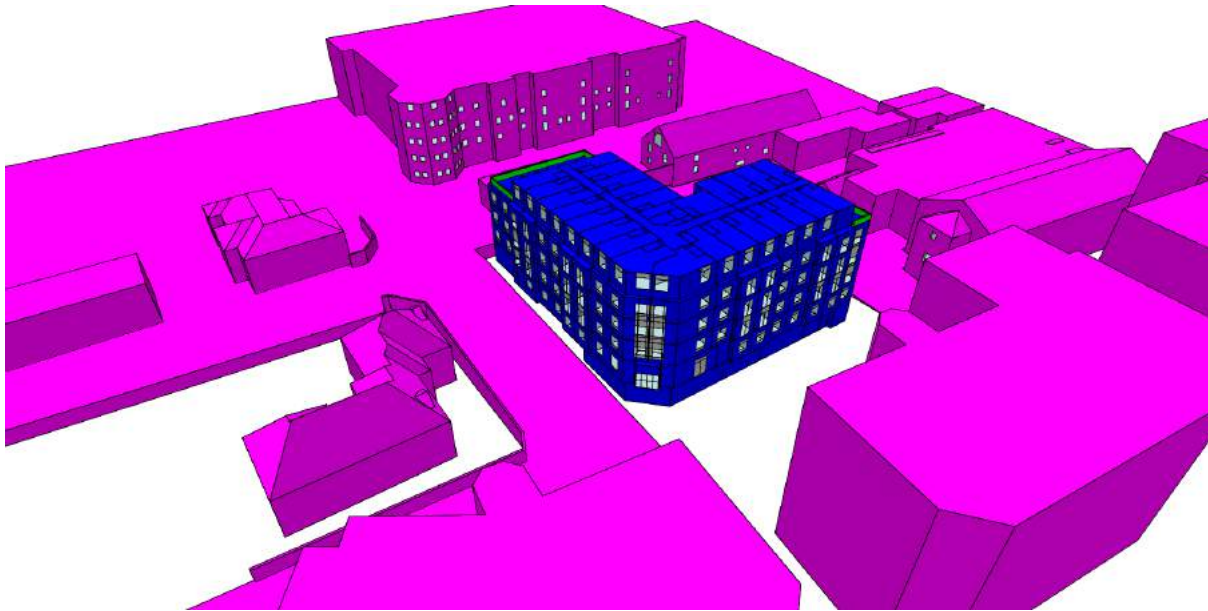


**ENERGY STRATEGY REPORT FOR
EAST STREET
PROPOSED STUDENT ACCOMMODATION
READING
5 STOREY SCHEME**



Date: 10th December 2018
Revision: 6
Our Ref:
Author: NRB
Checked: PML

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APPENDICES

APPENDIX A	BRUKL and EPC Updated Model 4
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1 EXECUTIVE SUMMARY

This document outlines the Part L2A (2013) analysis carried out for the proposed East Street development in Reading as prepared by Wilson Gray Consulting Ltd. Dynamic thermal modelling has been employed utilising IES software, to determine how the building performs in compliance terms and to underpin the building services design rationale and analysis updated to include the revised 5 storey, 135 bedroom plus basement proposal.

The primary purpose of this document is to establish and demonstrate how the project can meet the requirements of Reading Borough Council's energy policies along with the requirements of Part L2a (2013 with 2016 amendments). WGC have reviewed the relevant policy documentation and along with input from the planning consultant, DP9 have agreed and established a target of 19 % betterment in carbon reduction.

The report has also taken due cognisance of the 'Energy Hierarchy' which is recognised nationally.

The model we built for this report changed from the previously submitted report prepared by others, to increase to two number CHP with a 75 kW thermal contribution to offset the requirement for the PV and thus allowed the revised model to omit the PV.

To reduce the energy consumption of the development and to assist in achieving a Building Regulation Part L 2013 compliant development, the following design measures are recommended and will need to be incorporated into the detailed design:-

- Building fabric construction U-values significantly improved compared with standard Building Regulations U-values;
- Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers;
- On-site efficient energy generation through the use of CHP generators
- High-efficient Air-Source Heat Pumps and MVHR providing heating to key building areas such as study areas and the cinema;
- HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values;
- High efficiency LED lighting utilizing low-energy control systems such as daylight dimming and occupancy sensing.

The present option that has been considered in order to demonstrate compliance with Building Regulations Part L2A (2013) is generally as follows:

Updated Model 4

- Electric Heating to all Bedrooms and Studios
- Electric heating and Electric Heating frost protection to some ancillary areas
- Air sourced heat pumps [ASHP] to the following areas
 - Comms Room
 - Lounge
 - Office/Reception
 - Cinema
 - Basement and Ground Floor Social Space
 - Gym
 - Dinner Party Room
- Standalone CHP and Gas fired domestic hot water heaters

The DHW system modelled is via a lead gas-fired Combined Heat and Power (CHP) unit with indirect gas-fired water heaters for backup at periods of high demand and CHP maintenance.

Reading Borough Councils planning guidance where a percentage of the total energy demand of the development has been sourced from Low or Zero Carbon (LZC) energy sources is predicted to be achieved. The following outcome in terms of % renewable technology contribution is detailed further in section 10 of this report. The predicted carbon savings are as follows :-

Updated Model 3	16.63% Renewable Contribution
Updated Model 3	19.03% Reduction in Carbon [BER/TER]

2 INTRODUCTION

Wilson Gray Consulting Limited are an MEP and building physics consultant any who also specialist in sustainability report on behalf of clients. On this occasion we have been engaged by the client, Studios Development (Reading) Ltd to undertake an energy study to predict the carbon savings and % betterment of the proposed development, a 135 bedroom new build student residential scheme situated on the current car park site.

The purpose of this report is to outline the initial Building Regulations Part L2A 2013 analysis carried out for the proposed East Street development in Reading. The data within this report shows how the building performs in compliance terms and is thus intended to represent the current design rationale of the building following feedback from planning and a reduction in the building mass.

This report summarises the input data and analysis procedure adopted. The model and analysis have been created using IES Virtual Environment v.2018.1.0.0 software which has the approval of the BRE and is accredited to the requirements of the guidelines as set out in CIBSE publications AM11 and TM33.

The report and simulation represent a simulation of the predicted outcomes based on reasonable assumptions which will be carried through in the detailed design stage at RIBA stage 5 to ensure the outcomes are as required and predicted within this document and by the planning policy guidance.

The Design team have been considering the scheme and renewable technologies and the impact on the scheme.

The planning requirements are to have a percentage of regulated energy generated from onsite renewable technologies is to be achieved. This has been considered within our report and it was felt that a combination of technologies offer the best whole life solution to the scheme.

The Design team and client have collaboratively worked together to understand the benefits of the proposed scheme, along with the impacts of the site.

The following LZC options have been considered and are based on Regulation 25 - Renewable Technologies.

- Micro CHP units

- Air Sourced Heat Pumps

1.1 Energy Policy Background

the principles for delivering a low-carbon development lies within the UK planning systems implemented through both local /regional planning policies and wider national guidance. A review of all relevant documentation was reviewed alongside DP9 to arrive at the target figure of 19 % betterment. Another key consideration is the revised National Planning Policy Framework , published 14th July this year which sets out the framework for planning policy and how these are expected to be delivered.

The three key objectives of the planning system as identified within the NPPF in achieving sustainable development are as follows : -

- an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
- a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
- an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Planning plays a key role in helping shape places to radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. The NPPF does not include detailed measures on sustainable design codes and standards to apply, although expects that when setting any local requirement for a building's sustainability, local planning authorities should do so in a way consistent with the national technical standards

1.2 Reading Borough Council Planning Policy.

The key policies which require consideration for this report are the following 2 adopted policies :

- 1) Core strategy (adopted 2006, with amendments 2015)
- 2) Sustainable design and construction (adopted July 2011)

In addition to the above RBC is also working on finalisation and implementation of the new local plan which will replace the current development plan policies, detailing future plans up to 2036. Whilst the currently adopted policies require a 20 % betterment, Policy H4 'Standards for new housing' requires at a minimum, a 19% improvement in the dwelling emission rate over the TER s defined in the Building Regulations 2013. Therefore this is the rate to be targeted.

3 BUILDING FORM & GEOMETRY

The scheme comprises the redevelopment of an existing car park site which will house a new five -storey and basement student accommodation building with ancillary support accommodation.

Building design, layout and massing have been developed with the aim of minimising operational energy usage as follows:

- The building layout and orientation provides reasonable self-shading to a large proportion of the occupied areas.
- All occupied areas have an external façade to allow occupant controlled natural ventilation via opening windows.
- Glazed areas provide a balance between maximising day-lighting and reducing heat loss/gain.
- Good levels of insulation, in excess of the minimum building regulations standards.
- A low target air permeability lower than the notional standard set within the latest Compliance calculation software tools

The model geometry has been extracted from the available Architectural drawings provided to ensure geometrical accuracy and thus be a detailed representation of the proposed building form. Model images are detailed overleaf.

