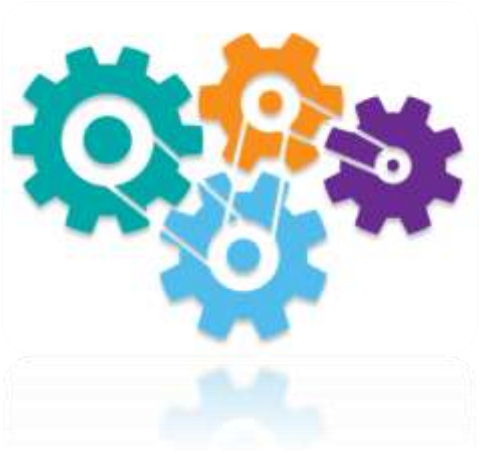
SYNTEGRA
CONSULTING

19-5436

Climate Change Adaptation - Overheating Analysis Report

2-6 Camden High Street, London , NW1 0HJ

June 2019



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Revision	-	*Rev A*	*Rev B*	*Rev C*
Date	13/06/2019			
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1. Executive Summary

Syntegra Consulting has assessed the overheating risk for the proposed development at **2-6 Camden High Street, London NW1 0HJ,** The proposed development comprises **a refurbishment and extension of a six-floor commercial building.** This report outlines the inputs and the results of the overheating analysis for all rooms within the development.

Dynamic overheating modelling using IES-VE 2018 has been carried out in line with London Plan 2016 policy 5.9, CIBSE TM 52 (The Limits of Thermal Comfort) and TM49 (Design Summer Years for London). The overheating criteria set by TM52 and Design Summer Years (DSY) set by TM49 can be found in section 3 of this report. The assessment results by 3 DSY weather data are summarised as follows.

1.1 Baseline

The baseline design is based on the building without any measures to reduce the overheating risks. All inputs used for this scenario can be found in section 4 of this report. The results below show that none of the habitable rooms meet the TM52 criteria with all DSY weather files. Detailed results are in section 5.1 of this report.

	Long, less intense warm spell – DSY 1	Moderately warm summer– DSY 2	Short intense warm spell – DSY 3
TM52 Compliance	0% (No Room Compliant)	0% (No Room Compliant)	0% (No Room Compliant)

Table 1 Baseline results

1.2 Baseline + Internal Blind + 50% Openable windows/doors

To reduce the overheating issues, internal blinds/curtains and 50% Openable windows/doors have been tested to all rooms. Details of the internal blind and Openable windows used for this scenario can be found in section 5.2 of this report.

As shown in the table below, the majority of habitable rooms are still failing on the TM52 criteria. However, the amount of exceedance in each criterion has been decreased. Detailed results are in section 5.1 of this report.

	Long, less intense warm spell – DSY 1	Moderately warm summer– DSY 2	Short intense warm spell – DSY 3
TM52 Compliance	11.11% (1 rooms)	88.89% (8 rooms)	0% (0 rooms)

Table 2 Baseline + Internal Blind + 50% Openable Windows results

1.3 Baseline + Internal Blind + 50% Openable Window/Door + MVHR.

Mechanical Ventilation with Heat Recovery (MVHR) system has been tested to remove the hot humid air from wet rooms and supply fresh air to dry rooms. Details of the MVHR system used for this scenario can be found in section 5.3 of this report.

However, although the MVHR system is effective to reduce the energy use and carbon emissions, it was not adequate to remove all overheating risk. Consequently, the results are still similar to the previous scenario (baseline + internal blind + 50% openable window/door). Hence, this scenario will not be adopted for the proposed development.

	Long, less intense warm spell – DSY 1	Moderately warm summer– DSY 2	Short intense warm spell – DSY 3
TM52 Compliance	11.11% (1 rooms)	88.89% (8 rooms)	0% (0 rooms)

Table 3 Baseline + Internal Blind + 50% openable window/door results

1.4 Baseline + Internal Blind + 50% Openable Window/Door + Comfort Cooling

To remove the overheating risks completely with all DSY weather conditions, the suitable method is a comfort cooling system. In this case, the analysis suggests that this could be achieved via air source heat pumps. (Cooling EER 4.48).

