Overheating Assessment

Uxbridge Town Centre West

St.UT.UB8

On behalf of St Modwen Homes Ltd

Revision 01

Date: 08th December 2021

REVISION HISTORY

Revision	Issue Date	Description	Issued By	Checked By
R00	30/11/2021	Initial Issue	TW	MA
R01	08/12/2021	Inclusion of communal corridors	TW	

Calculations contained within this report have been produced based on information supplied by the Client and the design team. Any alterations to the technical specification on which this report is based will invalidate its findings.

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CONTENTS

EXECUTIVE SUMMARY

1.1. Purpose of the Assessment

Energist UK has been instructed by St Modwen Homes Ltd ("the Applicant") to carry out an overheating assessment for the development of Uxbridge Town Centre West ("the Development").

This Overheating Assessment outlines the passive and active design measures taken by the Applicant to ensure that the risk of overheating has been minimised and that the strategy:

- Follows the methodology set out in CIBSE TM59 for the residential elements and complies with the overheating criteria.
- Considers CIBSE Guide A and CIBSE TM52

Assessment Methodology and Compliance Criteria

For the assessment of overheating risk at Uxbridge Town Centre West Central a Dynamic Thermal Model has been created using the IES-VE version 2021 software.

Fourteen sample residential dwellings of Block 1 and two selected commercial units have been modelled and simulated.

The Energist approach to the overheating assessment is based on the CIBSE TM59 and TM52 Methodologies which are standardised approaches that aim to encourage good design and propose a standardised process for assessing overheating in residential and non-residential properties, that would be common across the industry.

They propose typical profiles to describe the internal gains through occupancy, lighting, and equipment. For further details with regard to the profiles used for the Dynamic Thermal Modelling, please refer to Appendices 3 and 4.

TM59 introduces two sets of compliance criteria for assessing overheating which are based on the ventilation type of the dwelling:

For houses predominantly naturally ventilated

a. The number of hours for living rooms, kitchens and bedrooms, for which the difference between the internal and external temperatures (ΔT) is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of the occupied hours (TM52 criterion 1).

b. For bedrooms only, to guarantee comfort during the sleeping hours the operative temperature from 10pm to 7am shall not exceed 26 degrees Celsius for more than 1 per cent of annual hours.

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both a and b above must be met.

For homes predominantly mechanically ventilated

a. (for example, because of air quality or noise issues), the CIBSE Guide A fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26 degrees Celsius for more than 3 per cent of the annual occupied hours.

Corridors should demonstrate that an operative temperature of 28ºC should not be exceeded for more than 3% of the total annual hours.

TM52 introduces three sets of compliance criteria for assessing overheating which are based on the ventilation type of the dwelling.

For non-residential buildings

The following three criteria, taken together, are used to assess the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three criteria is classed as overheating.

a. The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature by 1°K or more during the occupied hours of a typical non-heating season (1st May to 30th September.

b. The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. The criterion sets a daily limit for acceptability.

c. The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

For communal corridors, CIBSE TM52 does not provide any assessment methodology. For this reason, communal corridors have been assessed against the criteria specified in the CIBSE TM59 methodology. These are:

- Corridors should demonstrate that an operative temperature of 28ºC should not be exceeded for more than 3% of the total annual hours.

- All communal corridors have been found to be passing the CIBSE TM59 overheating criteria.

1.2. Weather Data & Climate Change Adaptation

As required by CIBSE the Design Summer Year DSY1 for the 2020s, high emissions, 50% percentile for the most appropriate location has been used for this overheating assessment.

The site is located in a suburban area and therefore the London Gatwick DSY1 has been selected as the most appropriate location.

1.3. Conclusions & Recommendations

This Overheating Assessment demonstrates that the Uxbridge Town Centre West development fully complies with:

- Methodology as set out in CIBSE TM59 and TM52 and the overheating criteria under DSY1.
- CIBSE Guide A and CIBSE TM52.

The Applicant incorporates the following passive and active design measures to address and partially mitigate for the risk of overheating at the Uxbridge Town Centre West development:

- Improved Building Fabrics.
- Natural Ventilation through Openable Windows
- An improved G-Value to all glazing panels
- Mechanical Ventilation with Heat Recovery (MVHR)
- Balconies which can create shading

The development successfully complies with all the CIBSE TM59 requirements for predominantly naturally ventilated residential buildings and the CIBSE TM52 requirements for the non-residential elements of the development.

