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TAYLOR PROJECT SERVICES LLP
BUILDING SERVICES CONSULTANTS

DRAFT

Energy Statement

18 Bloomsbury Square

London

WC1A 2NS

October 2024

Revision 0

TAYLOR PROJECT SERVICES LLP
BUILDING SERVICES CONSULTANTS

Issue and Revision Record

Rev	Date	Rev Comments	Produced by	Checked by
0	29/10/2024	Draft Issue	K Hogan	G Taylor

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1.0 INTRODUCTION

1.1 Energy Statement

This Energy Statement has been prepared by TPS LLP on behalf of Bedford Estates in support of the planning application for the proposed works at 18 Bloomsbury Square, London, WC1A 2NS consisting of the internal refurbishment of the property.

It demonstrates the aspirations of the team proposing the development to meet the energy and climate change issue raised within the London Borough of Camden planning policy and the London Plan. In particular, the requirement for developments to make the fullest contribution to the mitigation of adaptation to climate change, as well as to minimise emissions of carbon dioxide.

The following energy hierarchy has been used through the design process:

- Be Lean: Reduce energy demand through good design and construction measures
- Be Clean: Providing efficient energy supply through low carbon infrastructure
- Be Green: Providing energy from efficient renewable energy sources on site.

The development approach proposed is also inherently sustainable and sees the existing building structure and fabric retained. This reduces the amount of embodied carbon expended in developing the site, unlike a redevelopment proposal where the existing building is demolished and replaced.

1.2 Basic Description of the Development

The internal refurbishment of the Grade II listed building consisting of Basement, Ground and First to Third Floors, including upgrading the roof insulation to meet building regulations, new LED lighting throughout and replacement of existing heating system with an Air Source Heat Pump (ASHP) system.

2.0 BE LEAN – USE LESS ENERGY

In applying the recognised energy hierarchy as part of a holistic approach, the first stage is to **be lean,** i.e. use less energy, and in particular adopting sustainable design and construction techniques.

Due to the Grade II listed nature of the building, and the required retention of any heritage features, it is not proposed for any additional insulation to be applied to the existing walls or at ceiling level. There is potential for secondary glazing to be installed to the existing single glazing at the rear of the unit but relevant planning permission would need to be obtained.

The passive design of the building will however be improved with additional insulation at roof level to meet Building Regulations (Part L2 2021).

Element	**Assumed existing U-values (W/m^2K)**	**Proposed U-values (W/m^2K)**
Roof	1.4	0.18
Walls	1.6	-
Floors	0.58	-
Windows	5.08	2.40 (rear glazing)

Table 1: Existing and Proposed U-values

In addition to upgrading the roof insulation, highly efficient LED lighting and controls are proposed to be installed throughout the development.

3.0 BE CLEAN – SUPPLY ENERGY EFFICIENTLY

Using energy efficiently and cleanly will result in a reduced energy demand and savings in CO_2 emissions. Heat networks and community heating have been considered.

The London heat map does not demonstrate that any existing or proposed heat networks run close to the site that would be feasible to connect to.

Figure 3.0-01 London Heat Map for 18 Bloomsbury Square and surrounding area

Efficient systems for energy delivery have also been investigated. At the scale of this development, Combined Heat and Power (CHP) systems are not viable. CHP requires a high base energy demand load in order to operate efficiently. It is usually more suited to a hotel or hospital scheme which have a high hot water demand, or very large residential schemes incorporating hundreds of units. With the continued decarbonisation of the grid over the buildings lifespan, in the long term, CHP is also not viewed as the ideal technology for reducing carbon emissions.

4.0 BE GREEN – USE RENEWABLE ENERGY

The feasibility of various renewable energy technologies have been reviewed for use in this development. It has been concluded that the use of wind turbines is impractical, and because of the issues of fuel deliveries, air quality concerns and other environmental worries, that the use of biofuels in this location is also inappropriate. Solar thermal collectors have been discounted due to low carbon savings and being quite a high-cost technology. Photovoltaics (PV) has been discounted due to the heritage nature and limited roof space available. Ground Source Heat Pumps have also been considered as not feasible since there is limited external space available for the installation of boreholes.

ASHPs have been considered as the most appropriate technologies for the development.