	Long, less intense warm spell – DSY 1	Moderately warm summer– DSY 2	Short intense warm spell – DSY 3
TM52 Compliance	100% (All habitable rooms)	100% (All habitable rooms)	100% (All habitable rooms)

Table 4 Baseline + Internal Blind + 50% openable window/door + Comfort Cooling results

2. Introduction

Overheating analysis has been carried out to satisfy the planning requirement. The proposal is **a refurbishment and extension of a six-floor commercial building at 2-6 Camden High Street, London, NW1 0HJ**. This report outlines the inputs and the results of the overheating analysis for all rooms (9 rooms).

IES Virtual Environment version 2018 was used to conduct Dynamic Simulation Modelling (DSM) simulation. Below images are the 3D view of proposed development for the overheating analysis. All images used in this report are not 3D visualisation images, but technical 3D model images.

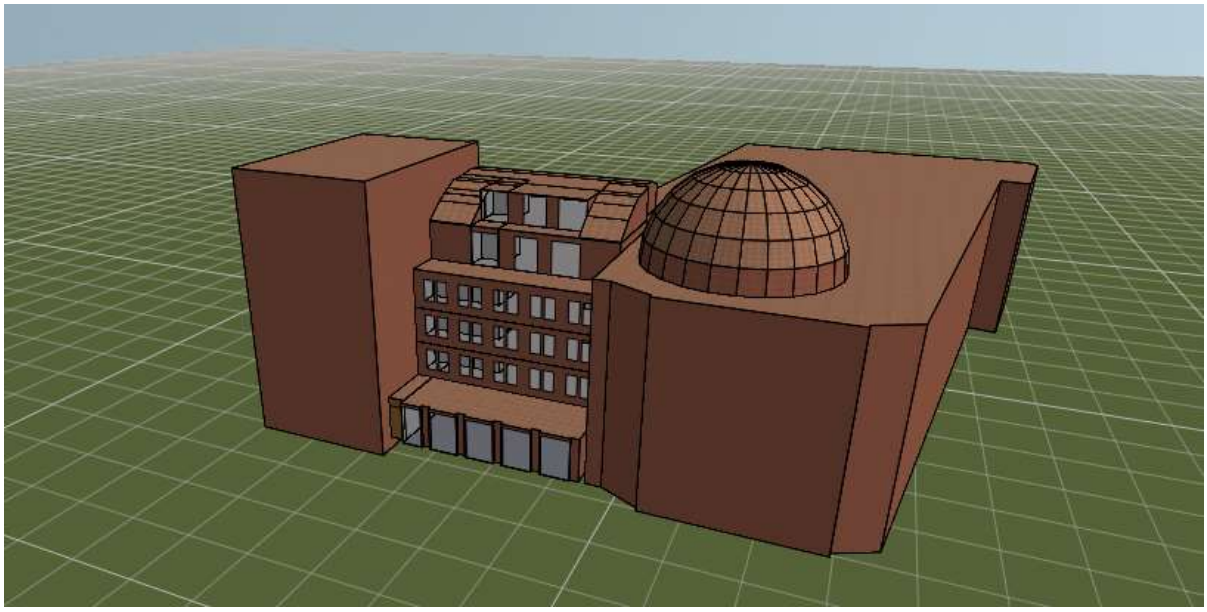

Figure 1 IES 3D model view 1

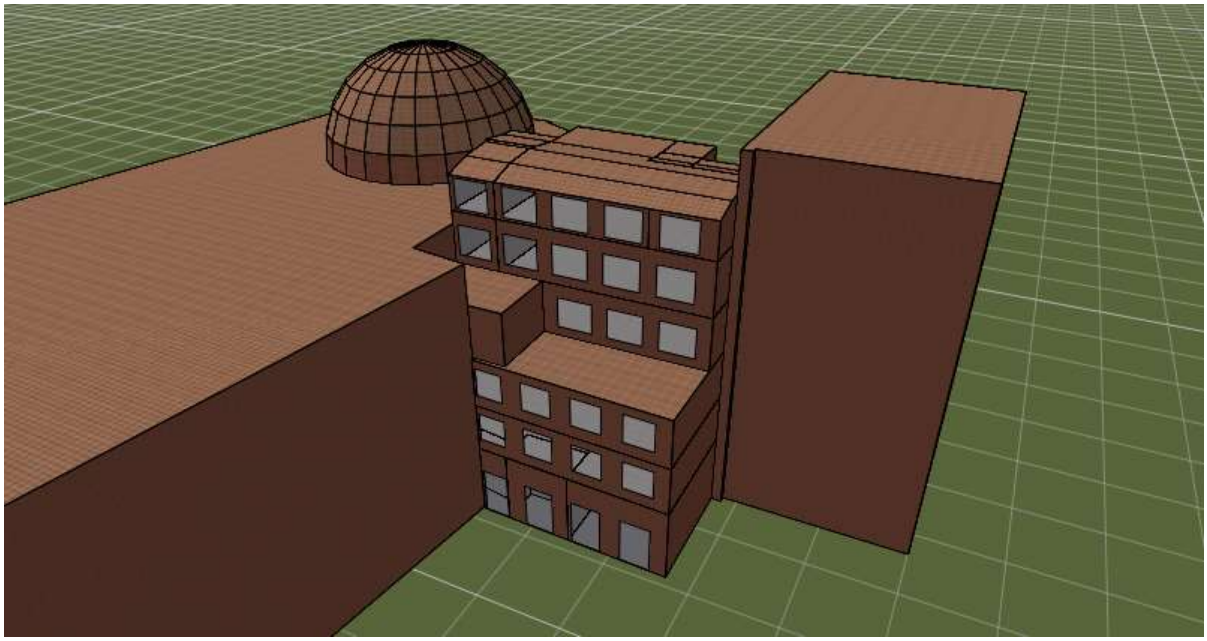

Figure 2 IES 3D model view 2

3. Assessment criteria

3.1 CIBSE TM52: The limits of thermal comfort

CIBSE TM52 defines overheating criteria in free-running buildings and mechanically ventilated buildings according to different categories. The analysed building falls under the Category 2 given that it is a new building (see table below).

Category	Explanation	Free-running buildings (acceptable range K)	Mechanically ventilated buildings (acceptable PMV limits)