The results for the non-residential spaces are shown in two separate assessments, Assessment 1, showing all spaces (without mechanical cooling) initially pass the overheating criteria specified in the CIBSE TM52 methodology. This is due to mechanical ventilation alone being enough to mitigate overheating.

Assessment 2, (mechanical cooling model to all spaces) shows all the assessed non-residential spaces passing the overheating criteria specified in the CIBSE TM52 methodology. This demonstrates that Uxbridge Town Centre West complies with GLA guidance on assessing overheating to non-residential spaces.

INTRODUCTION

1.4. Background

Overheating has become a Common Issue in recent years due to climate change and stricter national and regional policies for energy efficient buildings, improved building fabrics and airtight buildings. Furthermore, in urban centres, especially in the South and Southeast of the UK, the Urban Heat Island (UHI) effect is deteriorating the consequences of the already intense and frequent hot summer events to the building industry.

Therefore, it becomes of significant importance to assess the risk of overheating at the early stages of the design process to avoid any expensive modifications to the design at later stages of the development process.

This Overheating Assessment has been prepared by Energist UK Ltd. for the mixed-use development scheme at Uxbridge Town Centre West.

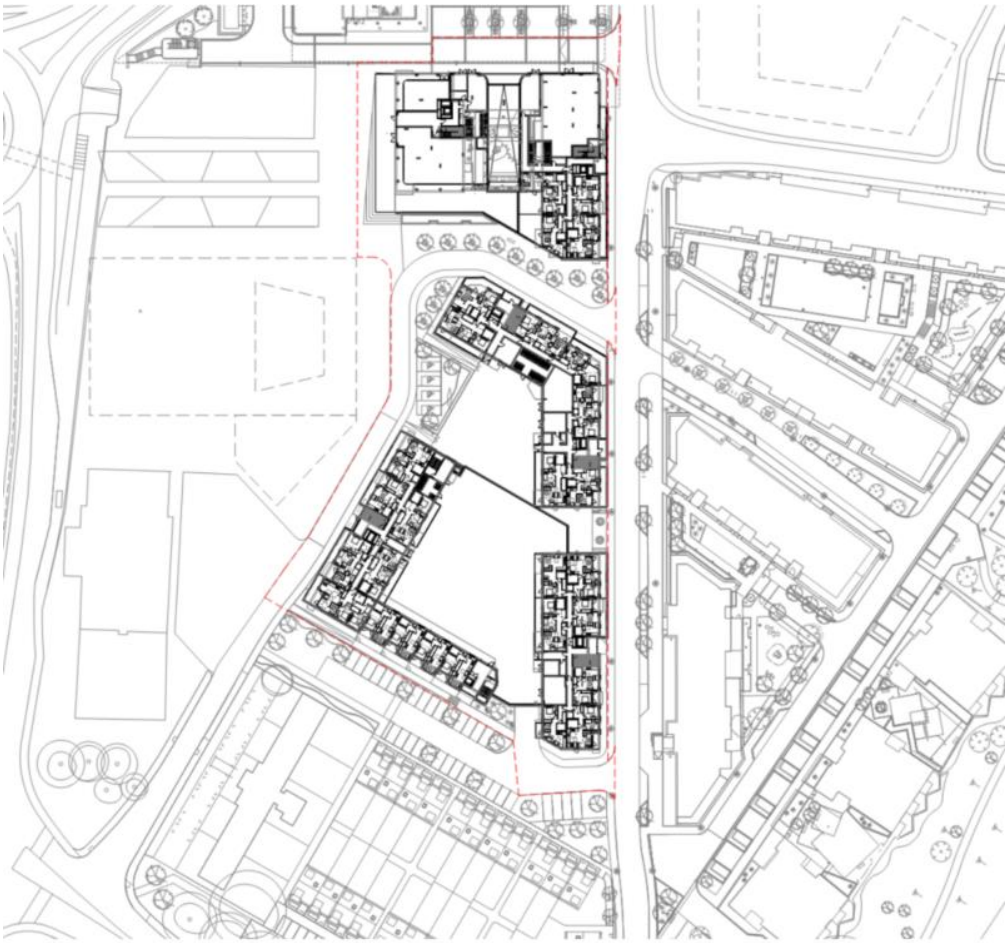
This report presents how the Development aligns with the requirements of national and regional planning policies related to overheating, described in Appendix 2. It follows the steps proposed by the CIBSE TM59 guidance "*Design methodology for the assessment of overheating risk in homes"* and the CIBSE TM52 guidance "*Avoiding overheating in buildings in the UK and Europe".*

For this assessment, the IES Virtual Environment version 2021 software has been used. Sample dwellings and non-domestic areas have been modelled and the risk of overheating assessed under current climate conditions. Where applicable, mitigation measures are put forward.

