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# **WARNER BROS. STUDIOS LEAVESDEN BACKLOT CAFE EXTENSION ENERGY STATEMENT**

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# 1. EXECUTIVE SUMMARY

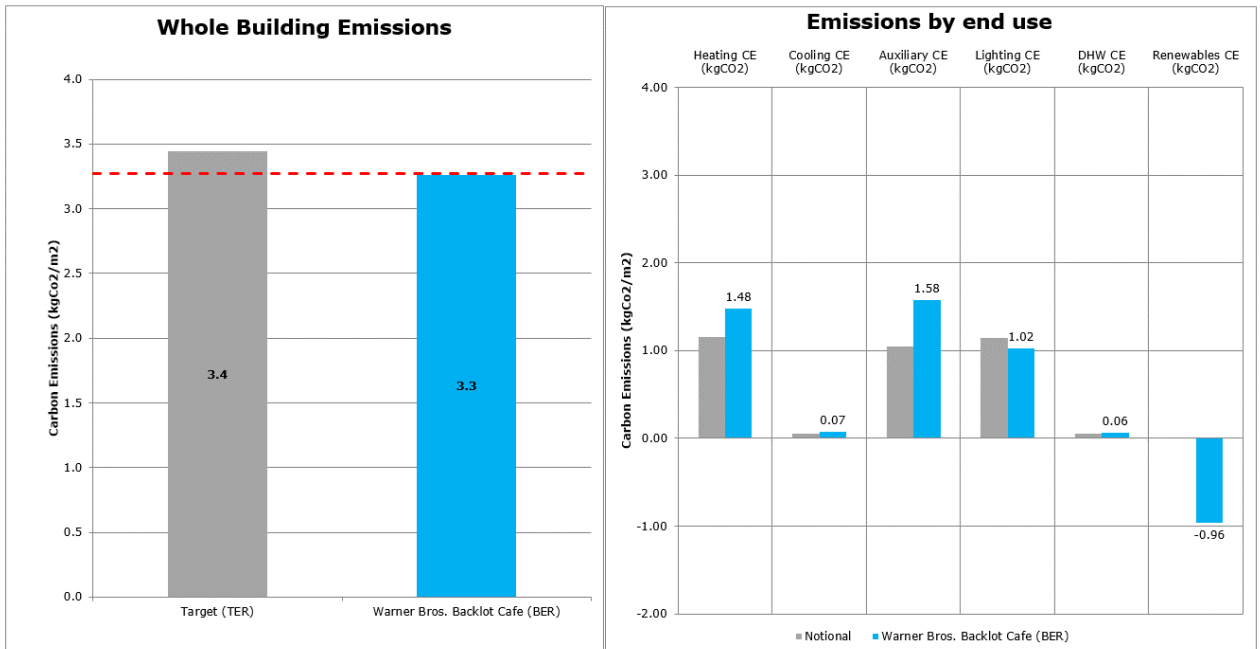
This report has been produced to support the planning application for the proposed WBSL Backlot Café extension. The report seeks to establish a philosophy and design intent for the development going forward, in relation to energy and sustainability, responding to the planning requirements of the following:

- National Planning Policy Framework 2023
- Hertfordshire Building Futures
- Three Rivers Council Core Strategy
- Three Rivers Development Management Policies: Local Development Document (LDD)

New applications in Three Rivers District Council (TRDC) are required to submit an Energy Statement demonstrating the extent to which their proposals meet the requirements of Policy DM4 of the LDD. Therefore, this report has been submitted in compliance with policy DM4.

Policy DM4 sets out that developments must produce at least 5% less carbon dioxide emissions than Building Regulations Part L (2013) requirements having regard to feasibility and viability. This may be achieved through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies, connection to a local, decentralized, renewable or low carbon energy supply. Please note, this policy has not been updated to take account of the new Building Regulations (2021). As such, complying with the newer standards represents a more onerous target than 2013 and so simply complying with the new regulations means this policy is met by default.