Energy efficient active design measures that will be incorporated into the development include:

Heating Strategy:	Heating will be provided from high efficiency VRV systems, which utilise heat pump technology when in heating mode, utilising renewable heat within the air. These systems are a very efficient technology that allow different areas to be simultaneously heated and cooled and take advantage of heat recovery within the system. The selected system will offer considerable improved performance over the existing old gas boiler system. In line with the requirements of Building Regulations Part L2 2021, the selected heat pump solution will exceed the minimum requirements set out in table 6.8 of the Part L document. The selected system offers a COP at maximum capacity of 4.7 (Daikin), exceeding the minimum COP requirement of 2.5.
Cooling Strategy:	Cooling is also provided from the VRV systems, which offers improved cooling efficiently due to the het recovery within the system. The development currently does not have cooling. In line with requirements of Building Regulations Part L2 2021, the selected heat pump solution will exceed the minimum requirements set out in table 6.6 of the Part L document. The selected system offers an SEER at maximum capacity of 7.7 (Daikin), exceeding the minimum SEER requirement for comfort cooling of 5.0.
Local Controls:	Heating and cooling controls will include time and temperature control to ensure that heating and cooling is not in operation when not required.

Natural Ventilation:	Fresh air requirements will be met by natural ventilation via opening windows, thereby eliminating energy demand for mechanical ventilation.
Hot Water System:	Hot water will be provided via a high efficiency electric cylinder with factory fitted insulation.
Monitoring	Smart meters will be installed to monitor the heat and electricity consumption; the display board will demonstrate real-time and historical energy use data and will be installed at ana accessible location within building.

The ASHPs selected as part of the VRV heating solution are considered a renewable energy technology since they extract energy from ambient air to provide the source of heating. With the decarbonisation of the electricity grid, the use of heat pumps is seen as important in the provision of renewable heat. ASHPs are therefore being provided as part of the Be Green solution.

5.0 CIBSE TM52 OVERHEATING ASSESSMENT

The potential for summertime overheating for 18 Bloomsbury Square has been evaluated.

Dynamic simulation modelling (DSM) has been utilised, to highlight the risk of the building to overheating and design solutions reviewed to mitigate overheating. Simulations have been carried out using the current DesignBuilder Energy Plus DSM modelling software to accurately simulate the indoor temperatures and conditions for the purpose of identifying areas of potential overheating.

Note: CIBSE TM52 is used as a design benchmark to demonstrate the performance of the building. The development does not commit to meeting these standards.

Where information has not been available, reference figures have been used based on the National Calculation Methodology (NCM) document.

5.1 CIBSE TM52: Limits of Thermal Comfort

In order to assess the overheating risk at 18 Bloomsbury Square, the CIBSE TM52 methodology has been followed. The memorandum states:

"Overheating has become a key problem for building design. The need to reduce energy consumption whilst dealing with global climate change has reduced the options available for building comfortable, low-energy buildings. Research has been directed towards methods for increasing indoor winter temperatures, but this can lead to lightweight, highly insulated buildings that respond poorly in the summer.

one problem for designers has been the absence of an adequate definition of overheating in naturally ventilated buildings. In the past overheating has been defined as a number of hours over a particular temperature, irrespective of conditions outside the building. Recent work embodied in European standards suggests that the temperature that occupants will find uncomfortable changes with the outdoor conditions in a predictable way. This research informs the CIBSE guidance presented in this Technical Memorandum (TM). The meaning of the research and the link with overheating are explained and a series of criteria by which the risk of overheating can be assessed or identified are suggested.

The CIBSE Technical Memorandum 52 sets out the definition and compliance with limiting overheating.

The standard introduces three categories of building:

1. Category I – buildings whose occupants are sensitive or fragile
2. Category II – normal expectation, recommended for new build or renovations
3. Category III – moderate expectation, mainly applicable in existing buildings

The standard provides a robust, yet balanced, assessment of the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three following criteria is classed as overheating:

Criterion 1 sets a limit of 3% for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by one degree or more during the occupied hours of a typical non-heating season (1st May to the 30th September) temperature. The number of hours where ΔT is greater than or equal to one degree (ºK) during the period of May to September inclusive shall not last more than 3% of occupied hours. ΔT is defined as operative temperature less the maximum acceptable temperature.