Figure 3.1: Model image

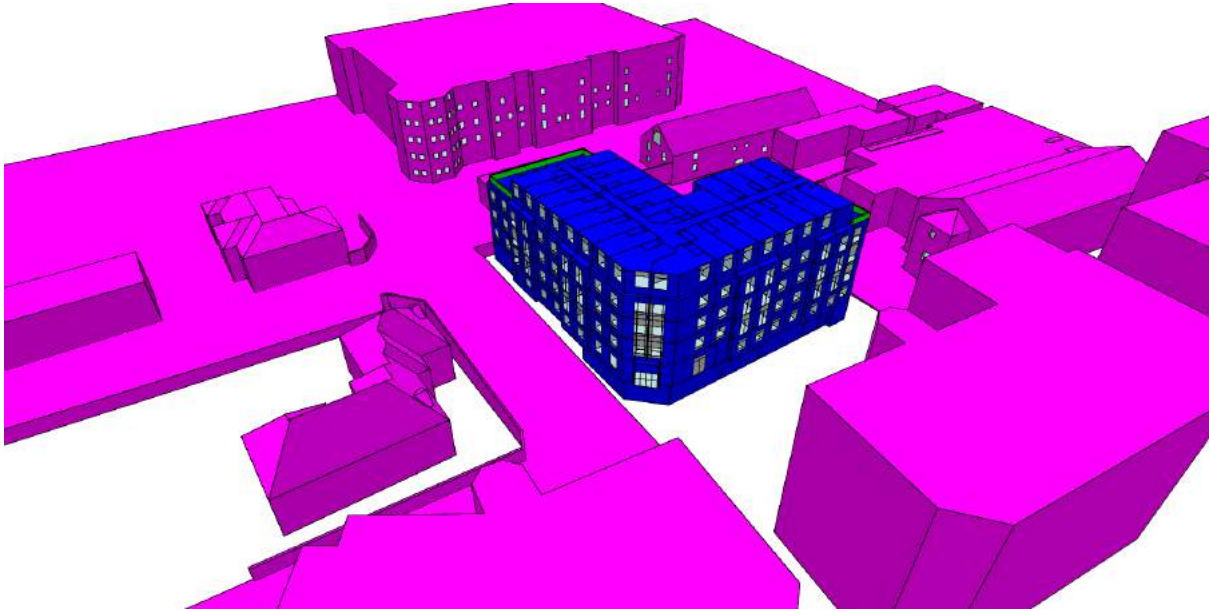
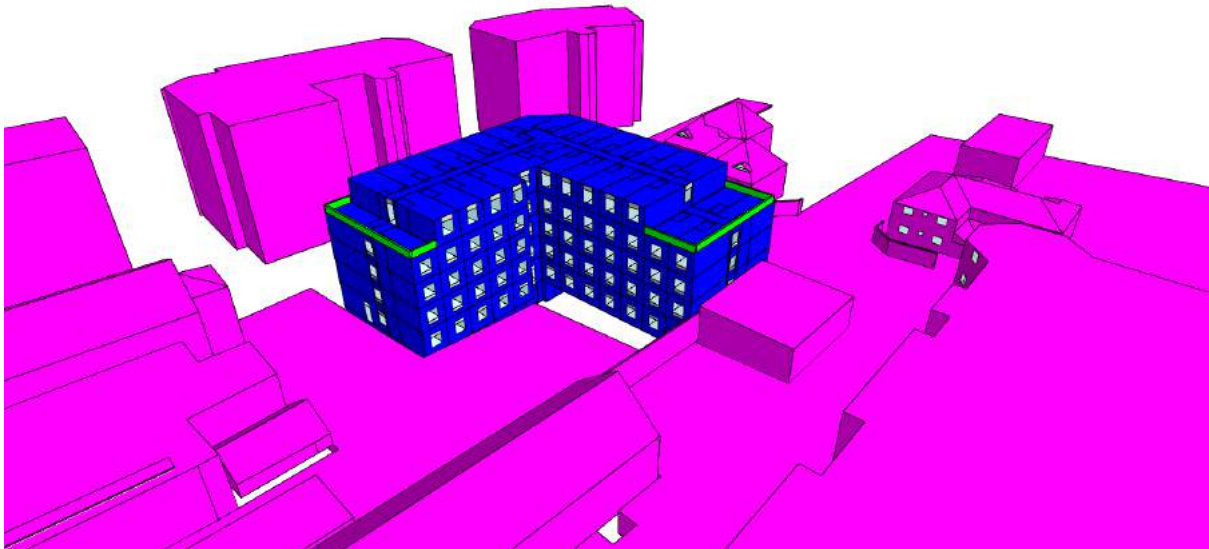


Figure 3.2: Model image



4 CONSTRUCTION DATA

The following constructions have been input into the analysis model. U-values have been provided and are better performing than limiting values stipulated by Building Regulations to reduce the carbon emissions associated with heating use.

Table 4.1: Construction data from BRUKL certificate

Element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	0000001A:Surf[3]
Floor	0.25	0.2	0.22	0R000000:Surf[1]
Roof	0.25	0.18	0.18	00000016:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.31	1.4	0R000000:Surf[2]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _{a-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		4	

Table 4.2: Construction data improvement over minimum ADL2 Limiting Values

		Elemental U Values Minimum Standards 2013		Proposed Elemental U Values		Proposed Elemental U Values Improvements over Minimum Standards
Element	Walls	0.35	W/m2K	0.26	W/m2K	25.71%
	Ground Floor	0.25	W/m2K	0.2	W/m2K	20.00%
	Exposed Floor	0.25	W/m2K	0.2	W/m2K	20.00%
	Windows	2.2	W/m2K	1.3	W/m2K	40.91%
	Roof	0.25	W/m2K	0.18	W/m2K	28.00%

Glazing is stated as comprising of 6mm Low-E double glazing – 16mm Air – 6mm Clear glass and has the following photometric properties:

- Visible light transmittance: 71%
- G-value: 0.40
- With blinds. Yes {Blinds not used in BRUKL Calculation}

5 WEATHER DATA & SITE ORIENTATION AND LOCATION

5.1 SITE LOCATION :-

The 0.3 acre site is located to the current carpark to the South of New Century Place, fronting East Street in Reading. The car park is no longer in use with the exception of a substation which is to be relocated as part of the works pending a new planning application.

5.2 WEATHER DATA

CIBSE Test Reference Year (TRY) weather data for Swindon has been applied to the model. This is the closest and most appropriate weather file for the Reading area and comprises of hourly data for 12-typical months, selected from around 20-year data sets. The TRY weather file is used for all Part L and EPC calculations and has been verified by the CL2.1 SBEM weather data locations lookup spreadsheet.

Figure 5.1: Extract-CL2.1 SBEM spreadsheet

CL2.1 SBEM Weather Locations Lookup			
England & Wales Postcode Areas Lookup			
			SBEM Weather Location
Search:	RG	Swindon	
Type the Post Area in the green field above, then press 'enter' to lookup the SBEM Location			