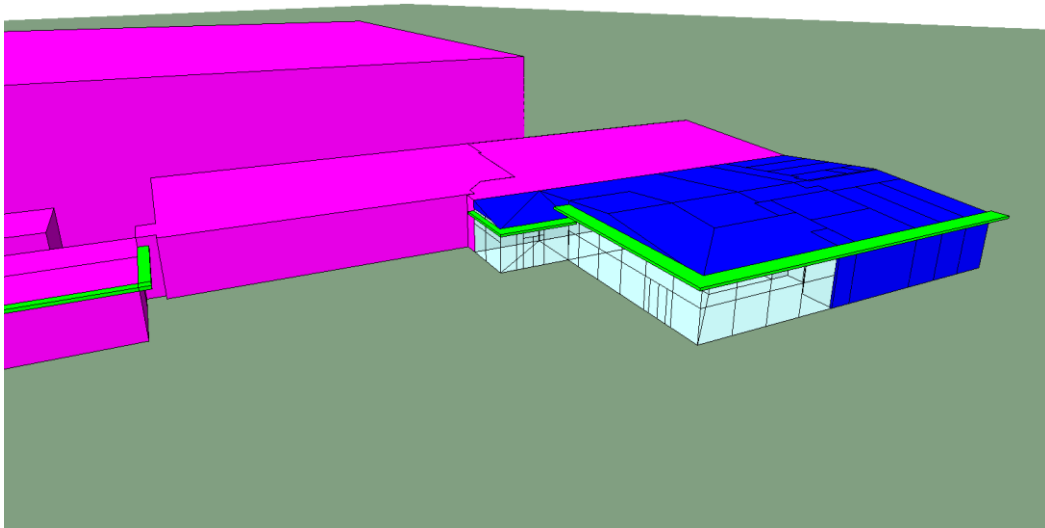
The philosophy for the Backlot Café Extension is to achieve as much of the necessary reduction in carbon emissions using a highly efficient building envelope and HVAC systems. In this instance, the development is achieving 5.4% above Part L 2021. This therefore meets the TRDC Planning Policy requirements.



**Figure 1: WBSL Backlot Café Extension Part L Results**  
(Red line indicates a 5% compliance margin)

## 2. INTRODUCTION

This report has been produced to support the planning application for the proposed WBSL Backlot Café Extension. The proposed development is located adjacent to the Warner Brothers Studio Tour and connected to the existing Studio Tour Backlot Café. The proposed extension has an approximate 692m<sup>2</sup> floor area and consists of an open seating area. A visualisation of the thermal model is shown in Figure 1 below.



**Figure 2: 3D Energy Model of the Backlot Café Extension**

The report seeks to establish a philosophy and design intent for the development going forward, in relation to energy and sustainability, responding to the planning requirements of the following:

- National Planning Policy Framework 2023
- Hertfordshire Building Futures
- Three Rivers Council Core Strategy
- Three Rivers Development Management Policies: Local Development Document (LDD)

This energy report for the proposed extension sets out a high-level strategy and a general approach to energy and sustainability. Passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the philosophy of the planning documents listed above.

The energy strategy defined within this report will be further developed and refined as the development proceeds through the planning process and the design.

### 3. PLANNING POLICY

New applications required to submit an Energy Statement demonstrating the extent to which their proposals meet the requirements of the local planning policies.

This report seeks to adhere to the following planning requirements with regards to energy and sustainability:

- National Planning Policy Framework 2023
- Hertfordshire Building Futures
- Three Rivers Council Core Strategy
- Three Rivers Development Management Policies: Local Development Document (LDD)

#### 3.1 National Planning Policy Framework 2023

The National Planning Policy Framework contains guidance “to achieve sustainable development”. It sets out the government’s overarching strategy for sustainable development and covers economic, social and environmental aspects of planning.

This energy strategy deals specifically with the carbon emissions aspects of Section 14 of the National Planning Policy Framework: Meeting the challenge of climate change, flooding and coastal change.

#### 3.2 Hertfordshire Building Futures Guide

The Hertfordshire Building Futures Guide is web-based, designed to provide guidance for planning officers and developers on how to make development in Hertfordshire more sustainable and of a higher design quality.