1.5. Site Description

This Overheating Assessment has been produced for the proposed mixed-use development at Uxbridge Town Centre West. The development incorporates 267 one and two bedroom dwellings and 4 commercial ground floor units over a 3-block scheme.

Map 1: Site location for Uxbridge Town Centre West.



2. ASSESSMENT METHODOLOGY AND INPUTS

2.1. Sample Units

For the purpose of this Overheating Assessment, fourteen sample dwellings in Block 1 of the development have been selected to be assessed for the residential elements and both commercial units within the same block against the criteria set by CIBSE TM59 for units being at high risk of overheating. These are likely to be:

a. on the topmost floor,
b. with large glazing areas,
c. having less shading,
d. having large, sun facing windows,
e. having a single aspect,
f. having limited opening windows.

2.2. Simulation Weather Data

For the assessment of the risk of overheating the CIBSE Design Weather Year (DSY1) for the 2020s, high emissions, 50% percentile scenario has been used as required in the CIBSE TM59 methodology.

The DSY1 is the current weather file for Uxbridge Town Centre West.

The location of the site is considered to be semi-urban and therefore the London GTW weather location has been chosen.

2.3. Building Fabric Specification

A summary of the design specification for the Uxbridge Town Centre West site, is provided in Table 1.

Table 1. Uxbridge Town Centre West Specification

Element	U-Value (W/m^{2}K)
Ground Floor U-Value (W/m^2.K)	0.14
External Wall U-Value (W/m^2.K)	0.16
Roof U-value (W/m^2.K)	0.12
Glazing U-Value, including frame (W/m^2.K)	1.5
Glazing G-value	0.4

2.4. Internal Gains

2.4.1. Occupancy Gains

As per the CIBSE TM59 guidance, occupancy maximum sensible and latent gains should be equal to 75W/person and 55W/person in all living spaces.

As per the CIBSE TM52 guidance, occupancy maximum sensible and latent gains should be equal to 90W/person and 60W/person in all non-residential spaces.

A summary of the occupancy gains as required by CIBSE TM59 and TM52 are provided in Appendix 3.

2.4.2. Lighting Gains

Internal gains due to lighting within the assessed dwellings, for the purposes of this assessment, have been assumed to be equal to 2 W/m^2 and will be operating from 18:00 till 23:00.

Internal gains due to lighting within the assessed non-domestic units, for the purposes of this assessment, have been assumed to be equal to 8 W/m^2 and will be operating from 08.00 till 18:00.

2.4.3. Equipment Gains

Equipment gains should be assumed to be equal to the values provided in CIBSE TM59.

Equipment gains for the non-residential areas are assumed to be equal to the values provided in CIBSE TM52 of 10W/m^2.

Further details for equipment gain values and hours of operation for each space can be found in Appendix 4.

2.5. Ventilation

2.5.1. Natural Ventilation

The assessed flats in the Uxbridge Town Centre West development are considered predominantly naturally ventilated.

In particular, windows in all assessed plots have been assumed to open when the internal temperature exceeds 22^{o}C and when the internal temperature is higher than the external. This formula has been applied from 08:00 till 23:00.

For the purposes of this assessment all external glazed areas to the non-residential spaces have been modelled as open. Due to their variable use throughout the day, the external windows have been inappropriate to be relied upon for natural ventilation.

2.5.2. Mechanical Ventilation

Flats in the Uxbridge Town Centre West development use Mechanical Ventilation with Heat Recovery Systems (MVHR).

Background MVHR system has been assumed to operate at 0.3 l/s/m^2 in the occupied areas when the room temperature is above 21^{o}C

For the purposes of the non-residential overheating assessment at Uxbridge Town Centre West two assessments have been modelled to demonstrate the need for mechanical cooling. Assessment 1 has been modelled without any form of mechanical cooling. It is completely reliant on natural ventilation and background heat recovery. Assessment 2 includes a basic air conditioning system to all the assessed non-residential spaces. A basic system has been modelled for demonstrative purposes and it is intended that these parameters may change in the future.

3. RESIDENTIAL SIMULATION RESULTS

The following section demonstrates and analyses the results of the Overheating Assessment for the Uxbridge Town Centre West development.

As required by the CIBSE TM59 methodology the modelled air speed has been set at 0.1m/s.

All assessed residential areas have been assessed against the predominantly naturally ventilated criteria of the CIBSE TM59 and TM52 methodologies.