1	High level of expectation only used for spaces occupied by very sensitive and fragile persons	± 2	± 0.2
2	Normal expectation (for new buildings and renovations)	± 3	± 0.5
3	A moderate expectation	± 4	± 0.7
4	Values outside the criteria for the above categories (only acceptable for a limited period)	> 4	> 0.7

Table 5 Suggested applicability of the category

As shown in table below, the three criteria in the CIBSE TM52 provide a robust and balanced assessment of the risk of overheating and in order for a room to be classified as compliant then it will need to meet at least two out of the three criteria.

Criteria		Details
1	Hours of exceedance (H_e)	The number of hours (H_e) during 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 occupied hours.
2	Daily weighted exceedance (W_e)	To 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. This criterion sets a daily limit for acceptability, which should be less than or equal to 6 in any one day.
3	Upper limit temperature (T_{upp})	To set an absolute maximum value daily temperature for a room, beyond which the level of overheating is unacceptable. The value of ΔT shall not exceed 4K.

Table 6 Overheating criteria in CIBSE TM52

3.2 CIBSE TM49: Design Summer Years for London

Overheating risk assessments are carried out using dynamic thermal simulation models running under the CIBSE Design Summer Year (DSY) weather data. The DSY is a single continuous year rather than a composite one made up from average months.