The guide is endorsed by each of the eleven local authorities in Hertfordshire and reflects the Hertfordshire context. The guide has been developed in alignment with existing policies, environmental initiatives and assessment procedures.

Currently, the guide contains nine modules, each covering a sustainable building topic area. Note that none of the issues contains quantifiable targets. The design team shall use quantifiable targets to address the issues as this project develops.

#### 3.3 Three Rivers Development Management Policies: Local Development Document (Adopted July 2013)

Three Rivers District Council (TRDC) adopted their LDD in 2013. The LDD sets out in broad terms how the council plans for, and deal with, future development in Three Rivers. The applicable policy (DM4) is outlined in table 1 below.

**Table 1 - Responses to the LDD Policy DM4**

Policy within Three Rivers LDD	Design Response
From 2013, applicants will be required to demonstrate that development will produce 5% less carbon dioxide emissions than Building Regulations Part L requirements (2013) having regard to feasibility and viability. This may be achieved through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies, connection to a local, decentralised, renewable or low carbon energy supply.	Part L 2021 is currently applicable to this project. By complying with the 2021 update of the building regulations, the development is inherently exceeding the 5% carbon reduction.

## 4. ENERGY STATEMENT

A strategic approach has been proposed for the Backlot Café extension to reduce the demand for energy with passive measures, as well as specifying energy efficient equipment and considering the integration of Low and Zero Carbon (LZC) technologies, as summarised below. Detailed design inputs to thermal modelling are shown in section 5.

### **Reduce Energy Demand**

- A highly insulated building envelope
  - All U-values are to meet or improve upon building regulations standards.
  - Solar Glazing are required to reduce solar gains and cooling demand.

### **Energy Efficiency Equipment**

- Low energy lighting across the proposed extension, with a minimum of:
  - 110 luminaire lm/W for all spaces
- Automatic lighting controls to reduce waste energy from unused lighting.
  - PIR controls turn lights on and off when not in use.
  - Daylight linked dimming controls modulate lighting to meet comfortable working levels, reducing glare and reliance on artificial lighting.

### **Low and Zero Carbon Technologies**

- For the proposed extension, compliance with national building regulations and local planning policy can be achieved using Air Source Heating Pumps for heating and cooling of the café extension with additional Photovoltaic panels on the south-eastern roof.

## 5. COMPLIANCE MODEL SETTINGS AND ASSUMPTIONS

The proposed extension has been modelled following the National Calculation Methodology (NCM) 2021. The IES virtual environment 2023 software version 2023.1.0.0 was used for the simulation using the Part L2A 2021 module VE compliance 7.0.22.0.

The BRUKL Output Document can be found in the appendices of this report. The settings and key inputs of the model are included within the following sections.

### 5.1 Geometry

The energy model of the Backlot Café Extension has been built based on the layout and fabric drawings received from dn-a architects dated 31/01/2024.

### 5.2 Weather

Weather data for simulation-based Part L2 assessments are provided by CIBSE. The weather file used for the Part L analysis in this study is London Typical Reference Year (TRY).

### 5.3 Building Fabric Properties

The proposed extension will feature good passive design in order to minimise the energy demand and achieve excellent building performance.

#### 5.3.1 Designed Fabric Properties

The building fabric properties inputted in the model are shown in the table below:

**Table 2 - Building fabric properties of the proposed extension**

Opaque Elements	
Ground Floor U-Value (W/m <sup>2</sup> K)	0.15
Roof U-Value (W/m <sup>2</sup> K)	0.15
External Wall U-Value (W/m <sup>2</sup> K)	0.16
Glazed Elements	
Window U-Value (W/m <sup>2</sup> K)	1.4
g-Value	0.4
Air Permeability	
Design Air Permeability (m <sup>3</sup> /m <sup>2</sup> h @ 50 Pa)	5

### 5.4 Efficient servicing

#### 5.4.1 HVAC Systems

For the Backlot Café Extension, the proposed heating & cooling system for the building shall comprise of a variable capacity heat pump system with heat recovery via a range of ceiling void mounted units matched to externally mounted condensing units.

Air source heat pumps are proposed for the Backlot Café Extension to provide both heating and cooling.