The results show that all rooms assessed successfully comply with Criterion 1a and b of the CIBSE TM59 and TM52 methodologies.

All bedrooms comply with being no greater than 26°C for more than 1% of the annual hours from 22:00-07:00. Therefore, it is expected that future occupants will not suffer from sleeping discomfort due to overheating.

Unit Reference	Criterion 1	Criterion 2 (Bedrooms)	Compliance
GF 2 Bed Kitchen	0.3	N/A	PASS
GF 2bed Living	0.3	N/A	PASS
GF Single Bed	0.4	0.21%	PASS
GF Double Bed	0.5	0.18%	PASS
GF Double Bed	0.1	0.30%	PASS
GF 1 Bed Kitchen	0.5	N/A	PASS
GF 1 bed Living	0.8	N/A	PASS
GF 2 Bed Living	0.3	N/A	PASS
GF 2 Bed Kitchen	0.3	N/A	PASS
GF Single Bed	0.2	0.24%	PASS
GF Double Bed	0.1	0.27%	PASS
GF Double Bed	0.1	0.15%	PASS
GF 1 Bed Kitchen	0	N/A	PASS
GF 1 Bed Living	0	N/A	PASS
FF I Bed Kitchen	0	N/A	PASS
FF 1 Bed Living	0	N/A	PASS
FF Double Bed	0	0.06%	PASS
FF Double Bed	0.4	0.15%	PASS
FF Double Bed	0	0.06%	PASS

FF Double Bed	0	0.09%	PASS
FF Double Bed	0.2	0.12%	PASS
FF Single Bed	1	0.%	PASS
FF 2 Bed Living	0.1	N/A	PASS
FF 2 Bed Kitchen	0.1	N/A	PASS
FF 2 Bed Living	2.5	N/A	PASS
FF 2 Bed Kitchen	1.7	N/A	PASS
FF 1 Bed Living	0	N/A	PASS
FF 1 Bed Kitchen	0.1	N/A	PASS
3F Double Bed	0.1	0.12%	PASS
3F Double Bed	0	0.09%	PASS
3F Double Bed	0.2	0.12%	PASS
3F Single Bed	0.6	0.09%	PASS
3F 2 Bed Kitchen	1.3	N/A	PASS
3F 2 Bed Living	0.5	N/A	PASS
3F Double Bed	0.4	0.09%	PASS
3F 1 Bed Living	0.3	N/A	PASS
3F 1 Bed Kitchen	0.3	N/A	PASS
5F Double Bed	0.3	0.12%	PASS
5F Single Bed	0	0.06%	PASS
5F Double Bed	0	0.09%	PASS
5F 2 Bed Kitchen	0	N/A	PASS
5F 2 Bed Living	0	N/A	PASS
5F Double Bed	0	0.09%	PASS
5F Double Bed	0.4	0.09%	PASS
5F Single Bed	0.1	0.06%	PASS
5F 2Bed Living	0	N/A	PASS
5F 2 Bed Kitchen	0	N/A	PASS
5F 2 Bed Kitchen	0.4	N/A	PASS
5F 2 Bed Living	0.9	N/A	PASS
3F 2 Bed Kitchen	0	N/A	PASS
3F 2 Bed Living	0	N/A	PASS
6F 2 Bed Kitchen	1.1	N/A	PASS
6F 2 Bed Living	1.7	N/A	PASS
6F Double Bed	1.5	0.30%	PASS

6F Double Bed	0.1	0.12%	PASS
6F Double Bed	0.5	0.12%	PASS
6F 1 Bed Living	0.3	N/A	PASS
6F 1 Bed Kitchen	0.2	N/A	PASS
6F 2 Bed Kitchen	0	N/A	PASS
6F 2 Bed Living	0	N/A	PASS
6F Double Bed	0	0.09%	PASS
6F Double Bed	0	0.12%	PASS
Double Bed	0	0.12%	PASS
6F 1 Bed Kitchen	0	N/A	PASS
6F 1 Bed Living	0	N/A	PASS
7F Double Bed	0.1	0.15%	PASS
7F Double Bed	0.4	0.09%	PASS
7F 2 Bed Kitchen	0.1	N/A	PASS
7F 2 Bed Living	0.2	N/A	PASS
7F Double Bed	0.4	0.18%	PASS
7F Double Bed	0.9	0.18%	PASS
7F 2 Bed Kitchen	1	N/A	PASS
7F 2 Bed Living	1.2	N/A	PASS
7F 2Bed Kitchen	1.3	N/A	PASS
7F 2 Bed Living	1.7	N/A	PASS
7F Double Bed	0.4	0.24%	PASS
7F Double Bed	0.3	0.24%	PASS
7F Double Bed	0.3	0.24%	PASS
7F 1 Bed Kitchen	0.2	N/A	PASS
7F 1 Bed Living	0.4	N/A	PASS

Summary of the assessed Communal Corridors of Block 1 against CIBSE TM59 Overheating Criteria.