Figure 5.2: UK Building Regulations simulation weather data

ApacheSim

Simulation Weather File: SwindonDSY05.fwt

Select

Nearest

Get more weather files from iesve.com

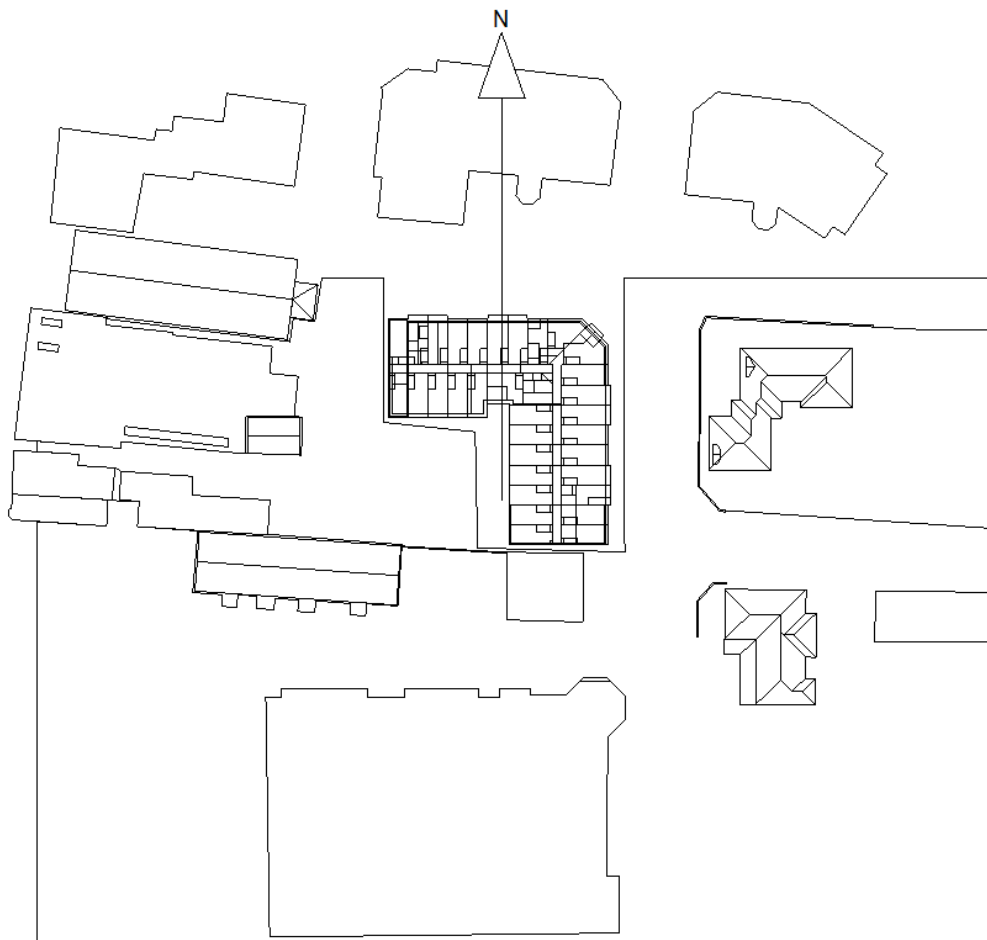
UK Building Regulations

City: Swindon

Select

Simulation Weather File: SwindonTRY05.fwt

Figure 5.3: Site orientation



6 ROOM TEMPLATES & BUILDING DEFINITION

The building definition identifies the type of building it is and what design data will be used. This sets the basis for the calculation parameters prior to simulation.

Figure 6.1: Building settings

Room template data is derived from the National Calculation Methodology (NCM) database collated by the Department of Communities and Local Government (DCLG) for Part L2 and EPC compliance assessment. Each type of space has been assigned an NCM template relative to the activity associated with it as detailed below:

Table 6.2: Summary of room template data

Space Name (Actual)	NCM Building Area Type (Actual)	NCM Activity (Actual)
0.01 Studio Bathroom	C2: University or college <from template>	NCM C2Uni: Bathroom <from template>
0.11 Premium Bathroom	C2: University or college <from template>	NCM C2Uni: Bathroom <from template>
0.11 Premium	C2: University or college <from template>	NCM C2Uni: Bedroom <from template>
2.29 Studio	C2: University or college <from template>	NCM C2Uni: Bedroom <from template>
-1.Stair 2	C2: University or college <from template>	NCM C2Uni: Circulation area <from template>
-1.Corridor	C2: University or college <from template>	NCM C2Uni: Circulation area <from template>
-1.Library and Study Room	C2: University or college <from template>	NCM C2Uni: Classroom <from template>
-1.Cleaner	C2: University or college <from template>	NCM C2Uni: Cupboard <from template>
-1.Store	C2: University or college <from template>	NCM C2Uni: Cupboard <from template>
-1.Dinner Party Room	C2: University or college <from template>	NCM C2Uni: Eating/drinking area <from template>
-1.Cinema	C2: University or college <from template>	NCM C2Uni: Hall/lecture theatre/assembly area (Performance) <from template>
-1.laundry	C2: University or college <from template>	NCM C2Uni: Laundry <from template>
-1.Plant	C2: University or college <from template>	NCM C2Uni: Light plant room <from template>
-1.WC Acc	C2: University or college <from template>	NCM C2Uni: Toilet <from template>
-1.Comms	Other: Misc. 24hr Activities <from template>	NCM Misc24Hr: Server room <from template>

Air permeability Target has been modelled as 4.0 m³/(h.m²) at 50 Pa.

7 LIGHTING LOADS & CONTROL

No lighting loads or control details have been provided for the project. As such, details from similar projects have been input into the current model and are summarised below.

The lighting control strategy is generally as follows: Corridors, staircases and bathrooms will have automatic occupancy detection via PIR sensors. Remaining areas will have no occupancy detection or photocell daylight control.

Table 7.1: Summary of modelled lighting data

Space Name (Actual)	Gain 1 Lamp Efficacy (lm/W) (Actual)	Gain 1 Light Output Ratio (Actual)
-1.Cinema	98	1
-1.Cleaner	98	1
0.01 Studio Bathroom	98	1
0.11 Premium Bathroom	98	1
-1.Plant	98	1
-1.Dinner Party Room	98	1
-1.Store	98	1
-1.WC Acc	98	1
-1.laundry	98	1
-1.Stair 2	98	1
-1.Corridor	98	1
0.11 Premium	98	1
0.01 Studio	98	1
-1.Library and Study Room	98	1

Lighting control parasitic power has been assumed to be 0.05 W/m².

8 MECHANICAL SYSTEMS

8.1 VENTILATION SYSTEMS – STUDENT ACCOMMODATION

The analysis has considered ventilation for the student accommodation areas as follows:

1. Single bedrooms will be ventilated by means of central extract fans to the bathroom/en-suite areas [8 l/s] with make-up air via suitably sized trickle ventilators with enhanced Control.
2. Student Kitchen zones shall be will be ventilated by means of central extract fans to the bathroom/En-suite areas [13 l/s] with make-up air via suitably sized trickle ventilators with enhanced Control.
3. Rooms with Heat recovery ventilation shall also have demand control ventilation to allow the systems to operate from a setback to a boost condition when required under the dictates of a CO2 controller.

8.2 VENTILATION SYSTEMS – LANDLORD AND COMMUNAL AREAS

Extract ventilation will be provided from the Cleaner's rooms [8 l/s], communal WCs [13 l/s] and Laundry [6 ach-1] by means of individual extract fans with PIR control and overrun timers.

8.3 DOMESTIC HOT WATER

The primary method of providing domestic hot water will be from a CHP packaged unit located in the plant room, which will supply heat to a DHWS thermal store. Indirect gas-fired water heaters will be provided for periods when the CHP system is being maintained or at periods of high demand.

Figure 8.1: Example Technical details used in the analysis

☒ CHP Generator	
Source Consumption Meter:	Natural Gas: Meter 1
Performance at rated output:	CHPQA Quality Index: 105.000
Heat output (kW):	66.000
Thermal efficiency:	0.650
Power efficiency:	0.310
Performance at minimum output:	
Fraction of rated heat output:	0.200
Thermal efficiency:	0.670
Power efficiency:	0.298

- Fuel: Natural gas
- Heat output: 66Kw_h min
- Electrical output: 35 Kw_E
- Thermal efficiency: 65% @100%
- Electrical efficiency: 31% @ 100%

8.4 HEATING SYSTEMS

Bedrooms, Studios and some communal areas have been modelled using electric panel heaters. The main staircases, corridors and transient spaces will be provided with frost protection heating only and have therefore been modelled as occupied but unheated.

Comms room and areas detailed in section 8.1 have been modelled with VRF air source heat pump units.

Communal areas detailed in the following table shall be serviced with VRF heating and cooling units and heat recovery ventilation units and are an example selection of areas served.

Table 8.1: example HVAC assignments

Space Name (Actual)	System (Actual)	Aux. Vent System (Actual)	DHW System (Actual)
-1.Stair 2	01 Electric Panel Heaters Nat Vent	01 Electric Panel Heaters Nat Vent	03 LTHW DHWS
0.01 Studio Bathroom	02 Electric Panel Heaters Mech Extract	02 Electric Panel Heaters Mech Extract	03 LTHW DHWS
0.11 Premium Bathroom	02 Electric Panel Heaters Mech Extract	02 Electric Panel Heaters Mech Extract	03 LTHW DHWS
0.11 Premium	02 Electric Panel Heaters Mech Extract	02 Electric Panel Heaters Mech Extract	03 LTHW DHWS
2.29 Studio	02 Electric Panel Heaters Mech Extract	02 Electric Panel Heaters Mech Extract	03 LTHW DHWS
-1.laundry	02 Electric Panel Heaters Mech Extract	02 Electric Panel Heaters Mech Extract	03 LTHW DHWS
-1.WC Acc	02 Electric Panel Heaters Mech Extract	02 Electric Panel Heaters Mech Extract	03 LTHW DHWS
-1.Library and Study Room	04 VRF HRU	04 VRF HRU	03 LTHW DHWS
-1.Dinner Party Room	04 VRF HRU	04 VRF HRU	03 LTHW DHWS
-1.Cinema	04 VRF HRU	04 VRF HRU	03 LTHW DHWS
-1.Comms	05 Comms	05 Comms	03 LTHW DHWS
-1.Corridor	None <from template>	None <from template>	03 LTHW DHWS <from template>
-1.Cleaner	None	None	03 LTHW DHWS
-1.Store	None <from template>	None <from template>	03 LTHW DHWS
-1.Plant	None	None	03 LTHW DHWS

8.5 SUMMARY

The following details the Mechanical systems performance used in the analysis:

Table 8.2: HVAC Systems Performance Data

HVAC System Details	HVAC system name	01 Electric Panel Heaters Nat Vent
	NCM System Type	Other Local Room heater : Unfanned
Heating	Heat source	Direct or storage electric heater
	Fuel	Grid supplied electricity
	District Heating Carbon Factor	0.165
	Qualify for ECAs?	-
	Inst. On or after 1998?	Yes
	Does system use CHP?	No
	Heat Gen. SEER	1
Cooling	Pack chiller type	-
	Pack chiller power	-
	Chiller fuel type	-
	Qualify for ECAs?	-
	SEER	
	EER	
	Mixed Mode	-
System adjustment	Heat rejection [Pump and Fan Power %]	
	Ductwork Leakage tested	-
	AHU Leakage Tested	-
	Terminal Unit SFP (W/I/S)	
	Extract Fan SFP (W/I/S)	
	Extract rate [l/s/m2]	
	Supply SFP (W/I/S)	
Metering Provision	Variable speed pumps	-
	Met.	Yes
	Alarm for out of range	No
Ventilation	Cooling/vent Mechanism	Natural Ventilation
	Air supply mechanism	-
	Demand controlled ventilation	-
	Heat recovery method	-
	Variable Heat recovery efficiency	-
System Controls (EPC only)	Heat recovery efficiency	
	Central Time Control	-
	Optimum start/stop control	-
	Local time control	Yes
	Local temp control	Yes
Bivalent systems	Weather Comp control	No
	Heat source	
	Fuel	
	Gen Seff	
	% load	

HVAC System Details	HVAC system name	02 Electric Panel Heaters Mech Extract
	NCM System Type	Other Local Room heater : Unfanned
Heating	Heat source	Direct or storage electric heater
	Fuel	Grid supplied electricity
	District Heating Carbon Factor	1
	Qualify for ECAs?	-
	Inst. On or after 1998?	Yes
	Does system use CHP?	No
	Heat Gen. SEER	1
Cooling	Pack chiller type	-
	Pack chiller power	-
	Chiller fuel type	-
	Qualify for ECAs?	-
	SEER	
	EER	
	Mixed Mode	-
System adjustment	Heat rejection [Pump and Fan Power %]	
	Ductwork Leakage tested	-
	AHU Leakage Tested	-
	Terminal Unit SFP (W/I/S)	
	Extract Fan SFP (W/I/S)	0.40
	Extract rate [l/s]	[8 for En Suite] [13 For Studio room]
	Supply SFP (W/I/S)	
Metering Provision	Variable speed pumps	-
	Met.	Yes
Ventilation	Alarm for out of range	No
	Cooling/vent Mechanism	Mechanical Ventilation
	Air supply mechanism	Zonal extract with remote fan
	Demand controled ventilation	Yes [Trickle and Boost]
	Heat recovery method	-
	Variable Heat recovery efficiency	-
System Controls (EPC only)	Heat recovery efficiency	
	Central Time Control	-
	Optimum start/stop control	-
	Local time control	Yes
	Local temp control	Yes
Bivalent systems	Weather Comp control	-
	Heat source	
	Fuel	
	Gen Seff	
	% load	

System Details	system name	03 LTHW DHWS
		same as Heating system
Domestic Hot Water	DHW Delivery Efficiency	0.95
	Generator Type	Stand alone water heater
	Fuel Type	Gas
	Does the system have storage?	Yes
	Storage Volume (litres)	3000
	Storage Losses (kWh/l day)	0.0045
	Does the system have secondary circulation?	Yes
	Circulation Losses (W/m)	5.00
	Pump Power (kW)	0.1
	Loop Length (m)	1000
	Does the system use CHP	Yes
	Time Switch?	Yes
Solar Water Heating Panel		None
	Area (m ²)	
	Azimuth (° clockwise from North)	
	Tilt (° from horizontal)	
	Shading factor	
	Degredation factor	
	Conversion efficiency at ambient temp	
	first order heat loss coefficient (W/m ² K)	
	second order heat loss coefficient (W/m ² K)	
	Flow rate (l/h.m ²)	
	Pump Power (kW)	
	heat exchanger effectiveness	
Solar Water Heating Cylinder		
	Volume (litre)	
	Storage loss at max. temp (kWh/l.day)	
Bivalent systems	Heat source	None
	Fuel	
	Gen Seff	
	% load	

HVAC System Details	HVAC system name	04 VRF HRU
	NCM System Type	Split or multi-split system
Heating	Heat source	Heat pump [Electric]: air source
	Fuel	Grid supplied electricity
	Qualify for ECAs?	Yes
	Inst. On or after 1998?	Yes
	Does system use CHP?	No
	Heat Gen. SEER	4.5 min
Cooling	Pack chiller type	-
	Pack chiller power	-
	Chiller fuel type	-
	Qualify for ECAs?	-
	SEER	4.5 Min
	EER	3.5 Min
	Mixed Mode	Mechanical Ventilation
System adjustment	Heat rejection [Pump and Fan Power %]	
	Ductwork Leakage tested	Class worse than A, or not tested
	AHU Leakage Tested	Class L2
	Extract SFP (W/I/S)	
	Extract rate [l/s/m2]	
	Supply SFP (W/I/S)	1.40
Metering Provision	Variable speed pumps	-
	Met.	Yes
	Alarm for out of range	Yes
Ventilation	Cooling/vent Mechanism	Mechanical Ventilation
	Air supply mechanism	Central balanced A/C or mech vent system
	Demand controled ventilation	Yes
	Heat recovery method	plate heat exchanger
	Variable Heat recovery efficiency	Yes
	Heat recovery efficiency	0.775
System Controls (EPC only)	Central Time Control	Yes
	Optimum start/stop control	-
	Local time control	Yes
	Local temp control	Yes
	Weather Comp control	-
Bivalent systems	Heat source	-
	Fuel	-
	Gen Seff	
	% load	

HVAC System Details	HVAC system name	05 Comms
	NCM System Type	Split or multi-split system
Heating	Heat source	Heat pump [Electric]: air source
	Fuel	Grid supplied electricity
	Qualify for ECAs?	Yes
	Inst. On or after 1998?	Yes
	Does system use CHP?	No
	Heat Gen. SEER	3
Cooling	Pack chiller type	-
	Pack chiller power	-
	Chiller fuel type	-
	Qualify for ECAs?	-
	SEER	3
	EER	3
	Mixed Mode	-
	Heat rejection [Pump and Fan Power %]	
System adjustment	Ductwork Leakage tested	-
	AHU Leakage Tested	-
	Extract SFP (W/I/S)	
	Extract rate [l/s/m2]	
	Supply SFP (W/I/S)	
	Variable speed pumps	-
Metering Provision	Met.	Yes
	Alarm for out of range	Yes
Ventilation	Cooling/vent Mechanism	-
	Air supply mechanism	-
	Demand controled ventilation	-
	Heat recovery method	-
	Variable Heat recovery efficiency	-
	Heat recovery efficiency	
System Controls (EPC only)	Central Time Control	-
	Optimum start/stop control	-
	Local time control	Yes
	Local temp control	Yes
	Weather Comp control	-
Bivalent systems	Heat source	-
	Fuel	-
	Gen Seff	
	% load	

9 ELECTRICAL SYSTEMS

9.1 ADL2A MANAGEMENT FEATURES

The analysis has assumed a whole building electric power factor achieved by power factor correction of >0.95 .

9.2 METERING PROVISION

In terms of metering provision, the modelling has assumed that HVAC systems have provision for metering and that the metering warns of 'out-of-range' values.