Criterion 2 deals with the severity of overheating within any one day, which can be as important as its frequency. This is a function of both temperature above maximum temperature and its duration. This criterion sets a daily limit for acceptability. If each hour (or part-hour) in which the temperature exceeds max temperature by at least 1ºK is multiplied by the number of degrees by which it is exceeded, then this 'excess' should not be more than six degree-hours.

Criterion 3 sets an absolute maximum temperature of (Tmax + 4) °C for a room (Tupp), beyond which the level of overheating is unacceptable. To set an absolute maximum value for the indoor operative temperature, the value of (ºK) shall not exceed 4 ºK.

The weather file for the TM52 analysis is the London Design Summer Year (DSY) 2020, obtained by CIBSE data.

5.2 Consideration of Cooling Hierarchy

In accordance with Policy SI 4, Managing heat risk, of the London Plan, the cooling hierarchy has been used to reduce the potential for overheating and the reliance on air conditioning systems:

Reduce the amount of heat entering a building

The building is Grade II listed and is in a conservation area and as such there are limited upgrades which can be made to the building fabric. Despite these limitations, proposed enhancements, both passive and active, were suggested for the existing building where possible. This includes:

- Upgrading the roof insulation to meet building regulations
- Install internal blinds to all windows to reduce solar gains

Minimise Internal Heat Generation through Energy Efficient Design

In order to optimise energy efficiency and minimise internal heat generation, the design and distribution of services have been located into general circulation spaces reducing the implied casual load on the occupied zones. Horizontal pipework runs have been minimised. Risers will be existing and as the building is Grade II listed we are unable to vent the risers to minimise heat built up in these spaces.

Highly efficient LED lighting has been proposed with low heat output.

Best practice insulation levels will be provided to all heating and hot water pipework with the minimisation of dead-legs to avoid standing heat loss from pipework.

Manage the Heat Within the Building Through Exposed Internal Thermal Mass and High Ceilings

The construction methodology limits the amount of thermal mass that can be introduced into the building design and construction, however, generous floor to ceiling heights have been provided to all occupied areas.

As this is an existing Georgian building there are no false ceilings and the ceilings are left exposed.

Provide Passive Ventilation

For the study the windows have been set to open to 30% and automated to start opening at 22°C which approximately simulates occupants manually opening the windows. These windows are designed to be key-controlled solely for cleaning and maintenance access. By presuming that all windows are openable, we aim to illustrate that even under this extreme assumption, it is insufficient to address the issue of overheating. This is scheduled between the hours of 8:00 am and 7:00 pm., unfortunately as modelled the building still fails the criterion.

Blinds have also been included within the model to help reduce the risk of overheating by blocking/reflecting solar heat gains out of the building. Internal opaque blinds were chosen for this purpose as these are most likely to be used within the building. These blinds were automated to operate during 100% of daylight hours and to not interfere with the opening of windows which illustrates extreme operating conditions. The results show that blinds in conjunction with openable windows is not enough for all rooms to pass the TM52 criterion.

Provide Mechanical Ventilation

The TM52 has also been provided with mechanical ventilation set at 14l/s per person to combat overheating, however the building still fails the criterion.

Provide Active Cooling Systems

Active cooling is provided to the office rooms as a by-product of the already proposed Air Source heat Pump. This will utilise high-efficiency systems, appropriately zoned and thermostatically controlled. This will allow the building to pass the criterion.

5.3 Model Inputs

Geometry

The geometry for the building has been modelled using DesignBuilder. The building has been modelled from drawings provided by M.J.H.

Weather

The weather file used for the CIBSE TM52 assessment is the CIBSE London Design Summer Year (DSY) 'London_LHR_DSY2_2020High50'.