Unit Reference	Annual Hours	% Hours Exceeding 28C	Compliance
GF Communal Corridor	8760	0.3%	PASS
FF Communal Corridor	8760	0%	PASS
5F Communal Corridor	8760	0%	PASS
6F Communal Corridor	8760	0%	PASS

7F Communal Corridor	8760	0.13%	PASS

4. NON-RESIDENTIAL SIMULATION RESULTS

Table 1 below provide the results of Assessment 1 for all the assessed non-residential units against Criteria 1, 2 and 3 of the CIBSE TM52 guidance.

Table 1: Assessment 1

Unit Reference	Criterion 1 (% Hrs Top-Tmax>1K)		Criterion 2 (Max daily Deg.Hrs)		Criterion 3 (Max DeltaT)		Compliance with CIBSE TM52
	Result	Compliance	Result	Compliance	Result	Compliance	
Retail 1	1.8	3	24	6	4	4	PASS
Retail 2	1.7	3	26	6	4	4	PASS

Table 2 below provide the results of Assessment 2 for all the assessed units against Criteria 1, 2 and 3 of the CIBSE TM52 guidance.

Table 2: Assessment 2

Unit Reference	Criterion 1 (% Hrs Top-Tmax>1K)		Criterion 2 (Max daily Deg.Hrs)		Criterion 3 (Max DeltaT)		Compliance with CIBSE TM52
	Result	Compliance	Result	Compliance	Result	Compliance	
Retail 1	0	3	0	6	0	4	PASS
Retail 2	0	3	0	6	0	4	PASS

5. CONCLUSIONS AND RECOMMENDATIONS

This Overheating Assessment demonstrates that the Uxbridge Town Centre West development fully complies with:

- Methodologies as set out in CIBSE TM59 and TM52 and the overheating criteria under DSY1.
- CIBSE Guide A and CIBSE TM52.

The Applicant incorporates the following passive and active design measures to address and partially mitigate for the risk of overheating at the Uxbridge Town Centre West development:

- Improved Building Fabrics.
- Natural Ventilation through Fully Openable Windows
- Improved G-Value of 0.4 to all glazing
- Mechanical Ventilation with Heat Recovery (MVHR)
- Balconies
- The provision for air conditioning to the non-residential spaces so future occupants may control temperatures

The Applicant takes full account of a requirement to adapt to, and mitigate for, the impact of climate change and has taken steps to ensure this is considered within the design of the proposed scheme at Uxbridge Town Centre West.

6. APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

CIBSE	Chartered Institute of Building Services Engineers
TM	Technical Memorandum
GLA	Greater London Authority
UHI	Urban Heat Island
IESVE	Integrated Environmental Solutions Virtual Environment
DSY	Design Summer Year
MEV	Mechanical Extract Ventilation
MVHR	Mechanical Ventilation with Heat Recovery
HIU	Heat Interface Unit
ASHP	Air Source Heat Pump
CHP	Combined Heat & Power
DHN	District Heat Network
DHW	Domestic Hot Water
GSHP	Ground Source Heat Pump
LPA	Local Planning Authority
SBEM	Simplified Building Energy Model

APPENDIX 2. DESIGN GUIDANCE

CIBSE TM 52:2013 – The Limits of Thermal Comfort: Avoiding Overheating in European Buildings

The CIBSE TM52 guidance has been published in 2013 and uses the adaptive approach to assess whether a building will be overheating. TM52 uses the deviation from a set comfort temperature to assess whether a development is overheating.

CIBSE TM52 uses 3 criteria for assessing overheating. These are:

- **Criterion 1 – Hours of Exceedance (He):** The number of hours (He) during which DT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.
  If data are not available for the whole period (or if occupancy is only for a part of the period) then 3 per cent of available hours should be used.

- **Criterion 2 – Daily Weighted Exceedance (We):** To allow for the severity of overheating the weighted exceedance (We) shall be less than or equal to 6 in any one day.

- **Criterion 3 – Upper Limit Temperature (Tupp):** To set an absolute maximum value for the indoor operative temperature the value of DT shall not exceed 4 K.

For a dwelling to be considered as overheating, it must be failing in 2 of the above criteria.

