NRG CONSULTING

30 Chalcot Road

Overheating Assessment

October 2024

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1 Executive Summary

NRG Consulting have been commissioned to undertake an Overheating Assessment to support a Planning Application at **30 Chalcot Road, London, NW1 8LN**.

The development is an existing house for which an overheating assessment is required to verify the need for mechanical cooling. This is to support the application for the installation of air conditioning within the habitable rooms of the dwelling.

The following guidelines have been followed to assess the proposed development:

- CIBSE TM59: 2017 – Design methodology for the assessment of overheating risk in homes.
- GLA Guidance on preparing Energy Statements (June 2022)

This assessment has been performed based on the follow specification, details of which are contained within this report:

- U-Values of thermal elements. (Obtained from the EPC and from the Design Team)
- Window specification including U-Value, G-Value and opening details.
- The ventilation strategy, infiltration and air permeability rates.

Based on the information and statement made within this report, we have run a dynamic thermal analysis of the proposed habitable rooms for the residential development in order to assess compliance against CIBSE TM59 (Part O version) without cooling. This assessment failed for the rooms with the proposed cooling. The cooling hierarchy was then reviewed before the assessment was re-run with mechanical cooling.

This report has been written to address the following comment from Camden Council during determining of a similar application within the borough:

"Note that the Council typically resists the installation of air condition units unless it is demonstrated, through the submission of an Overheating Assessment, that the existing property cannot be actively cooled through passive measures (ie, not using air conditioning). Any proposal would need to be accompanied by an Overheating Assessment (thermal modelling), which would be reviewed by one of our Sustainability Officers, to ensure it meets policy and guidance. Please refer to Local Plan Policy CC2, para. 8.41 and Camden Planning Guidance: Energy efficiency and adaptation for further information and guidance."

Figure 1: 3D model of the proposed building

2 Overheating Guidance for Homes

2.1 CIBSE TM59 (2017) and Approved Document O: Overheating

The Chartered Institute of Building Services Engineers guidance "*Design Methodology for the Assessment of Overheating Risk in Homes*" (CIBSE TM59) was published in 2017 and presents a standardised approach to predicting overheating risk for residential building using dynamic thermal analysis.

Approved Document O (Part O) of the Building Regulations (2021) was introduced in June 2022. The aim and reason for the introduction of Part O1: Overheating mitigation is to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures. This is met by designing and constructing the building to achieve both of the following:

(a) limit unwanted solar gains in summer.
(b) provide an adequate means to remove heat from the indoor environment.

Part O applies to:

1. Residential (dwellings) Dwellings, which includes both dwellinghouses and flats.
2. Residential (institutional) Home, school, or other similar establishment, where people sleep on the premises.
3. The building may be living accommodation for the care or maintenance of any of the following:
    a. Older and disabled people, due to illness or other physical or mental condition.
    b. People under the age of 5 years.
4. Residential (other) Residential college, hall of residence and other student accommodation, and living. Accommodation for children aged 5 years and older.

2.2 CIBSE TM59: 2017 – Assessment Criterion

TM59:2017 provides a baseline in which to simulate overheating risk against which includes specific weather files, defined internal gains and a set of profiles that represent reasonable usage patterns for a home suitable for evaluating overheating risk.

It then has two criterion which deem whether it believes a habitable room within a dwelling is at risk of having issues with overheating. These are:

Test	Assessment Criterion	Acceptable Criterion	Investigated Period	Weather File
Criterion *a*	The frequency of the time when the operative temperature is higher than the maximum acceptable temperature	3% of occupied hours	May-September	Design Summer Year 1 DSY1, 2020s, High Emission, 50% percentile scenario
Criterion *b* (Bedrooms only)	Number of hours where temperature is above required	32 hours between 22:00 and 7:00	May-September	

Table 1: CIBSE TM59 – Assessment criteria for naturally ventilated buildings

2.3 Approved Document Part O – Amendments to the CIBSE TM59 Methodology

With the introduction of Part O, some clarifications were made within the guidance of the design parameters to input when running the dynamic thermal simulations for compliance that supersede or clarify the CIBSE TM59 manual. These are highlighted in Sections 2.4 and 2.5 below.