Modelling Inputs

Unless specified, the following data has been assumed, based on NCM (National Calculation Methodology). The methodology states:

1. In order to facilitate estimating energy performance on a consistent basis, a key part of the NCM is an Activity database that defines the activities in various types of space in different classes of building (which closely align with the Town and Country Planning (TCP) Use Classes). One of these standard activities must be assigned to each space in the building
2. The database provides standard occupancy, temperature set-points, outdoor air rates and heat gain profiles for each type of space in the building so that buildings with the same mix of activities will differ only in terms of their geometry, construction, building services, and weather location. Thus, it is possible for the Building Regulation 26 compliance test and EPCs to compare buildings based on their intrinsic potential performance, regardless of how they may actually be used in practice.
3. The fields of information in the database are as follows:
    a. Occupancy times and density; total metabolic rate and percentage which is latent (water vapour)
    b. Set-point temperature and humidity in heating and cooling modes; DSM software will use air temperature as the basis for temperature set-points for the Actual, Notional, and Reference buildings
    c. Set-back conditions for unoccupied periods
    d. Sensible and latent heat gain from other sources
    e. Outside air requirement
    f. Level of illuminance for general lighting and the power density for display lighting
    g. Hot water demand
    h. Type of space for glazing, lighting, and ventilation classification within Building Regulations compliance
    i. A marker indicating whether the activity requires high efficiency filtration, thereby justifying an increased SFP allowance for that space to account for the increased pressure drop.

Building Fabric

Element	Assumed existing U-values (W/m²K)	Proposed U-values (W/m²K)
Roof	1.4	0.18
Walls	1.6	-
Floors	0.58	-
Windows	5.08	2.40 (rear glazing)
Party Walls	0.48	-
Air Permeability (m^3/hm^2@50 Pa)	25	-

Table 5.3-01 – Fabric Elements

Internal Temperatures

The following temperatures have been inputted into the DSM model. These have been specified.

	Cooling	Heating
Office Areas	22°C	24°C

Table 5.3-02 – Internal temperatures used in model

Internal Gains

Lighting		Power (Sensible Gain)	
Office Areas	8.0 W/m²	**Office Areas**	11.77 W/m²

Table 5.3-03 – Internal gains assumed in model

Occupancy (BCO)

Space	Watts per m² person latent/sensible
Offices	6.25/11.25

Table 5.3-04 – Occupancy details assumed in model

6.0 OVERHEATING ANALYSIS AND RESULTS

6.1 TM52 Results – No Openable Windows

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Pass/Fail
Z0 – Basement Floor	Z0.01 – Office	15.37	31	0	Fail
Z0 – Basement Floor	Z0.03 – Office	97.78	93	697.5	Fail
Z0 – Basement Floor	Z0.04 – Office	51.15	42.5	5.5	Fail
Z1 – Ground Floor	Z1.01 – Office	63.69	55	64.5	Fail
Z1 – Ground Floor	Z1.06 – Office	99.5	164.5	1225	Fail
Z2 – First Floor	Z2.02 – Office	98.81	172.5	1231.5	Fail
Z2 – First Floor	Z2.03 – Office	99.04	170.5	1217	Fail
Z2 – First Floor	Z2.05 – Office	87.96	78	388	Fail
Z2 – First Floor	Z2.06 – Office	21.67	39.5	13	Fail
Z3 – Second Floor	Z3.01 – Office	98.78	159.5	1217.5	Fail
Z3 – Second Floor	Z3.02 – Office	91.7	85.5	512	Fail
Z3 – Second Floor	Z3.04 – Office	98.81	162.5	1219.5	Fail
Z3 – Second Floor	Z3.05 – Office	98.7	165	1198.5	Fail
Z4 – Third Floor	Z4.01 – Office	97.67	123	924.5	Fail
Z4 – Third Floor	Z4.02 – Office	98.39	130.5	1071.5	Fail
Z4 – Third Floor	Z4.03 – Office	86.62	74.5	301	Fail

From the results, all office areas fail the TM52 criterion, with an exceedance in temperature limits and will therefore require treatment to remedy this. The results are based on the building having no openable windows.

Therefore, the first treatment considered will be adding internal blinds to all windows.