CIBSE TM 59:2017 - Design Methodology for the Assessment of Overheating Risk in Homes

In May 2017, the Chartered Institute of Building Services Engineers (CIBSE) published the Technical Memorandum TM59.

The new methodology is based on the use of dynamic thermal modelling for assessing the overheating risk in residential developments and should be especially considered for:

- Large developments.
- Developments in urban areas, particularly in Southern England.
- Blocks of flats.
- Dwellings with high levels of insulation and air tightness.

- Single aspect flats.

Developments assessed under TM59 methodology are required to pass using the DSY1 (current design summer year) weather file most appropriate to the site location, for the 2020s, high emissions, 50% percentile scenario.

Other extreme weather files (DSY2 and DSY3) as well as future weather files for climate change adaptation should be considered in buildings of particular concern (e.g. care homes) and/or where required in the client's brief.

TM59 introduces two sets of compliance criteria for assessing overheating which are based on the ventilation type of the dwelling. That is,

2. **For houses predominantly naturally ventilated**
   a. The number of hours for living rooms, kitchens and bedrooms, which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of the occupied hours (TM52 criterion 1).

   b. For bedrooms only, to guarantee comfort during the sleeping hours the operative temperature from 10pm to 7am shall not exceed 26 degrees Celsius for more than 1 per cent of annual hours.

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both a and b above must be met.

3. **For homes predominantly mechanically ventilated** (for example because of air quality or noise issues), the CIBSE Guide A fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26 degrees Celsius for more than 3 per cent of the annual occupied hours.

APPENDIX 3: OCCUPANCY GAINS

Table 4: Residential

Number of People	Description	Peak Load (W)		Hours of Occupancy	Percentage of load
		Sensible	Latent		
1	Single Bedroom	75	55	23:00 – 08:00	0.7
				08:00 - 23:00	1
2	Double Bedroom	150	110	23:00 – 08:00	0.7
				08:00 – 09:00	1
				09:00 – 22:00	0.5
				22:00 – 23:00	1
1	1 Bed – Living Room/Kitchen	75	110	09:00 – 22:00	1
	1 Bed – Living Room			09:00 – 22:00	0.75
	1 Bed - Kitchen			09:00 – 22:00	0.25
2	2 Bed – Living Room/Kitchen	150	110	09:00 – 22:00	1
	2 Bed – Living Room			09:00 – 22:00	0.75
	2 Bed – Kitchen			09:00 – 22:00	0.25
3	3 Bed – Living/Kitchen	225	165	09:00 – 22:00	1
	3 Bed – Living Room			09:00 – 22:00	0.75
	3 Bed - Kitchen			09:00 – 22:00	0.25

Table 5: Non-domestic

Description	Peak Load (W)		Hours of Occupancy	Percentage of load
	Sensible	Latent		
Retail Area	90	60	18:00 – 08:00	0.0
			08:00 - 10:00	0.75
			10:00 – 12:00	1
			12:00 – 14:00	0.75
			14:00 – 17:00	1
			17:00 – 18:00	0.75