#### **5.4.2 Fan and Pump Energy**

Moving air, heat, coolth and water around a building requires work to be done. How much energy is required to do this work will depend on the design of the systems, the technology used and the controls.

The fans and pump of the proposed extension were designed to minimise the energy uses by:

- Fans and pumps operating with variable speed control in the main café area.
- SFP shall not exceed 1.4 W/l/s for the ventilation system.

#### **5.4.3 Heat Recovery**

Heat recovery system was used on ventilation in order to minimise the heat lost to provide fresh air throughout the building, with an efficiency of 80%

#### **5.4.4 Lighting Type and Control**

To reduce primary energy consumption below that of the notional building, a high specification of lighting was assigned to the model. The lamp efficacy of the lighting equipment was set as 110lm/W. Daylight dimming has been provided in the main café areas of the extension and these systems have a parasitic power of 0.05 W/m<sup>2</sup>.

#### **5.4.5 Domestic Hot Water (DHW)**

The design team has confirmed that the hot water will be served from point of use electric boilers with an efficiency of 100%.

#### **5.4.6 System Performance Summary**

The criteria used in the analysis for the heating, cooling, ventilation and hot water service and lighting are shown in the table below. Further design development will be required during the detailed design process.

**Table 3 - System performance inputs**

<b>Heating</b>	
Heating system type (i.e. FCU, VRF...)	VRF
Heat source	ASHP
Fuel	Electricity
Seasonal Efficiency	4.5
<b>Cooling</b>	
Cooling system type (i.e. FCU, VRF...)	VRF
Fuel Type	Electricity
Generator SEER	5.0
<b>Ventilation</b>	
Description	Central supply & extract
System specific fan power (SFP) @ mid-filter condition (W/l/s)	1.4
Heat recovery efficiency (%)	80
Summer bypass?	Yes
AHU CEN Leakage Class	Class L2
Ductwork CEN Leakage Class	Class A
Demand Controlled Ventilation?	Yes, based on occupancy density
<b>Domestic Hot Water</b>	
Generator Type	Point of Use Electric Boiler
Water heating efficiency	100%
Delivery Efficiency	100%
<b>Lighting</b>	
Installed Power density	Inference method
Lamp efficacy (lumen/W)	110
<b>Renewables</b>	
Area (m <sup>2</sup> )	30
Yield (kWh/yr)	4,172

## 6. COMPLIANCE MODEL RESULTS

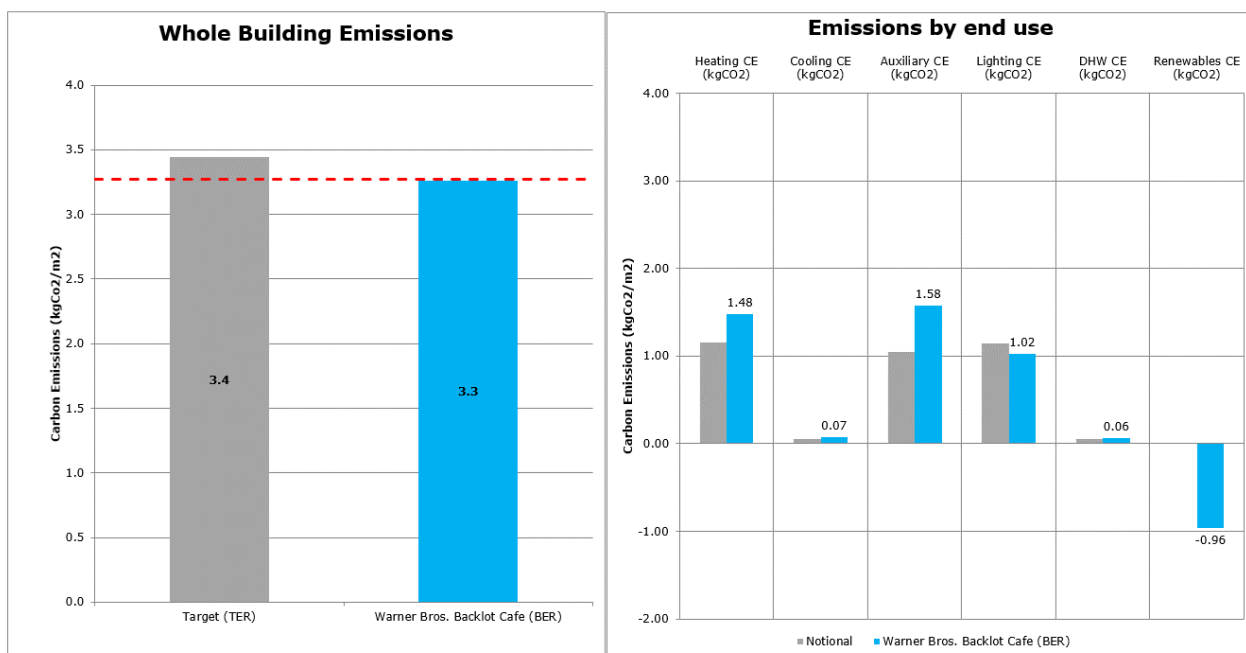
Table 4 and Figure 3 confirm a reduction in total emissions over the notional building. As the Building Emission Rate (BER) is less than the Target Emission Rate (TER), this development complies with criterion 1 of Building Regulations Part L2A 2021.