6.2 TM52 Results – No Openable Windows with Blinds

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Pass/Fail
Z0 – Basement Floor	Z0.01 – Office	5.81	20	0	Fail
Z0 – Basement Floor	Z0.03 – Office	76.19	44	0	Fail
Z0 – Basement Floor	Z0.04 – Office	6.04	10	0	Fail
Z1 – Ground Floor	Z1.01 – Office	21.75	21	0	Fail
Z1 – Ground Floor	Z1.06 – Office	93.88	77.5	426	Fail
Z2 – First Floor	Z2.02 – Office	82.68	68	216.5	Fail
Z2 – First Floor	Z2.03 – Office	90.37	75.5	340	Fail
Z2 – First Floor	Z2.05 – Office	47.06	38.5	0	Fail
Z2 – First Floor	Z2.06 – Office	5.81	22.5	0	Fail
Z3 – Second Floor	Z3.01 – Office	90.94	78	332.5	Fail
Z3 – Second Floor	Z3.02 – Office	66.21	49.5	11	Fail
Z3 – Second Floor	Z3.04 – Office	88.23	69.5	277	Fail
Z3 – Second Floor	Z3.05 – Office	77.6	65.5	179.5	Fail
Z4 – Third Floor	Z4.01 – Office	69.57	55	63.5	Fail
Z4 – Third Floor	Z4.02 – Office	86.89	66.5	209	Fail
Z4 – Third Floor	Z4.03 – Office	59.44	47	2.5	Fail

In this test, all windows have had high reflectance internal blinds added to help reduce the risk of overheating by blocking/reflecting solar gains to the building. These blinds were automated to operate 100% of daylight hours which illustrated extreme operating hours.

The results show that although there has been some improvement, shading alone does not prove sufficient in mitigating the overheating concerns.

The next treatment will add openable windows.

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6.3 TM52 Results – Openable Windows with Blinds

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Pass/Fail
Z0 – Basement Floor	Z0.01 – Office	4.4	17.5	0	Fail
Z0 – Basement Floor	Z0.03 – Office	32.11	22.5	0	Fail
Z0 – Basement Floor	Z0.04 – Office	1.11	4	0	Pass
Z1 – Ground Floor	Z1.01 – Office	6.92	10.5	0	Fail
Z1 – Ground Floor	Z1.06 – Office	69.99	50	22	Fail
Z2 – First Floor	Z2.02 – Office	56.8	45	1.5	Fail
Z2 – First Floor	Z2.03 – Office	62.5	50.5	18.5	Fail
Z2 – First Floor	Z2.05 – Office	20.11	20.5	0	Fail
Z2 – First Floor	Z2.06 – Office	4.47	17	0	Fail
Z3 – Second Floor	Z3.01 – Office	68.54	54.5	32.5	Fail
Z3 – Second Floor	Z3.02 – Office	36.54	31	0	Fail
Z3 – Second Floor	Z3.04 – Office	63.91	52.5	26	Fail
Z3 – Second Floor	Z3.05 – Office	56.65	46.5	2	Fail
Z4 – Third Floor	Z4.01 – Office	51.49	42	0	Fail
Z4 – Third Floor	Z4.02 – Office	65.02	47.5	19	Fail
Z4 – Third Floor	Z4.03 – Office	36.2	31.5	0	Fail

In this test, all windows are openable in addition to all windows having internal blinds. All windows are simulated to be open at 30%. It is important to note that this simulation is not intended to accurately mirror realistic occurrences or comply with building regulations. Rather, it is utilised to illustrate that even under such conditions, overheating issues still cannot be effectively addressed.

The windows have been automated to start opening at 22°C which approximately simulates occupants manually opening the windows. This is scheduled between 8.00am and 7.00pm.

The results show that although again there has been some improvement, having openable windows and blinds, with one zone now passing, it still does not prove sufficient in mitigating the overheating concerns.

The next treatment will be to add mechanical ventilation to the building.

6.4 TM52 Results – Openable Windows with Blinds and Mechanical Ventilation

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Pass/Fail
Z0 – Basement Floor	Z0.01 – Office	3.52	15	0	Fail
Z0 – Basement Floor	Z0.03 – Office	10.63	10.5	0	Fail
Z0 – Basement Floor	Z0.04 – Office	0.19	2.5	0	Pass
Z1 – Ground Floor	Z1.01 – Office	3.33	7.5	0	Fail
Z1 – Ground Floor	Z1.06 – Office	46.02	38	0	Fail
Z2 – First Floor	Z2.02 – Office	44.69	39	0	Fail
Z2 – First Floor	Z2.03 – Office	45.53	38.5	0	Fail
Z2 – First Floor	Z2.05 – Office	11.01	14	0	Fail
Z2 – First Floor	Z2.06 – Office	3.9	15.5	0	Fail
Z3 – Second Floor	Z3.01 – Office	46.25	37.5	0	Fail
Z3 – Second Floor	Z3.02 – Office	16.32	19	0	Fail
Z3 – Second Floor	Z3.04 – Office	45.34	38.5	0	Fail
Z3 – Second Floor	Z3.05 – Office	41.82	38.5	0	Fail
Z4 – Third Floor	Z4.01 – Office	30.47	27	0	Fail
Z4 – Third Floor	Z4.02 – Office	35.67	30.5	0	Fail
Z4 – Third Floor	Z4.03 – Office	13.19	17.5	0	Fail

