	No	Man On – Auto Off		0.10	-	
Changing	GF and above	200	-	2.50	-	1.0	0.45	No	Auto On – Off		0.10	-	
Lobby	GF and above	200	-	1.75	-	1.0	0.45	No	Auto On – Off	Dimming, Addressable – Only in perimeter zones	0.10	-	
Circulation	GF and above	200	-	1.75	-	1.0	0.45	No	Auto On – Off	Dimming, Addressable – Only in perimeter zones	0.10	-	
Reception/waiting	GF and above	200	-	1.30	-	1.0	0.45	No	Auto On – Off	Dimming, Addressable – Only in perimeter zones	0.10	-	Y- 80 lm/W
Office	GF and above	300	-	1.30	-	1.0	0.45	No	Man On – Auto - Off	Dimming, Addressable – Only in perimeter zones	0.10	-	
Consultation	GF and above	500	-	1.50	-	1.0	0.45	No	Man On-Dimmed	Dimming, Addressable – Only in perimeter zones	0.10	-	
Bedrooms	GF and above	500	-	1.20	-	1.0	0.45	No	Man On-Dimmed	Dimming, Addressable – Only in perimeter zones	0.10	-	
Scanning/imaging	GF and above	500	-	1.20	-	1.0	0.45	No	Auto On – Off		0.10	-	

Table 10 shows the target installed power densities and lighting controls for each space. The values are specified as an average for these space types. Lighting loads have been set at the W/m^2/100 lux shown below. It is considered that this lighting level is achievable and could be bettered, as such the Luminaire Efficacy (lm/W) and Light Output Ratio (LOR) values can be ignored.

* Values assumed for the majority of rooms – a full breakdown of each individual room can be provided in request

+ Applied to Perimeter areas only

* Lighting Controls are defined as follows:

Auto On – Auto Off: Specifies presence detection sensors within the space which automatically switches lighting on when occupants are detected and switches lighting off when the space is detected to be unoccupied.

Manual On – Auto Off: Specifies absence detection sensors within the space. Lighting is required to be manually switched on. Automatically switches lighting off when the space is detected to be unoccupied.

Appendix D: BRUKL Outputs.

Be Green.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Christie Rev05 - extended glazing As designed

Date: Tue Sep 12 10:18:20 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.22
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.22
BRUKL compliance module version: v6.1.e1

Foundation area [m^2]: 1236.76

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	13.94	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	13.56	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	152.33	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	147.67	
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	GF000007:Surf[1]
Floors	0.18	0.1	0.1	GF000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.11	0.11	GF000003:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	GF000007:Surf[2]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	GF000001:Surf[4]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = 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	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	7494.9	7494.9
External area [m^2]	7151.7	7151.7
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	1753.2	2281.9
Average U-value [W/m^2K]	0.25	0.32
Alpha value* [%]	25.88	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
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
99	**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
	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	2.25	1.59
Cooling	6.81	5.39
Auxiliary	36.18	27.11
Lighting	21.54	29.4
Hot water	43.14	39.89
Equipment*	111.33	111.33
TOTAL**	**109.92**	**103.38**

* 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	11.3	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*11.3*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	101.11	105.84
Primary energy [kWh_{PE}/m^2]	147.67	152.33
Total emissions [kg/m^2]	13.56	13.94

HOARE LEA

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