The simulation results show that the total carbon savings of the Backlot Café Extension can achieve 5.4% against Part L 2021. Since this is a much more onerous standard than Part L 2013, it complies with the minimum 5% carbon dioxide emission savings requirement of the Policy DM4 of the LDD by default.

Criterion 2 compliance has been achieved by using fabric and services efficiency values provided by the design team within the model that were better than the limiting values specified within Building Regulations Part L2A 2021.

**Table 4 - Energy & CO<sub>2</sub> Emissions Summary**

	Actual	Notional	Improvement
<b>Heating and cooling demand [MJ/m<sup>2</sup>]</b>	155.31	80.26	
<b>Primary energy [kWh/m<sup>2</sup>]</b>	33.85	36.72	
<b>Total emissions [kg/m<sup>2</sup>]</b>	3.26	3.45	5.4%



**Figure 3: WBSL Backlot Café Extension Part L Results**

(Red line indicates a 5% compliance margin)

## 7. CONCLUSION

An energy strategy for the WBSL Backlot Café Extension has been defined based on the energy hierarchy of Local Authority plan by prioritising passive design and a general energy demand reduction.

The proposed extension with good practice measures such as highly efficient equipment, good U-values, and low air permeability ensures that Building Regulations Part L2A 2021 regulations are met.

The philosophy for the site is to achieve as much of the necessary reduction in carbon emissions using a highly efficient building envelope and HVAC systems. The results show that the current proposed extension betters the Building Regulation Part L 2021 target emissions rate by 5.4%. The scheme therefore achieves the minimum standard that is required by planning.

## APPENDIX 1 - GUIDANCE ON PRODUCING AN ENERGY STATEMENT

Policy DM4 of the Development Management Policies LDD sets out that development must produce at least 5% less carbon dioxide emissions than Building Regulations Part L (2013) requirements having regard to feasibility and viability. This may be achieved through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies, connection to a local, decentralised, renewable or low carbon energy supply.

To prove compliance with the policy, the developer is required to submit an Energy Statement. The statement shall include the following details as a minimum:

1. The development's predicted energy demand in kWh/year. This figure should be based on SAP or SBEM calculations and separated by fuel type (this is the DER or BER value)
2. The total carbon dioxide (CO<sub>2</sub>) emissions resulting from the above energy demand (kgCO<sub>2</sub>/year).
3. Proposals to reduce the energy demand. Specifications of any decentralised energy source and/or low or renewable energy systems proposed for the development shall be included.
4. The reduction in carbon dioxide emissions resulting from the above measures.

The Energy Statement should be presented in a way that is easy to read and understand. It should clearly state that the proposals meet the policy criteria, and it should also be clear where data has been obtained from. It is preferable if this statement is produced by an accredited Energy Assessor.