GLA Energy Planning: guidance on preparing energy assessments (March 2016) specifies that 3 different DSY weather data files should be used in overheating analysis as follows.

- 1976: a year with a prolonged period of sustained warmth
- 1989: a moderately warm summer (current design year for London)
- 2003: a year with a very intense single warm spell.

According to the site location, 3 DSYs are available capturing the local climate in three different London sites, i.e. LWC for urban, LHR for semi-urban, and GTW for rural area.

4. Input data

4.1 Drawings

Syntegra received the architectural drawings, and they were used to build the geometry of the building and undertake the overheating analysis in IES. The drawing reference is shown below.

No.	Document Name	Format	Received Date
1	540 PROPOSED PLANNING D 12 2019	dwg	08-04-2019
2	Camden High Street D&A Report Revision D	pdf	06-03-2019

Table 7 The drawing list

4.2 Weather data

The development is based Camden NW1 0JH, and the overheating assessment has been carried out using the following weather files in accordance with CIBSE TM49 and GLA Guidance on preparing energy assessments (March 2016).

		Weather files
DSY weather Data	**Long less intense warm spell**	LWC 1976_baseline.epw
	Moderately warm summer	LWC 1989_baseline.epw
	Short intense warm spell	LWC 2003_baseline.epw

Table 8 CIBSE TM49 weather data used for the overheating analysis

4.3 Building fabric

The assessment was carried out based on highly efficient building elements to meet Building Regulations Part L. The fabric specifications used for this assessment are in the table below,

	U-values (W/m^2K)	**Air permeability** $m^3/(h.m^2)$ at 50 Pa
Roof	0.13	3.5
Floor	0.2	
Walls	0.16	
Windows	1.2	
Door	1.0	

Table 9 Building fabric specifications

4.4 Internal gains

The internal gains and variation profiles for occupancy, lighting, and equipment are based on National Calculation Methodology (NCM) default data being available in IES-VE 2018.

4.5 Ventilation

As a baseline design, local extracts have been appplied to wet rooms (kitchen, changing room, toilet) to remove the hot humid air. The extract flow rate of 0.8 l/sm^2 and specific fan power of 0.3 W/l/s have been used for this assessement.

Futher measures (MVHR systems and artificial cooling) to reduce the overheating risks have been tested. Details can be found in section 5 of this report.

5. Results

This section presents the results, using CIBSE TM52 methodology based on 3 DSY weather files that mentioned in the previous section.

5.1 Baseline

The baseline scenario is based on the building without any measures to reduce the overheating risks. All inputs used for this scenario can be found in section 4 of this report. The results below show that none of the habitable rooms meet the TM52 criteria with all DSY weather files. Please note that in order for a room to be classified as compliant it will need to meet at least two out of the three criteria.

- **Long less intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	83.7	110	11	1 & 2 & 3	**FAIL**
0.02 RECEPTION	96.9	166	15	1 & 2 & 3	**FAIL**
0.07 PRET A MANGER	91.3	44	12	1 & 2 & 3	**FAIL**
1.03 OFFICE AREA	99.7	177	17	1 & 2 & 3	**FAIL**
2.03 OFFICE AREA	99.9	184	17	1 & 2 & 3	**FAIL**
3.03 OFFICE AREA	100	200	19	1 & 2 & 3	**FAIL**
4.03 OFFICE AREA	100	221	20	1 & 2 & 3	**FAIL**
5.03-01 OFFICE AREA	100	195	18	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	100	242	22	1 & 2 & 3	**FAIL**