9.3 SOLAR PV

Solar PV has not been included the this analysis

10 RESULTS

10.1 RESULTS [Model 3]

Figure 10.1: BRUKL Updated Model 2 result

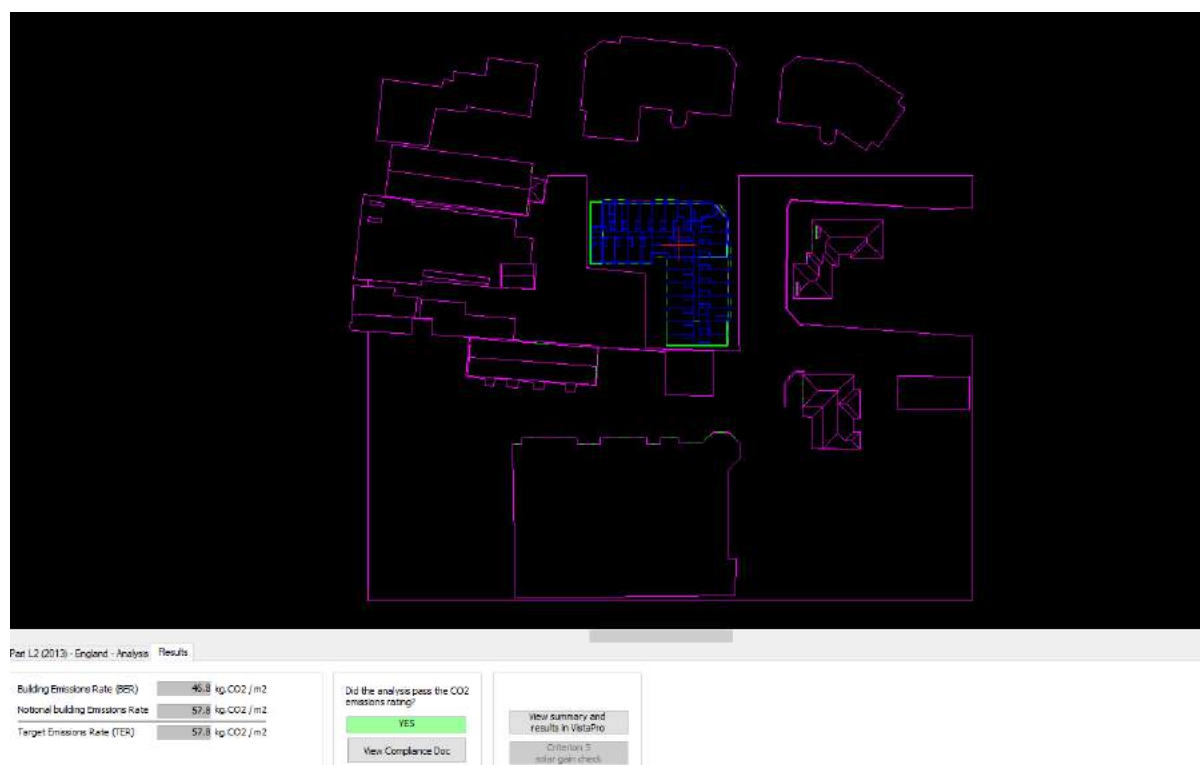
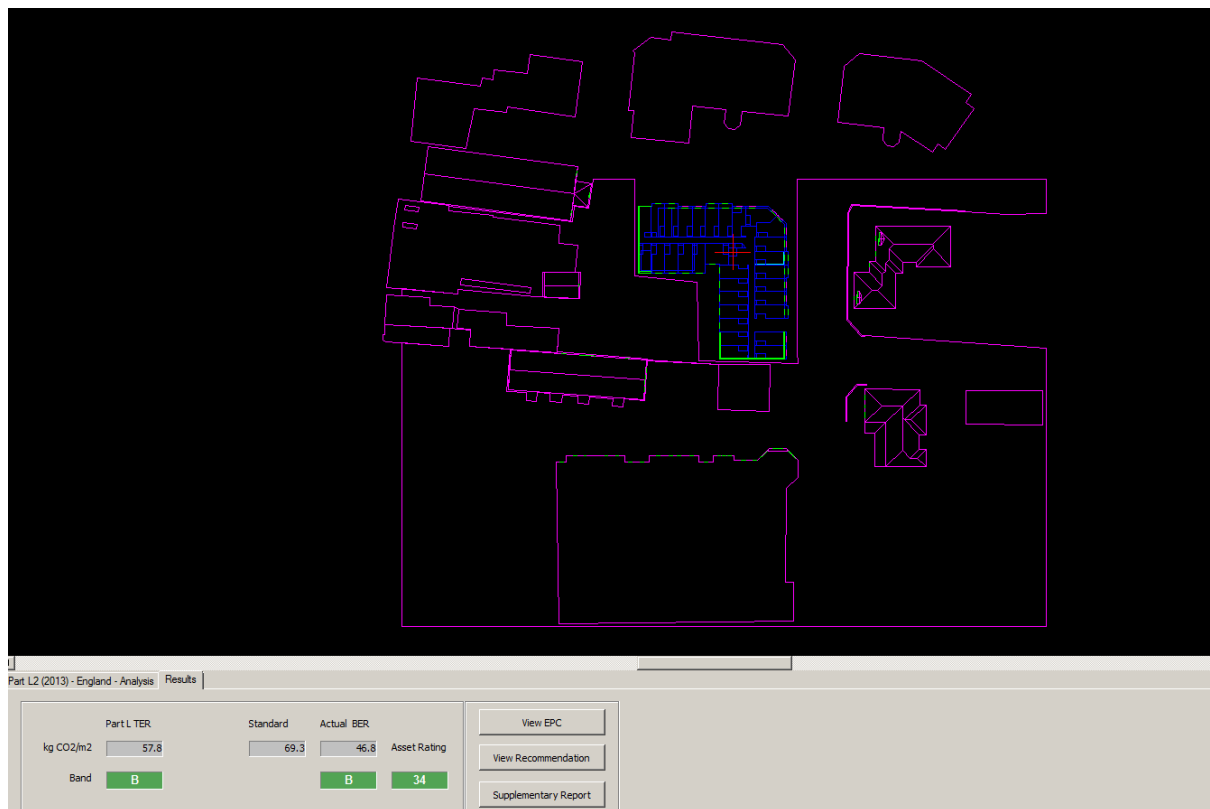


Figure 10.2: Regulated energy contribution from L2C energy source

	WGC Design Model 3 CHP only		
	Actual [kWh/m ²]	Notional [kWh/m ²]	Improvement [%]
Heating	44.32	67.54	34.38%
Cooling	0.3	0.39	23.08%
Auxiliary	2.28	2.69	15.24%
Lighting	5.41	10.38	47.88%
Hot water	170.41	136.34	-24.99%
Equipment	17.84	17.84	
Total	191.02	217.35	12.11%
	Actual [kWh/m ²]	Notional [kWh/m ²]	L2C Contribution [%]
Photovoltaic Systems	0	0	0.00%
Wind Turbines	0	0	0.00%
CHP generator	31.7	0	16.60%
Solar Thermal systems	0	0	0.00%
Heat Pump	0.08	0	0.04%
total			16.63%
TER	57.8	kgCO ₂ /annum	
BER	46.8	kgCO ₂ /annum	
Air Permeability	4	m ³ /[h.m ²]/@50Pa	
			19.03%

Figure 10.3: EPC Updated Model 3 result



APPENDIX A – BRUKL and EPC Updated Model 3

Please see attached PDF document.

Project name

181030 NCP3 Reading Model 3**As designed****Date:** Thu Nov 15 12:53:34 2018**Administrative information****Building Details****Address:** NCP3 No PV, Reading,**Certification tool****Calculation engine:** Apache**Calculation engine version:** 7.0.10**Interface to calculation engine:** IES Virtual Environment**Interface to calculation engine version:** 7.0.10**BRUKL compliance check version:** v5.4.b.0**Owner Details****Name:****Telephone number:****Address:** , ,**Certifier details****Name:** Wilson Gray Consulting**Telephone number:** 0191 691 6770**Address:** Swan Building, Prestwick Park, Newcastle upon Tyne, NE20 9SJ**Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	57.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	57.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	46.8
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	0.26	0.26	0000001A:Surf[3]
Floor	0.25	0.2	0.22	0R000000:Surf[1]
Roof	0.25	0.18	0.18	00000016:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.31	1.4	0R000000:Surf[2]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	4

Building services

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

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

1- 04 VRF HRU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	4.5	0	0	0.77
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- 05 Comms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	3.5	0	0	-
Standard value	2.5*	3.2	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- 02 Electric Panel Heaters Mech Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.3	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

4- 01 Electric Panel Heaters Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.3	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- 03 LTHW DHWS

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	105	0.31
Standard value	105	0.2

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		Zone	Standard
-1.Cinema	-	1.5	0	-	-	-	-	-	-	-	-	N/A
-1.Dinner Party Room	-	1.5	0	-	-	-	-	-	-	-	-	N/A
-1.laundry	-	-	0.4	-	-	-	-	-	-	-	-	N/A
-1.Library and Study Room	-	1.5	0	-	-	-	-	-	-	-	-	N/A
0. Foyer	-	1.5	0	-	-	-	-	-	-	-	-	N/A
0.01 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.01 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.02 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.02 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.03 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.03 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.04 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.04 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.05 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.05 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.06 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.06 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.07 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.07 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.08 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.08 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.09 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.09 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.10 Studio	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.10 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.11 Premium	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.11 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.12 Premium	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.12 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.13 Premium	-	-	0.4	-	-	-	-	-	-	-	-	N/A
0.13 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
0.14 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
0.14 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.15 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
0.15 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.16 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
0.16 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.17 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
0.17 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.18 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
0.18 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.19 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
0.19 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.20 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
0.20 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.21 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
0.21 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
0.22 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
0.22 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.01 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.01 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.02 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.02 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.03 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.03 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.04 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.04 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.05 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.05 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.06 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.06 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.07 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.07 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.08 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.08 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.09 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.09 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.10 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.10 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.11 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.11 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.12 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.12 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.13 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
1.13 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.14 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.14 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.15 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.15 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.16 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.16 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.17 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.17 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.18 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.18 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.19 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.19 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.20 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.20 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.21 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.21 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.22 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.22 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.23 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.23 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.24 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.24 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.25 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
1.25 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.26 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.26 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.27 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.27 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.28 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.28 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.29 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.29 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
1.30 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
1.30 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.01 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.01 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.02 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.02 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.03 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.03 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.04 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.04 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
2.05 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.05 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.06 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.06 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.07 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.07 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.08 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.08 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.09 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.09 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.10 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.10 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.11 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.11 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.12 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.12 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.13 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.13 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.14 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.14 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.15 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.15 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.16 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.16 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.17 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.17 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.18 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.18 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.19 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.19 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.20 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.20 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.21 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.21 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.22 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.22 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.23 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.23 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.24 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.24 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.25 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.25 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A	
2.26 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A	