To demonstrate compliance using the dynamic thermal modelling method, all the following guidance should be followed:

- CIBSE's TM59 methodology for predicting overheating risk.
- The limits on the use of CIBSE's TM59 methodology set out in paragraphs 2.5 and 2.6. of ADO.
- The acceptable strategies for reducing overheating risk in paragraphs 2.7 to 2.11 of ADO.

2.4 Amendments to CIBSE TM59 methodology within Part O

All of the following limits on CIBSE's TM59, section 3.3, apply:

a. When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following:
  i. Start to open when the internal temperature exceeds 22°C.
  ii. Be fully open when the internal temperature exceeds 26°C.
  iii. Start to close when the internal temperature falls below 26°C.
  iv. Be fully closed when the internal temperature falls below 22°C.
b. At night (11pm to 8am), openings should be modelled as fully open if both of the following apply.
  i. The opening is on the first floor or above and not easily accessible.
  ii. The internal temperature exceeds 23°C at 11pm.
c. When a ground floor or easily accessible room is unoccupied, both of the following apply.
  i. In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely.
  ii. At night, windows, patio doors and balcony doors should be modelled as closed.
d. An entrance door should be included, which should be shut all the time.

2.5 GLA Guidance on Energy Statements

The GLA Guidance (June 2022) contains a section on overheating in-line with the requirements of Policy SI 4 of the London Plan (2021). This introduces the cooling hierarchy and the text states:

It is important to identify potential overheating risk, particularly in residential accommodation, early in the design process, and then incorporate suitable passive measures within the building envelope and services design to mitigate overheating and reduce cooling demand, in line with London Plan Policy SI 4. 8.2. Applicants should apply the cooling hierarchy in Policy SI 4 of the London Plan to the development. Whilst the cooling hierarchy applies to major developments, the principles can also be applied to minor developments. Measures that are proposed to reduce the demand for cooling should be set out under the following categories:

1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.
2. Minimise internal heat generation through energy efficient design:
3. Manage the heat within the building through exposed internal thermal mass and high ceilings:
4. Provide passive ventilation
5. Provide mechanical ventilation
6. Provide active cooling systems

3 Methodology Applied & Model Inputs

This section includes the model inputs used to assess the risk of overheating within the proposed development.

3.1 Scope of Assessment

All the habitable rooms of the proposed dwelling that are proposed to be supplied with Air Conditioning have been included within the overheating analysis.

3.2 Basis for Model

Project Information	
Building Category	Category II – New Builds
Software	IES Virtual Environment - 2023
Weather File - Location	London
Weather File - Details	DSY1, 2020s, High Emission, 50% percentile scenario
Summer Days	May 1st to September 30th – 153 days
Drawing Issue Date	July 2024

Table 2: Project information

3.3 Occupancy Patterns and Behaviour – CIBSE TM59 Data

In line with CIBSE guidance, realistic algorithms for occupant behaviour, the use of windows and other adaptive behaviour were used in the dynamic thermal model, as well as a realistic occupancy schedule.

Internal heat gains are based on '*Table 2 Occupancy and equipment gain description*' content in CIBSE TM59 (Appendix 1). These are replicated in the table below.

Room	Occupancy Heat Gain (W/person)		Light Heat Gain (W/m2)	(Other Small Power W/m2)
	Sensible	Latent		
Kitchen/Living Room	75	55	2	450
Bedroom	75	55	2	80

Table 3: Heat gain figures – Modelling & data inputs

3.4 Fabric Element and Ventilation Details

Thermal Elements	Proposed U-Value (W/m²K)
External Wall	2.00
Ground Floor	0.40
Roof	0.30
Ventilation Type	System 1 – Natural Ventilation
Air Permeability	
15 m³/(hm²) @50Pa	

Table 4: Fabric elements and ventilation details

For the fabric elements, GLA and Part L notional U-Values have been used to reflect the condition of the existing building along with information obtained from the EPC for the dwelling. This is with the exception of the U-Value and G-Value of the Windows (as highlighted below) which have come direct from the manufacturer as new windows are being installed as part of the proposals.