Table 10 Baseline DSY1 results

- **Moderately warm summer**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	90	101	10	1 & 2 & 3	**FAIL**
0.02 RECEPTION	99.5	157	14	1 & 2 & 3	**FAIL**
0.07 PRET A MANGER	95.6	42	12	1 & 2 & 3	**FAIL**
1.03 OFFICE AREA	99.9	169	16	1 & 2 & 3	**FAIL**
2.03 OFFICE AREA	100	180	17	1 & 2 & 3	**FAIL**
3.03 OFFICE AREA	100	193	18	1 & 2 & 3	**FAIL**
4.03 OFFICE AREA	100	210	19	1 & 2 & 3	**FAIL**
5.03-01 OFFICE AREA	100	187	17	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	100	227	21	1 & 2 & 3	**FAIL**

Table 11 Baseline DSY2 results

- **Short intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	87.1	102	11	1 & 2 & 3	**FAIL**
0.02 RECEPTION	99.1	148	14	1 & 2 & 3	**FAIL**
0.07 PRET A MANGER	96.3	42	12	1 & 2 & 3	**FAIL**
1.03 OFFICE AREA	100	166	17	1 & 2 & 3	**FAIL**
2.03 OFFICE AREA	100	176	18	1 & 2 & 3	**FAIL**
3.03 OFFICE AREA	100	189	19	1 & 2 & 3	**FAIL**
4.03 OFFICE AREA	100	211	20	1 & 2 & 3	**FAIL**
5.03-01 OFFICE AREA	100	189	18	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	100	229	22	1 & 2 & 3	**FAIL**

Table 12 Baseline DSY3 results

5.2 Baseline + Internal Blind + 50% window openings/doors

To reduce the overheating issues, internal blinds/curtains have been tested to all rooms. Details of the internal blind used for this scenario are as follows.

Operation profile	On continuously
Incident radiation to lower device	1 W/m^2
Incident radiation to raise device	0 W/m^2
Night-time resistance	0 m^{2}K/W
Daytime resistance	0 m^{2}K/W
Shading coefficient	0.4
Short-wave radiant fraction	0.0
Blind or curtain type	Net curtain (covering whole window)
Fraction of daylight hours closed	0.1

Table 13 Internal curtain details

In addition to the internal blind, the 50% of total window and door areas have been opened for the natural ventilation. The opening threshold is set at 23°C.

As shown in the table below, the majority of habitable rooms are still failing on the TM52 criteria. However, the amount of exceedance in each criterion has been decreased. Please note that in order for a room to be classified as compliant it will need to meet at least two out of the three criteria.

- **Long less intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	2	13	3	2	**PASS**
0.02 RECEPTION	3.8	21	4	1 & 2	**FAIL**
0.07 PRET A MANGER	4.4	8	4	1 & 2	**FAIL**
1.03 OFFICE AREA	3.9	23	5	1 & 2 & 3	**FAIL**
2.03 OFFICE AREA	4	23	5	1 & 2 & 3	**FAIL**
3.03 OFFICE AREA	3.8	23	5	1 & 2 & 3	**FAIL**
4.03 OFFICE AREA	3.8	23	5	1 & 2 & 3	**FAIL**
5.03-01 OFFICE AREA	28.5	50	6	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	3.9	24	5	1 & 2 & 3	**FAIL**

Table 14 Baseline + Internal Blind + 50% Openable Windows DSY1 results

- **Moderately warm summer**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	0.8	9	2	2	**PASS**
0.02 RECEPTION	1.7	18	3	2	**PASS**
0.07 PRET A MANGER	2.1	7	3	2	**PASS**
1.03 OFFICE AREA	1.9	19	4	2	**PASS**
2.03 OFFICE AREA	2.1	21	4	2	**PASS**
3.03 OFFICE AREA	1.9	20	4	2	**PASS**
4.03 OFFICE AREA	1.8	21	4	2	**PASS**
5.03-01 OFFICE AREA	26.2	39	5	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	1.9	22	4	2	**PASS**