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
2.26 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.27 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.27 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.28 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.28 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.29 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.29 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
2.30 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
2.30 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.01 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.01 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.02 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.02 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.03 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.03 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.04 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.04 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.05 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.05 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.06 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.06 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.07 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.07 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.08 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.08 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.09 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.09 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.10 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.10 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.11 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.11 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.12 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.12 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.13 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.13 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.14 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.14 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.15 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.15 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.16 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.16 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.17 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.17 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
3.18 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.18 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.19 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.19 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.20 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.20 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.21 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.21 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.22 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.22 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.23 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.23 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.24 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
3.24 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.25 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.25 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.26 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.26 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.27 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.27 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.28 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.28 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
3.29 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
3.29 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.01 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.01 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.02 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.02 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.03 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.03 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.04 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.04 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.05 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.05 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.06 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.06 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.07 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.07 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.08 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.08 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.09 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.09 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.10 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
4.10 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.11 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.11 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.12 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.12 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.13 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.13 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.14 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.14 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.15 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
4.15 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.16 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
4.16 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.17 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
4.17 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.18 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
4.18 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.19 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
4.19 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.20 Premium	-	-	0.4	-	-	-	-	-	-	-	N/A
4.20 Premium Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.21 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.21 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.22 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.22 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.23 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.23 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A
4.24 Studio	-	-	0.4	-	-	-	-	-	-	-	N/A
4.24 Studio Bathroom	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
-1.Cinema		98	-	-	246
-1.Cleaner		98	-	-	9
-1.Comms		98	-	-	24
-1.Corridor		-	98	-	55
-1.Corridor		-	98	-	54
-1.Dinner Party Room		-	98	-	102
-1.laundry		-	98	-	100
-1.Library and Study Room		98	-	-	521
-1.Lobby		-	98	-	23
-1.Plant		98	-	-	225

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
-1.Plantroom Switch		98	-	-	79
-1.Stair 2		-	98	-	38
-1.Stair 3		-	98	-	36
-1.Store		98	-	-	9
-1.Store		98	-	-	9
-1.Store COSHH		98	-	-	4
-1.WC Acc		-	98	-	31
0. AWC		-	98	-	29
0. Cleaner		98	-	-	8
0. Corridor		-	98	-	48
0. Corridor		-	98	-	37
0. Corridor		-	98	-	44
0. Corridor		-	98	-	37
0. Foyer		-	98	98	218
0. Lobby		-	98	-	23
0. Lobby		-	98	-	37
0. Lobby		-	98	-	14
0. Lobby Entrance		-	98	-	19
0. Refuse		98	-	-	31
0. Stair 2		-	98	-	45
0. Stair 2		-	98	-	30
0. Stair 3		-	98	-	40
0. Store		98	-	-	7
0. Store		98	-	-	9
0. Store Cycle		98	-	-	26
0.01 Studio		-	98	-	33
0.01 Studio Bathroom		-	98	-	16
0.02 Studio		-	98	-	33
0.02 Studio Bathroom		-	98	-	16
0.03 Studio		-	98	-	32
0.03 Studio Bathroom		-	98	-	16
0.04 Studio		-	98	-	31
0.04 Studio Bathroom		-	98	-	16
0.05 Studio		-	98	-	33
0.05 Studio Bathroom		-	98	-	16
0.06 Studio		-	98	-	33
0.06 Studio Bathroom		-	98	-	15
0.07 Studio		-	98	-	33
0.07 Studio Bathroom		-	98	-	16
0.08 Studio		-	98	-	32
0.08 Studio Bathroom		-	98	-	16
0.09 Studio		-	98	-	32
0.09 Studio Bathroom		-	98	-	16

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
0.10 Studio		-	98	-	33
0.10 Studio Bathroom		-	98	-	16
0.11 Premium		-	98	-	29
0.11 Premium Bathroom		-	98	-	16
0.12 Premium		-	98	-	30
0.12 Premium Bathroom		-	98	-	16
0.13 Premium		-	98	-	30
0.13 Premium Bathroom		-	98	-	15
0.14 Premium		-	98	-	30
0.14 Premium Bathroom		-	98	-	16
0.15 Premium		-	98	-	30
0.15 Premium Bathroom		-	98	-	16
0.16 Premium		-	98	-	30
0.16 Premium Bathroom		-	98	-	16
0.17 Premium		-	98	-	30
0.17 Premium Bathroom		-	98	-	14
0.18 Studio		-	98	-	30
0.18 Studio Bathroom		-	98	-	15
0.19 Studio		-	98	-	30
0.19 Studio Bathroom		-	98	-	16
0.20 Studio		-	98	-	30
0.20 Studio Bathroom		-	98	-	16
0.21 Studio		-	98	-	30
0.21 Studio Bathroom		-	98	-	16
0.22 Studio		-	98	-	29
0.22 Studio Bathroom		-	98	-	15
1. Corridor		-	98	-	52
1. Corridor		-	98	-	52
1. Corridor		-	98	-	84
1. Lobby		-	98	-	20
1. Stair 2		-	98	-	39
1. Stair 3		-	98	-	37
1. Store		98	-	-	5
1. Store Cleaner		98	-	-	7
1.01 Studio		-	98	-	31
1.01 Studio Bathroom		-	98	-	16
1.02 Studio		-	98	-	31
1.02 Studio Bathroom		-	98	-	16
1.03 Studio		-	98	-	29
1.03 Studio Bathroom		-	98	-	16
1.04 Studio		-	98	-	29
1.04 Studio Bathroom		-	98	-	16
1.05 Studio		-	98	-	31

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
1.05 Studio Bathroom		-	98	-	16
1.06 Studio		-	98	-	31
1.06 Studio Bathroom		-	98	-	15
1.07 Studio		-	98	-	29
1.07 Studio Bathroom		-	98	-	15
1.08 Studio		-	98	-	34
1.08 Studio Bathroom		-	98	-	16
1.09 Studio		-	98	-	33
1.09 Studio Bathroom		-	98	-	16
1.10 Studio		-	98	-	30
1.10 Studio Bathroom		-	98	-	16
1.11 Studio		-	98	-	31
1.11 Studio Bathroom		-	98	-	16
1.12 Studio		-	98	-	31
1.12 Studio Bathroom		-	98	-	16
1.13 Studio		-	98	-	29
1.13 Studio Bathroom		-	98	-	16
1.14 Studio		-	98	-	29
1.14 Studio Bathroom		-	98	-	16
1.15 Studio		-	98	-	31
1.15 Studio Bathroom		-	98	-	16
1.16 Studio		-	98	-	29
1.16 Studio Bathroom		-	98	-	16
1.17 Studio		-	98	-	29
1.17 Studio Bathroom		-	98	-	15
1.18 Premium		-	98	-	27
1.18 Premium Bathroom		-	98	-	16
1.19 Premium		-	98	-	28
1.19 Premium Bathroom		-	98	-	15
1.20 Premium		-	98	-	27
1.20 Premium Bathroom		-	98	-	15
1.21 Premium		-	98	-	28
1.21 Premium Bathroom		-	98	-	16
1.22 Premium		-	98	-	28
1.22 Premium Bathroom		-	98	-	16
1.23 Premium		-	98	-	27
1.23 Premium Bathroom		-	98	-	15
1.24 Premium		-	98	-	28
1.24 Premium Bathroom		-	98	-	14
1.25 Premium		-	98	-	32
1.25 Premium Bathroom		-	98	-	16
1.26 Studio		-	98	-	27
1.26 Studio Bathroom		-	98	-	15