3.5 Windows and Internal Doors – Opening and Operation Details

Opening Type	Proposed U-Value (W/m²K)	Proposed G-Value (%)	Opening Hours
Window	1.5	0.48	As per Part O where windows have been modelled as openable.
Window (LGF)	1.0	0.48	
Rooflight	1.5	0.48	
Window Type	**Openable Area**	**Maximum Openable Angle**	
Fixed	-	-	
Side Hung (Red)	100%	10°	
Sash Widow (Green)	100mm	-	
Window Reveal Depth	N/A		
External Window Shading	**No**		
Internal Window Shading	**Curtains on the front windows, and blinds on the rear windows**		
Door Type	**Opening Hours**		
Internal Doors	Assumed open in the daytime and closed when the occupants are sleeping.		
In-line with GLA methodology, the impact of Internal Blinds or Curtains has not been modelled in this assessment.			

Table 5: Window and doors opening details

Figure 2: Window opening details – Front and rear elevation

4 Results

4.1 Without Cooling

The table below shows the results of the dynamic simulation based on the current design proposals against the CIBSE TM59 criteria for dwellings that are predominantly naturally ventilated. The results based on the current situation demonstrates that the living room as existing exceed the threshold outlined by CIBSE TM59 and therefore overheats during the summer.

Compliance for kitchens and living rooms is based on passing Criterion A. Bedrooms must pass both criteria.

DSY 1

Plot - Room	CIBSE TM59 – Predominantly Naturally Ventilated Homes		
	Criterion A (%Hrs Top-Tmax>=1K) Pass with value < 3	Criterion B – Bedrooms only (Hrs Top>26°C) Pass with value < 33	Compliance
LGF Open Plan Area	1.2		**YES**
LGF Guest Bedroom	0.8	46	**NO**
GF Library	1.3		**YES**
GF Study	2.9		**YES**
FF Principal Bedroom	1	49	**NO**
SF Bedroom 2	1.2	62	**NO**
SF Guest Bedroom	0.7	60	**NO**
TF Bedroom 3	1.9	36	**NO**

Table 6: Overheating Results – Without Cooling

DSY 2

Plot - Room	CIBSE TM59 – Predominantly Naturally Ventilated Homes		
	Criterion A (%Hrs Top-Tmax>=1K) Pass with value < 3	Criterion B – Bedrooms only (Hrs Top>26°C) Pass with value < 33	Compliance
LGF Open Plan Area	3.3		**NO**
LGF Guest Bedroom	2.4	95	**NO**
GF Library	4.4		**NO**
GF Study	6.2		**NO**
FF Principal Bedroom	3.1	91	**NO**
SF Bedroom 2	3.5	103	**NO**
SF Guest Bedroom	2.6	102	**NO**
TF Bedroom 3	3.6	85	**NO**

Table 7: Overheating Results – Without Cooling

DSY 3

Plot - Room	CIBSE TM59 – Predominantly Naturally Ventilated Homes		
	Criterion A (%Hrs Top-Tmax>=1K) Pass with value < 3	Criterion B – Bedrooms only (Hrs Top>26°C) Pass with value < 33	Compliance
LGF Open Plan Area	4		NO
LGF Guest Bedroom	2.6	111	NO
GF Library	4.7		NO
GF Study	7		NO
FF Principal Bedroom	3.1	99	NO
SF Bedroom 2	3.4	110	NO
SF Guest Bedroom	2.8	111	NO
TF Bedroom 3	3.9	91	NO

Table 7: Overheating Results – Without Cooling

From the above it can be seen that while the Front and Rear Living Room and Dining Rooms do comply, 5 out of the 8 modelled habitable rooms fail the CIBSE TM59 assessment with the current build and the installation of the new windows, even with the new windows having a low G-Value under DSY 1 weather file. Under DSY 2 and 3 weather files, all of modelled habitable rooms failed.