Abbreviations used:

SAP = Standard Assessment Procedure (Calculation procedure used for residential properties to calculate carbon dioxide emissions)

SBEM = The Simplified Building Energy Model, the equivalent to SAP but for non-residential properties

ref: [https://cdn.threerivers.gov.uk/files/2023/01/98cc1970-9ff5-11ed-8d80-6dc425ce7e94-final-development-management-policies-ldd-adopted-july-2013%20\(1\).pdf](https://cdn.threerivers.gov.uk/files/2023/01/98cc1970-9ff5-11ed-8d80-6dc425ce7e94-final-development-management-policies-ldd-adopted-july-2013%20(1).pdf)

## APPENDIX 2 - BRUKL REPORT

# BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

**191017 GF Backlot Cafe Part L**

As designed

Date: Mon Jan 29 10:07:54 2024

### Administrative information

#### Building Details

Address: Address 1, 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.e.1

#### Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m<sup>2</sup>]: 547.52

### The CO<sub>2</sub> emission and primary energy rates of the building must not exceed the targets

Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> annum	3.45
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> annum	3.26
Target primary energy rate (TPER), kWh <sub>ep</sub> /m <sup>2</sup> annum	36.72
Building primary energy rate (BPER), kWh <sub>ep</sub> /m <sup>2</sup> annum	33.85
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 <sub>a</sub> -Limit	U <sub>a</sub> -Calc	U <sub>i</sub> -Calc	First surface with maximum value
Walls*	0.26	0.16	0.16	MS00000E:Surf[1]
Floors	0.18	0.15	0.15	MS00000E:Surf[0]
Pitched roofs	0.16	0.15	0.15	L0000005:Surf[7]
Flat roofs	0.18	0.15	0.15	MS00000E:Surf[2]
Windows** and roof windows	1.6	1.4	1.4	L0000001:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
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<sub>a</sub>-Limit = Limiting area-weighted average U-values [W/(m<sup>2</sup>K)]

U<sub>i</sub>-Calc = Calculated maximum individual element U-values [W/(m<sup>2</sup>K)]

U<sub>a</sub>-Calc = Calculated area-weighted average U-values [W/(m<sup>2</sup>K)]

\* 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<sup>2</sup>K

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 <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa	8	5

**Building services**

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

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

1- Fan Coil

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	4.5	5	0	1.4	0.8
<b>Standard value</b>	2.5*	4.5**	N/A	2^	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
** Standard shown is for air-cooled chillers >=400 kW. For chillers <400 kW, limiting SEER is 4.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

2- Rads MechS&E

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	4.5	-	0.3	-	0.8
<b>Standard value</b>	2.5*	N/A	N/A	N/A	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- Kitchen ventilation Heater

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	4	-	0	1.4	-
<b>Standard value</b>	2.5*	N/A	N/A	1.9^	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

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

**Zone-level mechanical ventilation, exhaust, and terminal units**

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]									HR efficiency	
	A	B	C	D	E	F	G	H	I	Zone	Standard
<b>Standard value</b>	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
L00_Circulation_+00.00	-	-	-	-	-	-	-	0.2	-	-	N/A

Zone name	ID of system type	SFP [W/(l/s)]									HR efficiency	
		A	B	C	D	E	F	G	H	I	Zone	Standard
	<b>Standard value</b>	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
L00_Cleaners Store_+00.00	-	-	-	1.4	-	-	-	-	-	-	-	N/A
L00_Disabled WC_+00.00	-	-	-	1.4	-	-	-	-	-	-	-	N/A
L00_Female WC_+00.00	-	-	-	1.4	-	-	-	-	-	-	-	N/A
L00_Kitchen/Servery_+00.00	-	-	-	-	-	-	-	0.2	-	-	-	N/A
L00_Male WC_+00.00	-	-	-	1.4	-	-	-	-	-	-	-	N/A
L00_Queueing Area/Main Cafe 01_Perimeter_+00.00	-	-	-	-	-	-	-	0.2	-	-	-	N/A
L00_Queueing Area/Main Cafe 02_Perimeter_+00.00	-	-	-	-	-	-	-	0.2	-	-	-	N/A
L00_Queueing Area/Main Cafe 03_Perimeter_+00.00	-	-	-	-	-	-	-	0.2	-	-	-	N/A
L00_Queueing Area/Main Cafe 04_Perimeter_+00.00	-	-	-	-	-	-	-	0.2	-	-	-	N/A
L00_Store_+00.00	-	-	-	1.4	-	-	-	-	-	-	-	N/A
L00_WC Lobby_+00.00	-	-	-	1.4	-	-	-	-	-	-	-	N/A
L00_WC_+00.00	-	-	-	1.4	-	-	-	-	-	-	-	N/A