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
1.27 Studio		-	98	-	28
1.27 Studio Bathroom		-	98	-	16
1.28 Studio		-	98	-	28
1.28 Studio Bathroom		-	98	-	16
1.29 Studio		-	98	-	28
1.29 Studio Bathroom		-	98	-	16
1.30 Studio		-	98	-	27
1.30 Studio Bathroom		-	98	-	15
2. Corridor		-	98	-	52
2. Corridor		-	98	-	84
2. Corridor		-	98	-	52
2. Lobby		-	98	-	20
2. Stair		-	98	-	39
2. Stair		-	98	-	37
2. Store		98	-	-	5
2. Store Cleaner		98	-	-	7
2.01 Studio		-	98	-	31
2.01 Studio Bathroom		-	98	-	16
2.02 Studio		-	98	-	31
2.02 Studio Bathroom		-	98	-	16
2.03 Studio		-	98	-	29
2.03 Studio Bathroom		-	98	-	16
2.04 Studio		-	98	-	29
2.04 Studio Bathroom		-	98	-	16
2.05 Studio		-	98	-	31
2.05 Studio Bathroom		-	98	-	16
2.06 Studio		-	98	-	31
2.06 Studio Bathroom		-	98	-	15
2.07 Studio		-	98	-	29
2.07 Studio Bathroom		-	98	-	15
2.08 Studio		-	98	-	34
2.08 Studio Bathroom		-	98	-	16
2.09 Studio		-	98	-	33
2.09 Studio Bathroom		-	98	-	16
2.10 Studio		-	98	-	30
2.10 Studio Bathroom		-	98	-	16
2.11 Studio		-	98	-	31
2.11 Studio Bathroom		-	98	-	16
2.12 Studio		-	98	-	31
2.12 Studio Bathroom		-	98	-	16
2.13 Studio		-	98	-	29
2.13 Studio Bathroom		-	98	-	16
2.14 Studio		-	98	-	29

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
2.14 Studio Bathroom		-	98	-	16
2.15 Studio		-	98	-	31
2.15 Studio Bathroom		-	98	-	16
2.16 Studio		-	98	-	29
2.16 Studio Bathroom		-	98	-	16
2.17 Studio		-	98	-	29
2.17 Studio Bathroom		-	98	-	15
2.18 Premium		-	98	-	27
2.18 Premium Bathroom		-	98	-	16
2.19 Premium		-	98	-	28
2.19 Premium Bathroom		-	98	-	15
2.20 Premium		-	98	-	27
2.20 Premium Bathroom		-	98	-	15
2.21 Premium		-	98	-	28
2.21 Premium Bathroom		-	98	-	16
2.22 Premium		-	98	-	28
2.22 Premium Bathroom		-	98	-	16
2.23 Premium		-	98	-	27
2.23 Premium Bathroom		-	98	-	15
2.24 Premium		-	98	-	28
2.24 Premium Bathroom		-	98	-	14
2.25 Premium		-	98	-	32
2.25 Premium Bathroom		-	98	-	16
2.26 Studio		-	98	-	27
2.26 Studio Bathroom		-	98	-	15
2.27 Studio		-	98	-	28
2.27 Studio Bathroom		-	98	-	16
2.28 Studio		-	98	-	28
2.28 Studio Bathroom		-	98	-	16
2.29 Studio		-	98	-	28
2.29 Studio Bathroom		-	98	-	16
2.30 Studio		-	98	-	27
2.30 Studio Bathroom		-	98	-	15
3. Corridor		-	98	-	84
3. Corridor		-	98	-	52
3. Corridor		-	98	-	52
3. Lobby		-	98	-	20
3. Stair		-	98	-	39
3. Stair 3		-	98	-	37
3. Stair 3		-	98	-	32
3. Store		98	-	-	8
3. Store		98	-	-	5
3. Store		98	-	-	5

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
3. Store Cleaner		98	-	-	7
3.01 Studio		-	98	-	31
3.01 Studio Bathroom		-	98	-	16
3.02 Studio		-	98	-	29
3.02 Studio Bathroom		-	98	-	16
3.03 Studio		-	98	-	29
3.03 Studio Bathroom		-	98	-	16
3.04 Studio		-	98	-	31
3.04 Studio Bathroom		-	98	-	16
3.05 Studio		-	98	-	31
3.05 Studio Bathroom		-	98	-	15
3.06 Studio		-	98	-	29
3.06 Studio Bathroom		-	98	-	15
3.07 Studio		-	98	-	34
3.07 Studio Bathroom		-	98	-	16
3.08 Studio		-	98	-	33
3.08 Studio Bathroom		-	98	-	16
3.09 Studio		-	98	-	30
3.09 Studio Bathroom		-	98	-	16
3.10 Studio		-	98	-	31
3.10 Studio Bathroom		-	98	-	16
3.11 Studio		-	98	-	31
3.11 Studio Bathroom		-	98	-	16
3.12 Studio		-	98	-	29
3.12 Studio Bathroom		-	98	-	16
3.13 Studio		-	98	-	29
3.13 Studio Bathroom		-	98	-	16
3.14 Studio		-	98	-	31
3.14 Studio Bathroom		-	98	-	16
3.15 Studio		-	98	-	29
3.15 Studio Bathroom		-	98	-	16
3.16 Studio		-	98	-	29
3.16 Studio Bathroom		-	98	-	15
3.17 Premium		-	98	-	27
3.17 Premium Bathroom		-	98	-	16
3.18 Premium		-	98	-	28
3.18 Premium Bathroom		-	98	-	15
3.19 Premium		-	98	-	27
3.19 Premium Bathroom		-	98	-	15
3.20 Premium		-	98	-	28
3.20 Premium Bathroom		-	98	-	16
3.21 Premium		-	98	-	28
3.21 Premium Bathroom		-	98	-	16

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
3.22 Premium		-	98	-	27
3.22 Premium Bathroom		-	98	-	15
3.23 Premium		-	98	-	28
3.23 Premium Bathroom		-	98	-	14
3.24 Premium		-	98	-	32
3.24 Premium Bathroom		-	98	-	16
3.25 Studio		-	98	-	27
3.25 Studio Bathroom		-	98	-	15
3.26 Studio		-	98	-	28
3.26 Studio Bathroom		-	98	-	16
3.27 Studio		-	98	-	28
3.27 Studio Bathroom		-	98	-	16
3.28 Studio		-	98	-	28
3.28 Studio Bathroom		-	98	-	16
3.29 Studio		-	98	-	27
3.29 Studio Bathroom		-	98	-	15
4. Corridor		-	98	-	42
4. Corridor		-	98	-	84
4. Corridor		-	98	-	32
4. Lobby		-	98	-	20
4. Stair 2		-	98	-	34
4. Stair 3		-	98	-	35
4. Store		98	-	-	5
4. Store Cleaner		98	-	-	7
4.01 Studio		-	98	-	28
4.01 Studio Bathroom		-	98	-	16
4.02 Studio		-	98	-	28
4.02 Studio Bathroom		-	98	-	16
4.03 Studio		-	98	-	28
4.03 Studio Bathroom		-	98	-	16
4.04 Studio		-	98	-	28
4.04 Studio Bathroom		-	98	-	16
4.05 Studio		-	98	-	28
4.05 Studio Bathroom		-	98	-	15
4.06 Studio		-	98	-	27
4.06 Studio Bathroom		-	98	-	15
4.07 Studio		-	98	-	30
4.07 Studio Bathroom		-	98	-	16
4.08 Studio		-	98	-	30
4.08 Studio Bathroom		-	98	-	16
4.09 Studio		-	98	-	28
4.09 Studio Bathroom		-	98	-	16
4.10 Studio		-	98	-	28

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
4.10 Studio Bathroom		-	98	-	16
4.11 Studio		-	98	-	28
4.11 Studio Bathroom		-	98	-	16
4.12 Studio		-	98	-	28
4.12 Studio Bathroom		-	98	-	16
4.13 Studio		-	98	-	28
4.13 Studio Bathroom		-	98	-	16
4.14 Studio		-	98	-	28
4.14 Studio Bathroom		-	98	-	16
4.15 Premium		-	98	-	27
4.15 Premium Bathroom		-	98	-	15
4.16 Premium		-	98	-	28
4.16 Premium Bathroom		-	98	-	16
4.17 Premium		-	98	-	28
4.17 Premium Bathroom		-	98	-	16
4.18 Premium		-	98	-	27
4.18 Premium Bathroom		-	98	-	15
4.19 Premium		-	98	-	28
4.19 Premium Bathroom		-	98	-	14
4.20 Premium		-	98	-	32
4.20 Premium Bathroom		-	98	-	16
4.21 Studio		-	98	-	27
4.21 Studio Bathroom		-	98	-	15
4.22 Studio		-	98	-	28
4.22 Studio Bathroom		-	98	-	16
4.23 Studio		-	98	-	28
4.23 Studio Bathroom		-	98	-	16
4.24 Studio		-	98	-	27
4.24 Studio Bathroom		-	98	-	15