Upon implementing mechanical ventilation in addition to openable windows and internal blinds, although again there has been some improvement, it does not allow most zones to meet theTM52 criteria. Despite the introduction of forced air circulation, the heat built-up in various areas necessitates further intervention for effective cooling.

The next treatment will be adding cooling to the building.

6.5 TM52 Results – Active Cooling System (ASHP)

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Pass/Fail
Z0 – Basement Floor	Z0.01 – Office	0	0	0	Pass
Z0 – Basement Floor	Z0.03 – Office	0	0	0	Pass
Z0 – Basement Floor	Z0.04 – Office	0	0	0	Pass
Z1 – Ground Floor	Z1.01 – Office	0	0	0	Pass
Z1 – Ground Floor	Z1.06 – Office	0	0	0	Pass
Z2 – First Floor	Z2.02 – Office	0	0	0	Pass
Z2 – First Floor	Z2.03 – Office	0	0	0	Pass
Z2 – First Floor	Z2.05 – Office	0	0	0	Pass
Z2 – First Floor	Z2.06 – Office	0	0	0	Pass
Z3 – Second Floor	Z3.01 – Office	0	0	0	Pass
Z3 – Second Floor	Z3.02 – Office	0	0	0	Pass
Z3 – Second Floor	Z3.04 – Office	0	0	0	Pass
Z3 – Second Floor	Z3.05 – Office	0	0	0	Pass
Z4 – Third Floor	Z4.01 – Office	0	0	0	Pass
Z4 – Third Floor	Z4.02 – Office	0	0	0	Pass
Z4 – Third Floor	Z4.03 – Office	0	0	0	Pass

Upon implementing cooling into the building (subject to the system being designed correctly), all zones now meet the TM52 criteria and consequently pass. The ASHP system will heat or cool different zones of the building simultaneously with optimised temperature control.

7.0 CONCLUSION

The Energy statement for 18 Bloomsbury Square follows and responds to the Be Lean, Be Clean and Be Green methodology, and demonstrates the aspirations of the team proposing the works to meet the energy and climate change issues raised within the London Borough of Camden planning policy and the London Plan. In particular, the requirement for developments to make the fullest contribution to the mitigation of adaption to climate change, as well as to minimise emissions of carbon dioxide.

The thermal performance of the building envelope will be improved where possible, although limited in scope due to its Grade II listing. The proposed fabric upgrades include upgrading the roof insulation to meet building regulations and there is potential to install secondary glazing to the existing single glazing on the rear of the building.

Energy efficiency has been incorporated into the services solutions with energy efficient lighting and controls, energy metering and the use of energy efficient and low carbon cooling and heating solutions, the latter using heat pump technology.

The feasibility of a range of renewable energy technologies has been reviewed for use including wind turbines, biomass, ground-source, solar thermal and solar photovoltaic (PV). However, the nature of this urban development and its historical context precludes the use of the considered renewable energy technologies.

Air source heat pumps are considered the most appropriate renewable system to utilise in this development allowing for a reduction in the buildings carbon emission rate. A heat pump strategy will therefore be used for heating in the form of the proposed VRV heating and cooling solution.

An overheating assessment was also undertaken for the office spaces in the building. Out of all the zones assessed, all are expected to experience overheating. This is due to the internal conditions namely the occupancy, small power, infiltration, lighting gains and due to the existing building design and to maintain the aesthetics of the building there are limited options to alleviate these.

Overall, after strictly following the cooling hierarchy, investigating non openable windows, blinds, openable windows and blinds and the addition of mechanical ventilation, the overheating study demonstrated that an ASHP system will be required to enable sufficient cooling in the building to comply with the TM52 criteria and prevent overheating.