APPENDIX 4. EQUIPMENT GAINS

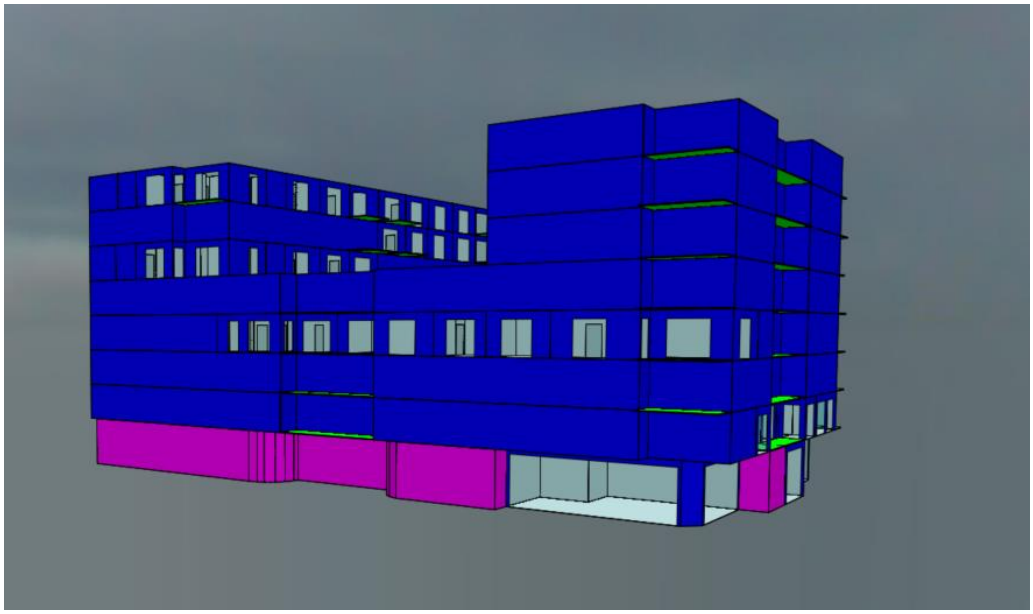
Table 6: Residential

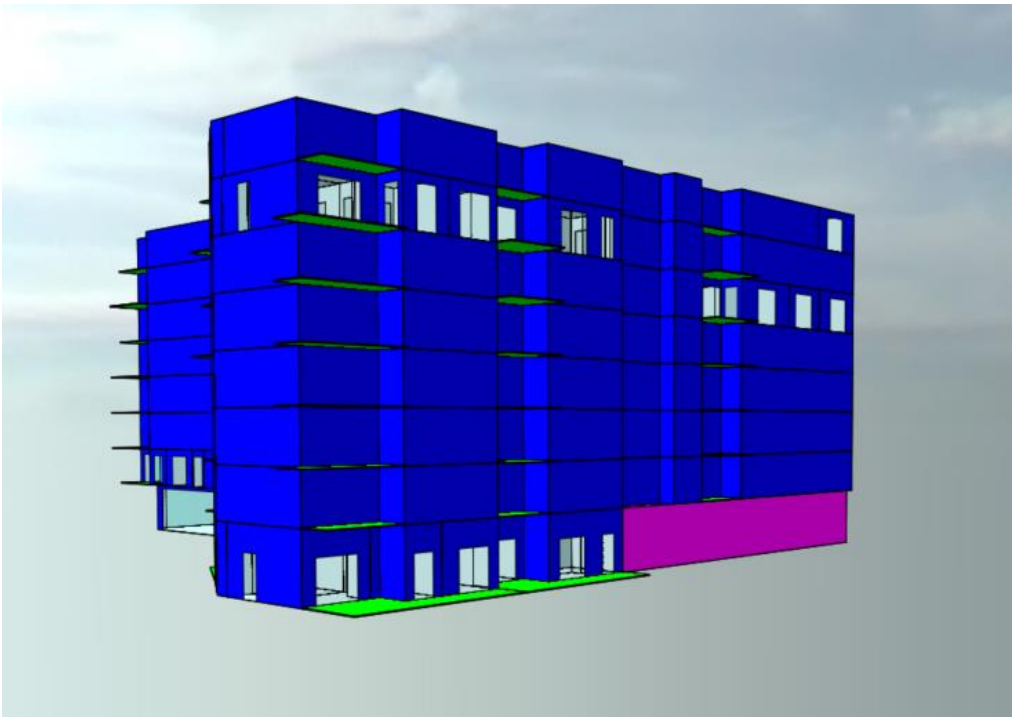
Description	Peak Load (W)	Hours of Occupancy	Percentage of load
Single Bedroom	80	23:00 – 08:00	0.13
		08:00 - 23:00	1
Double Bedroom	80	23:00 – 08:00	0.13
		08:00 – 23:00	1
Living Room/Kitchen	450	00:00 – 09:00	0.19
		09:00 – 18:00	0.24
		18:00 – 20:00	1
		20:00 – 22:00	0.44
		22:00 – 24:00	0.24
Living Room	150	00:00 - 09:00	0.23
		09:00 – 18:00	0.4
		18:00 – 22:00	1
		22:00 – 24:00	0.4
Kitchen	300	00:00 – 18:00	0.17
		18:00 – 20:00	1
		20:00 – 24:00	0.17