Table 15 Baseline + Internal Blind + 50% Openable Windows DSY2 results

- **Short intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	2.1	26	5	2 & 3	**FAIL**
0.02 RECEPTION	3.7	37	7	1 & 2 & 3	**FAIL**
0.07 PRET A MANGER	4.1	15	6	1 & 2 & 3	**FAIL**
1.03 OFFICE AREA	4.1	44	8	1 & 2 & 3	**FAIL**
2.03 OFFICE AREA	4.3	44	8	1 & 2 & 3	**FAIL**
3.03 OFFICE AREA	4	44	8	1 & 2 & 3	**FAIL**
4.03 OFFICE AREA	3.9	44	8	1 & 2 & 3	**FAIL**
5.03-01 OFFICE AREA	32.4	62	8	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	3.9	44	8	1 & 2 & 3	**FAIL**

Table 16 Baseline + Internal Blind + 50% Openable Windows DSY3 results

5.3 Baseline + Internal Blind + 50% Openable Window/door + MVHR

Mechanical Ventilation with Heat Recovery (MVHR) system has been tested to remove the hot humid air from wet rooms and supply fresh air to dry rooms. Details of the MVHR used for this scenario are as follows.

Extract Flow Rate	12 l/s/person
Supply Specific Fan Power	0.8 W/l/s
Exhaust Specific Fan Power	0.3 W/l/s
Heat Recovery Type	Plate heat exchanger (Recuperator)
Seasonal efficiency	0.65

Table 17 MVHR details

However, although the MVHR system is effective to reduce the energy use and carbon emissions, it was not adequate to remove all overheating risk. Consequently, the results are still same as the previous scenario (baseline + internal blind + 50% openable window/door). Hence, this scenario will not be adopted for the proposed development.

As shown in the table below, the majority of habitable rooms are still failing on the TM52 criteria. However, the amount of exceedance in each criterion has been decreased significantly. Please note that in order for a room to be classified as compliant it will need to meet at least two out of the three criteria.

- **Long less intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	1.9	13	3	2	**PASS**
0.02 RECEPTION	3.4	21	4	1 & 2	**FAIL**
0.07 PRET A MANGER	3.9	8	4	1 & 2	**FAIL**
1.03 OFFICE AREA	3.8	23	5	1 & 2 & 3	**FAIL**
2.03 OFFICE AREA	3.9	23	5	1 & 2 & 3	**FAIL**
3.03 OFFICE AREA	3.8	23	5	1 & 2 & 3	**FAIL**
4.03 OFFICE AREA	3.8	23	5	1 & 2 & 3	**FAIL**
5.03-01 OFFICE AREA	9.6	35	5	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	3.8	24	5	1 & 2 & 3	**FAIL**

Table 18 Baseline + Internal Blind +50% Openable Windows + MVHR DSY1 results

- **Moderately warm summer**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	0.7	9	2	2	**PASS**
0.02 RECEPTION	1.5	18	3	2	**PASS**
0.07 PRET A MANGER	2.1	7	3	2	**PASS**
1.03 OFFICE AREA	1.8	18	3	2	**PASS**
2.03 OFFICE AREA	1.8	19	4	2	**PASS**
3.03 OFFICE AREA	1.8	19	4	2	**PASS**
4.03 OFFICE AREA	1.8	20	4	2	**PASS**
5.03-01 OFFICE AREA	5.7	25	4	1 & 2	**FAIL**
5.03-02 OFFICE AREA	1.9	21	4	2	**PASS**

Table 19 Baseline + Internal Blind +50% Openable Windows + MVHR DSY2 results

- **Short intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	2	24	5	2 & 3	**FAIL**
0.02 RECEPTION	3.4	37	7	1 & 2 & 3	**FAIL**
0.07 PRET A MANGER	3.4	14	6	1 & 2 & 3	**FAIL**
1.03 OFFICE AREA	3.8	44	8	1 & 2 & 3	**FAIL**
2.03 OFFICE AREA	4	44	8	1 & 2 & 3	**FAIL**
3.03 OFFICE AREA	3.8	44	8	1 & 2 & 3	**FAIL**
4.03 OFFICE AREA	3.9	44	8	1 & 2 & 3	**FAIL**
5.03-01 OFFICE AREA	8.4	49	7	1 & 2 & 3	**FAIL**
5.03-02 OFFICE AREA	3.9	44	8	1 & 2 & 3	**FAIL**