Zone name	General lighting and display lighting	General luminaire		Display light source	
		Efficacy [lm/W]		Efficacy [lm/W]	Power density [W/m <sup>2</sup> ]
	<b>Standard value</b>	95		80	0.3
L00_Circulation_+00.00		110		-	-
L00_Cleaners Store_+00.00		110		-	-
L00_Disabled WC_+00.00		110		-	-
L00_Female WC_+00.00		110		-	-
L00_Kitchen/Servery_+00.00		110		-	-
L00_Male WC_+00.00		110		-	-
L00_Queueing Area/Main Cafe 01_Core_+00.00		110		-	-
L00_Queueing Area/Main Cafe 01_Perimeter_+00.00		110		-	-
L00_Queueing Area/Main Cafe 02_Perimeter_+00.00		110		-	-
L00_Queueing Area/Main Cafe 03_Perimeter_+00.00		110		-	-
L00_Queueing Area/Main Cafe 04_Perimeter_+00.00		110		-	-
L00_Store_+00.00		110		-	-
L00_WC Lobby_+00.00		110		-	-
L00_WC_+00.00		110		-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00_Circulation_+00.00	N/A	N/A
L00_Kitchen/Servery_+00.00	NO (-71%)	NO
L00_Queueing Area/Main Cafe 01_Perimeter_+00.00	YES (+67.1%)	NO
L00_Queueing Area/Main Cafe 02_Perimeter_+00.00	YES (+119.8%)	NO
L00_Queueing Area/Main Cafe 03_Perimeter_+00.00	YES (+2%)	NO
L00_Queueing Area/Main Cafe 04_Perimeter_+00.00	YES (+82.9%)	NO



**Regulation 25A: Consideration of high efficiency alternative energy systems**

<b>Were alternative energy systems considered and analysed as part of the design process?</b>	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			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m <sup>2</sup> ]	547.5	547.5		Retail/Financial and Professional Services
External area [m <sup>2</sup> ]	1368.2	1368.2		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON	100	<b>Offices and Workshop Businesses</b>
Infiltration [m <sup>3</sup> /hm <sup>2</sup> @ 50Pa]	5	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	434.47	312.51		Storage or Distribution
Average U-value [W/m <sup>2</sup> K]	0.32	0.23		Hotels
Alpha value* [%]	25	10		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
				Others: Miscellaneous 24hr Activities
				Others: Car Parks 24 hrs
				Others: Stand Alone Utility Block

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

### Energy Consumption by End Use [kWh/m<sup>2</sup>]

	Actual	Notional
Heating	9.8	7.56
Cooling	0.64	0.45
Auxiliary	11.67	7.74
Lighting	7.57	8.4
Hot water	0.46	0.44
Equipment*	25.64	25.64
<b>TOTAL**</b>	<b>30.13</b>	<b>24.59</b>

\* 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<sup>2</sup>]

	Actual	Notional
Photovoltaic systems	7.62	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>7.62</i>	<i>0</i>

### Energy & CO<sub>2</sub> Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	155.31	80.26
Primary energy [kWh <sub>th</sub> /m <sup>2</sup> ]	33.85	36.72
Total emissions [kg/m <sup>2</sup> ]	3.26	3.45

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] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	123.5	0	8.1	0	6.2	4.23	0	4.5	0
Notional	90.8	0	9.1	0	2.3	2.78	0	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	139.3	16.1	9.5	1.1	15.2	4.08	4.04	4.5	5
Notional	79.4	8	7.9	0.8	11	2.78	2.84	----	----
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	175.1	0	11.6	0	7.2	4.21	0	4	0
Notional	57.6	0	5.8	0	3.8	2.78	0	----	----

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