The bedrooms are particularly an issue with all bedrooms modelled predicted to overheat at nighttime. It should also be raised that 26 degrees is on the higher-end of acceptable temperatures with previous WHO studies suggesting 24 degrees is when people can begin to feel "uncomfortably warm at night". CIBSE themselves in *CIBSE Guide A (2015)* advise that sleep quality may be compromised when the indoor operative temperature rises above 24°C and recommends that peak bedroom temperatures should not exceed 26°C.

All rooms fail under DSY 2 and DSY 3 highlighting a large issue with potential future weather scenarios.

It is proposed to install cooling in all habitable rooms modelled.

4.2 With Cooling

The cooling hierarchy has been reviewed for the scheme as follows:

Cooling Hierarchy	Measures Undertaken
Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.	High albedo materials were prioritised where possible.
	Insulation levels are as per the constructed build.
Minimise internal heat generation through energy efficient design:	Individual heating so no internal pipework heat losses.
	LED lighting was installed to reduce internal heat gains.
Manage the heat within the building through exposed internal thermal mass and high ceilings:	High thermal mass throughout based on construction.
	The Floor to Ceiling Height exceeds National Space Standards.
Provide Passive Ventilation	Openable Windows allow for nighttime purge ventilation if required.
	The dwelling benefits from the provision of cross-ventilation
Provide Mechanical Ventilation	No mechanical ventilation and infeasible to retrofit.

As the above, all the feasible stages of the hierarchy were followed but due to the limited possibility to open the window due to external noise, active cooling is required in order to mitigate the risks of overheating. All the rooms modelled are proposed to have cooling installed.

Plot - Room	CIBSE TM59 – Predominantly Naturally Ventilated Homes		
	Criterion A (%Hrs Top-Tmax>=1K) Pass with value < 3	Criterion B – Bedrooms only (Hrs Top>26°C) Pass with value < 33	Compliance
LGF Open Plan Area	0		**YES**
LGF Guest Bedroom	0	0	**YES**
GF Library	0		**YES**
GF Study	0		**YES**
FF Principal Bedroom	0	0	**YES**
SF Bedroom 2	0	0	**YES**
SF Guest Bedroom	0	0	**YES**
TF Bedroom 3	0	0	**YES**

Table 7: Overheating results – With Cooling

4.3 Heating and Cooling system set – up

Refrigerant	GWP (AR4)
R-410A	2,088
R-407C	1,774
R-134a	1,430
R-32	675
R-452B	698
R-513A	573
R-454B	466

Table 8: GWP of common refrigerants

The proposed system uses R32 with a GWP of 675.

The proposed units will provide heating as well as cooling. In addition to this, there will be underfloor heating connected to the existing gas boiler. However, the control system will prioritize VRF heating over underfloor heating. The Gas Boiler is only intended to be used for heating if VRF heating is not enough to regulate temperature. The only exception would be for the lower ground floor where the underfloor heating will be used to ensure the floor is above a certain temperature (to prevent damp and cold floors).

5 Conclusion

Overall, based on the contents of this report, a dynamic overheating assessment was undertaken for the dwelling and it shows that based on CIBSE TM59 (Part O version) that the dwelling is at risk of overheating. The cooling hierarchy has been reviewed in the context of the dwelling being existing and with limited scope for the implementation of certain measures and based on accurate as-built construction data.

In order to mitigate the risk of overheating, a modern and stylish split system is proposed with industry leading cooling efficiency. The proposed plant installation comprises 1 No. condenser unit, which will be enclosed within an acoustic enclosure. Full details of this are provided within the noise report submitted with the application.

Based on this assessment, it is the authors opinion that the existing property cannot be actively cooled through passive measures and thus permission should be granted in terms of overheating and energy for the application.