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?
-1.Cinema	N/A	N/A
-1.Comms	N/A	N/A
-1.Dinner Party Room	N/A	N/A
-1.Library and Study Room	NO (-97.8%)	NO
0. Foyer	NO (-72.7%)	NO
0.01 Studio	NO (-92%)	NO
0.02 Studio	NO (-92%)	NO
0.03 Studio	NO (-91.2%)	NO
0.04 Studio	NO (-91.1%)	NO
0.05 Studio	NO (-91.8%)	NO
0.06 Studio	NO (-91.6%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0.07 Studio	NO (-79%)	NO
0.08 Studio	NO (-77%)	NO
0.09 Studio	NO (-76.3%)	NO
0.10 Studio	NO (-82.3%)	NO
0.11 Premium	NO (-94.3%)	NO
0.12 Premium	NO (-78.9%)	NO
0.13 Premium	NO (-77.9%)	NO
0.14 Premium	NO (-78.4%)	NO
0.15 Premium	NO (-79.3%)	NO
0.16 Premium	NO (-81.3%)	NO
0.17 Premium	NO (-85.1%)	NO
0.18 Studio	NO (-89.9%)	NO
0.19 Studio	NO (-82.1%)	NO
0.20 Studio	NO (-80.5%)	NO
0.21 Studio	NO (-79.9%)	NO
0.22 Studio	NO (-91.2%)	NO
1.01 Studio	NO (-85.7%)	NO
1.02 Studio	NO (-85.9%)	NO
1.03 Studio	NO (-90.5%)	NO
1.04 Studio	NO (-90.1%)	NO
1.05 Studio	NO (-85.4%)	NO
1.06 Studio	NO (-85%)	NO
1.07 Studio	NO (-89.5%)	NO
1.08 Studio	NO (-90.5%)	NO
1.09 Studio	NO (-78.5%)	NO
1.10 Studio	NO (-74.8%)	NO
1.11 Studio	NO (-63.1%)	NO
1.12 Studio	NO (-63.1%)	NO
1.13 Studio	NO (-74.8%)	NO
1.14 Studio	NO (-75.4%)	NO
1.15 Studio	NO (-63.3%)	NO
1.16 Studio	NO (-74.1%)	NO
1.17 Studio	NO (-89.2%)	NO
1.18 Premium	NO (-92.2%)	NO
1.19 Premium	NO (-76.2%)	NO
1.20 Premium	NO (-75.9%)	NO
1.21 Premium	NO (-76.6%)	NO
1.22 Premium	NO (-78.2%)	NO
1.23 Premium	NO (-80.2%)	NO
1.24 Premium	NO (-84.5%)	NO
1.25 Premium	NO (-89.7%)	NO
1.26 Studio	NO (-89%)	NO
1.27 Studio	NO (-80.5%)	NO
1.28 Studio	NO (-79.2%)	NO
1.29 Studio	NO (-78.5%)	NO
1.30 Studio	NO (-90.6%)	NO
2.01 Studio	NO (-83.7%)	NO
2.02 Studio	NO (-83.9%)	NO
2.03 Studio	NO (-89.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
2.04 Studio	NO (-89.1%)	NO
2.05 Studio	NO (-83.8%)	NO
2.06 Studio	NO (-83.7%)	NO
2.07 Studio	NO (-88.8%)	NO
2.08 Studio	NO (-89.6%)	NO
2.09 Studio	NO (-77.1%)	NO
2.10 Studio	NO (-74%)	NO
2.11 Studio	NO (-59.6%)	NO
2.12 Studio	NO (-59%)	NO
2.13 Studio	NO (-72.9%)	NO
2.14 Studio	NO (-73.2%)	NO
2.15 Studio	NO (-59.2%)	NO
2.16 Studio	NO (-72.4%)	NO
2.17 Studio	NO (-88.9%)	NO
2.18 Premium	NO (-91.8%)	NO
2.19 Premium	NO (-75.1%)	NO
2.20 Premium	NO (-75.1%)	NO
2.21 Premium	NO (-76.1%)	NO
2.22 Premium	NO (-77.1%)	NO
2.23 Premium	NO (-79.1%)	NO
2.24 Premium	NO (-83.9%)	NO
2.25 Premium	NO (-89%)	NO
2.26 Studio	NO (-88.1%)	NO
2.27 Studio	NO (-78.9%)	NO
2.28 Studio	NO (-77.8%)	NO
2.29 Studio	NO (-77.5%)	NO
2.30 Studio	NO (-90.1%)	NO
3.01 Studio	NO (-82.3%)	NO
3.02 Studio	NO (-88.3%)	NO
3.03 Studio	NO (-88%)	NO
3.04 Studio	NO (-82.1%)	NO
3.05 Studio	NO (-81.6%)	NO
3.06 Studio	NO (-87.4%)	NO
3.07 Studio	NO (-88.5%)	NO
3.08 Studio	NO (-76.3%)	NO
3.09 Studio	NO (-73.7%)	NO
3.10 Studio	NO (-59.4%)	NO
3.11 Studio	NO (-59%)	NO
3.12 Studio	NO (-72.7%)	NO
3.13 Studio	NO (-72.7%)	NO
3.14 Studio	NO (-58.9%)	NO
3.15 Studio	NO (-72.1%)	NO
3.16 Studio	NO (-88.8%)	NO
3.17 Premium	NO (-91.6%)	NO
3.18 Premium	NO (-74.5%)	NO
3.19 Premium	NO (-74.1%)	NO
3.20 Premium	NO (-75.1%)	NO
3.21 Premium	NO (-76%)	NO
3.22 Premium	NO (-77.9%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3.23 Premium	NO (-83.4%)	NO
3.24 Premium	NO (-87.7%)	NO
3.25 Studio	NO (-86.5%)	NO
3.26 Studio	NO (-77%)	NO
3.27 Studio	NO (-76.2%)	NO
3.28 Studio	NO (-76%)	NO
3.29 Studio	NO (-89.6%)	NO
4.01 Studio	NO (-84.5%)	NO
4.02 Studio	NO (-84.9%)	NO
4.03 Studio	NO (-84.4%)	NO
4.04 Studio	NO (-84.7%)	NO
4.05 Studio	NO (-84.7%)	NO
4.06 Studio	NO (-84.5%)	NO
4.07 Studio	NO (-85.3%)	NO
4.08 Studio	NO (-70.7%)	NO
4.09 Studio	NO (-69.8%)	NO
4.10 Studio	NO (-68.7%)	NO
4.11 Studio	NO (-69%)	NO
4.12 Studio	NO (-68.9%)	NO
4.13 Studio	NO (-69%)	NO
4.14 Studio	NO (-68.9%)	NO
4.15 Premium	NO (-89.9%)	NO
4.16 Premium	NO (-68.7%)	NO
4.17 Premium	NO (-69%)	NO
4.18 Premium	NO (-69.8%)	NO
4.19 Premium	NO (-74.5%)	NO
4.20 Premium	NO (-79.4%)	NO
4.21 Studio	NO (-81.7%)	NO
4.22 Studio	NO (-70%)	NO
4.23 Studio	NO (-69.6%)	NO
4.24 Studio	NO (-87%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	4055.6	4055.6
External area [m ²]	3909.7	3909.7
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	1332.06	1944.93
Average U-value [W/m ² K]	0.34	0.5
Alpha value* [%]	10.05	10

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

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services
A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
B1 Offices and Workshop businesses
B2 to B7 General Industrial and Special Industrial Groups
B8 Storage or Distribution
C1 Hotels
C2 Residential Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools
100 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
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	44.32	67.54
Cooling	0.3	0.39
Auxiliary	2.28	2.69
Lighting	5.41	10.38
Hot water	170.41	136.34
Equipment*	17.84	17.84
TOTAL **	191.02	217.35

* 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	31.7	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	164.02	215.22
Primary energy* [kWh/m ²]	267.35	281.25
Total emissions [kg/m ²]	46.8	57.8

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

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	218.4	0	60.7	0	0	1	0	1	0	
Notional	0	0	0	0	0	0	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	207.8	0	57.7	0	2.5	1	0	1	0	
Notional	206	0	66.4	0	0	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	16.1	3	1	0.2	4.9	4.41	4.11	4.5	5.5	
Notional	280.7	0	90.5	0	3.5	0.86	0	----	----	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
Actual	0	1713.9	0	141.6	0	4.41	3.36	4.5	4.5	
Notional	9.5	5.4	1	0.5	3	2.56	2.84	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	2399.7	0	175.9	0	2.56	3.79	----	----	

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.26	0R000000:Surf[0]
Floor	0.2	0.2	B_00000D:Surf[0]
Roof	0.15	0.18	03000003:Surf[5]
Windows, roof windows, and rooflights	1.5	1.3	0000001A:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-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	4

Energy Performance Certificate

Non-Domestic Building



NCP3 No PV

East street

Reading

Certificate Reference Number:

0000-0040-0030-9000-0803

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

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

◀ 34

This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Heating and Mechanical Ventilation
Total useful floor area (m ²):	4055.608
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ² per year):	46.83
Primary energy use (kWh/m ² per year):	267.35

Benchmarks

Buildings similar to this one could have ratings as follows:

42 If newly built

111 If typical of the existing stock

Administrative information

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

Assessment Software: Virtual Environment v7.0.10 using calculation engine ApacheSim v7.0.10

Property Reference: 000000000000

Assessor Name: Wilson Gray Consulting

Assessor Number: LCEA002521

Accreditation Scheme: CIBSE Certification Limited

Employer/Trading Name: Wilson Gray Consulting

Employer/Trading Address:

Issue Date: 15 Nov 2018

Valid Until: 14 Nov 2028 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 0040-0000-0408-0900-0004

About this document and the data in it

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

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

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

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

Opportunity to benefit from a Green Deal on this property

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

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