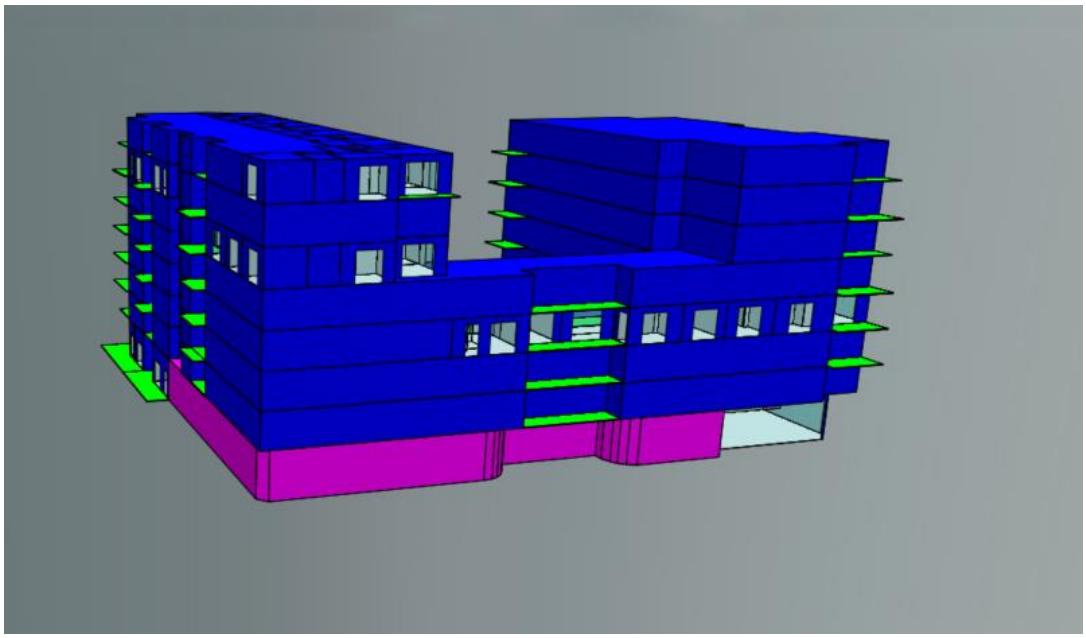
Table 7: Non-domestic

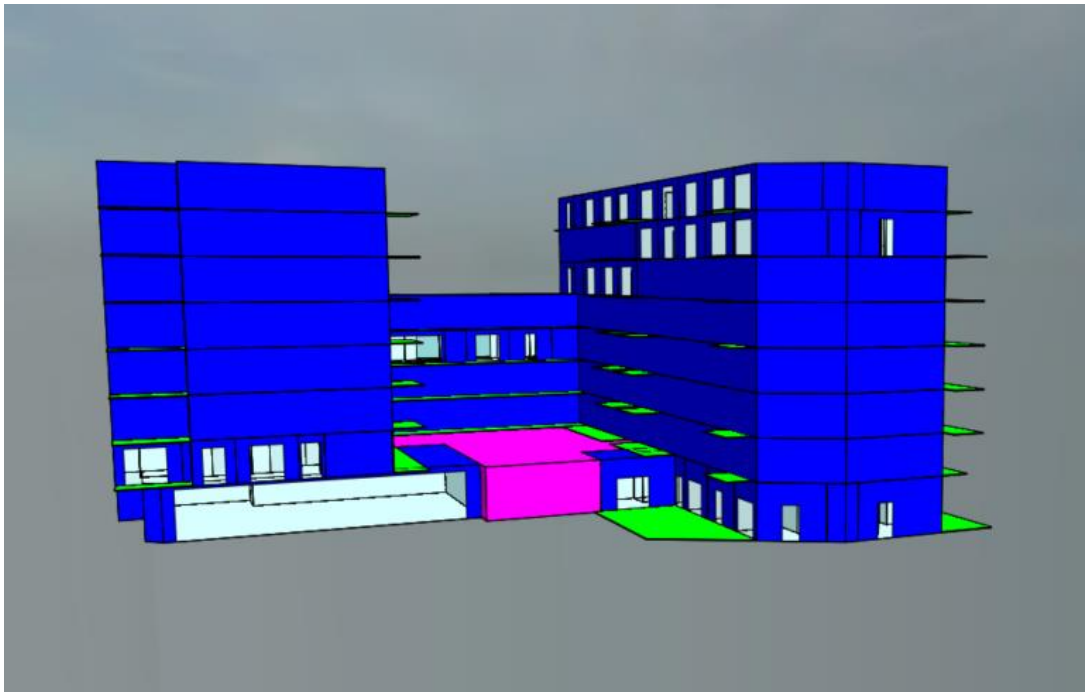
Description	Maximum Sensible Gain (W/m2)	Hours of Occupancy	Percentage of load
Retail Areas	5.2	18:00 – 08:00	0.0
		08:00 - 10:00	0.75
		10:00 – 12:00	1
		12:00 – 14:00	0.75
		14:00 – 17:00	1
		17:00 – 18:00	0.75

APPENDIX 5. RESIDENTIAL ASSESSED SPACES









APPENDIX 6. NON-DOMESTIC ASSESSED SPACES

Block 1: Ground Floor