Table 20 Baseline + Internal Blind +50% Openable Windows + MVHR DSY3 results

5.4 Baseline + Internal Blind + 50% Openable Window/door + Comfort cooling

To remove the overheating risks completely with all DSY weather conditions, the suitable method is a comfort cooling system. In this case, the analysis suggests that this could be achieved via air source heat pumps (cooling EER 4.48). The cooling set points are based on National Calculation Methodology (NCM) default data being available in IES-VE 2018.

- **Long less intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	0	0	0	-	**PASS**
0.02 RECEPTION	0	0	0	-	**PASS**
0.07 PRET A MANGER	0	0	0	-	**PASS**
1.03 OFFICE AREA	0	0	0	-	**PASS**
2.03 OFFICE AREA	0	0	0	-	**PASS**
3.03 OFFICE AREA	0	0	0	-	**PASS**
4.03 OFFICE AREA	0	0	0	-	**PASS**
5.03-01 OFFICE AREA	0	0	0	-	**PASS**
5.03-02 OFFICE AREA	0	0	0	-	**PASS**

Table 21 Baseline + Internal Blind +50% Openable Windows + Comfort Cooling DSY1 results

- **Moderately warm summer**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	0	0	0	-	**PASS**
0.02 RECEPTION	0	0	0	-	**PASS**
0.07 PRET A MANGER	0	0	0	-	**PASS**
1.03 OFFICE AREA	0	0	0	-	**PASS**
2.03 OFFICE AREA	0	0	0	-	**PASS**
3.03 OFFICE AREA	0	0	0	-	**PASS**
4.03 OFFICE AREA	0	0	0	-	**PASS**
5.03-01 OFFICE AREA	0	0	0	-	**PASS**
5.03-02 OFFICE AREA	0	0	0	-	**PASS**

Table 22 Baseline + Internal Blind +50% Openable Windows + Comfort Cooling results DSY2 results

- **Short intense warm spell**

Room Name	**Criteria 1** (%Hrs Top-Tmax>=1K)	**Criteria 2** (Max. Daily Deg.Hrs)	**Criteria 3** (Max. DeltaT)	**Criteria failing**	**Results**
0.00 ENTRANCE HALL	0	0	0	-	**PASS**
0.02 RECEPTION	0	0	0	-	**PASS**
0.07 PRET A MANGER	0	0	0	-	**PASS**
1.03 OFFICE AREA	0	0	0	-	**PASS**
2.03 OFFICE AREA	0	0	0	-	**PASS**
3.03 OFFICE AREA	0	0	0	-	**PASS**
4.03 OFFICE AREA	0	0	0	-	**PASS**
5.03-01 OFFICE AREA	0	0	0	-	**PASS**
5.03-02 OFFICE AREA	0	0	0	-	**PASS**

Table 23 Baseline + Internal Blind +50% Openable Windows + Comfort Cooling results DSY3 results

6. Conclusion

Dynamic overheating modelling using IES-VE 2018 has been carried out in line with London Plan 2016 policy 5.9, CIBSE TM 52 and TM49 to demonstrate that the development is not at risk of overheating.

The recommended measure is a combination of **the baseline design + Internal Blind + 50% Openable Window/Door + Comfort Cooling.** As shown in the table below, all habitable rooms meet the TM52 criteria with all DSY weathers.

	Long, less intense warm spell – DSY 1	**Moderately warm summer– DSY 2**	**Short intense warm spell – DSY 3**
TM52 Compliance	100 % (All habitable rooms)	100 % (All habitable rooms)	100 % (All habitable rooms)

Table 24 Baseline + Internal Blind + 50% openable window/door + Comfort Cooling