Figure 3 - Basement Commercial Units

Figure 4 – Ground Commercial Units

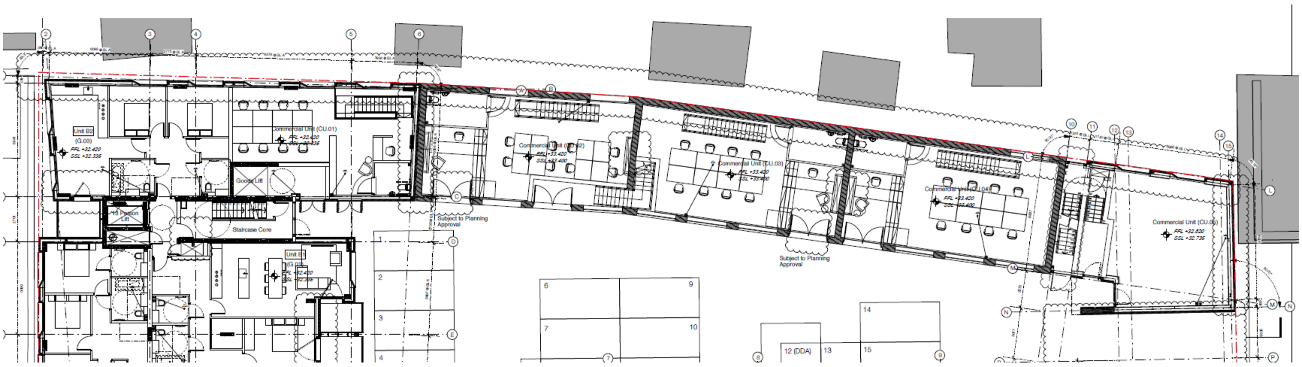


Figure 5 – Front Elevation

Figure 6 – Rear Elevation

4.2 Table 1 provides a summary of the input values for the proposed 44 Gloucester Avenue development.

Table 1 – Input Parameters

Specifications	Proposed Scheme
External Wall U-value - Retained / Upgraded (Residential)	2.10
External Wall U-value - Retained / Upgraded (Commercial)	0.50
External Wall U-value - New Build	0.15
Ground Floor / Exposed Floor U-value - Retained/Upgraded	0.25
Ground Floor / Exposed Floor U-value - New Build	0.20
Roof U-value - Retained / Upgraded	0.20
Roof U-value - New Build	0.20
Windows U-values - Retained / Upgraded	2.00
Windows U-values - New Build	1.40
Window G-value[1]	(Residential) = 0.62 (Commercial) = 0.40
Air Permeability - Retained / Upgraded	10.00
Air Permeability - New Build	5.00
Mechanical Ventilation Rate	(Residential) – 0.3l/s/m² (Commercial) – 1.2l/s/m²
Infiltration rate	0.5ach/h

[1] G-values represent the amount of solar energy able to be transmitted through glass.

4.3 Internal design conditions and window opening profiles applied in the model are as follow in Table 2.

Table 2 – Internal Design Conditions

Areas Analysed	Window Typology	Mechanical Ventilation rate	Occupancy	Lighting	Equipment
Sample Mid Floor & Top Floor Residential Units	Openable windows and balcony doors for Natural Ventilation	0.3 l/s/m²	2 Occupants per bedroom & 4/6 Occupants per lounge	5 w/m²	5 w/m²
Commercial Units	Openable windows(courtyard side)	1.2 l/s/m²	10 m²/p	12 w/m²	20 w/m²

4.4 Occupancy schedule for bedroom, lounge and commercial areas are as follows in Table 3:

Table 3 – Occupancy Schedule

Bedroom Occupancy Schedule	Lounge Occupancy Schedule	Commercial Units Occupancy Schedule
Until: 07:00, 1,	Until: 16:00, 0,	Until: 07:00, 0,
Until: 08:00, 0.5,	Until: 18:00, 0.5,	Until: 08:00, 0.25,
Until: 09:00, 0.25,	Until: 22:00, 1,	Until: 09:00, 0.5,
Until: 22:00, 0,	Until: 23:00, 0.67,	Until: 12:00, 1,
Until: 23:00, 0.25,	Until: 24:00, 0,	Until: 14:00, 0.75,
Until: 24:00, 0.75,		Until: 17:00, 1,
		Until: 18:00, 0.5,
		Until: 19:00, 0.25,
		Until: 24:00, 0,

5.0 THE COOLING HIERARCHY

5.1 The site is located within the Primrose Hill Conservation area of the London Borough of Camden. The area adjacent to the site mainly consists of residential and mixed office/light industrial accommodation. The site is bounded by over ground train line to the north east and Gloucester Avenue to the south west and sits on a busy junction of both Princess Road and Edis Street with Gloucester Road.

5.2 The Cooling Hierarchy[2] has been followed to ensure that suitable passive design measures have been incorporated into the design prior to the inclusion of any active cooling. The DSM has included the measures which are discussed below, however the results show that the commercial areas would be subject to overheating, therefore the inclusion of comfort cooling is required.

Minimising internal heat generation through energy efficient design

5.3 Stage one of the Cooling Hierarchy is to minimise internal heat generation through energy efficient design. Low energy lighting has been specified for the commercial units with occupancy controls to be provided for the luminaires. Lighting Power Density (LPD) of 2.75 W/m²/100 lux or less has been targeted.

5.4 In the office areas, the modelling accounts for office usage profiles, which have higher internal gains than other commercial spaces, as a result of occupants and equipment. These internal gains cannot be controlled through the design as they relate to occupancy levels and also equipment which may be used in the space. Energy efficient equipment such as mechanical ventilation supply and extract fans with highly efficient heat recovery system has been specified.

5.5 The large percentage of glazing within the residential and commercial areas maximises natural daylight within the proposed development, therefore providing significant benefits in terms of reduced space heating and artificial lighting, solar gains to reduce winter heating consumption and creating a healthier, and more pleasant environment.

5.6 Energy efficient lighting will be utilised throughout the development, to minimise energy demand and reduce internal heat gains.

5.7 In addition, detailed design of the heat distribution system will ensure that the pipe runs have been minimised to reduce heat loss.

Reducing the amount of heat entering the building in summer

5.8 Stage two of the hierarchy is to reduce the amount of heat entering the building in summer, this has been achieved through specifying a low window G-value of 0.4 for the commercial units. Windows for the residential units are specified with standard clear glazing G-value of 0.62. In addition, high performance windows

[2] GLA Guidance on Preparing Energy Assessments April 2015

with U-values of 1.4W/m^{2}K have been specified for all the new build areas and U- value of 2.0 W/m^{2}K for the refurbished areas.

5.9 As discussed above, large percentage of windows will allow beneficial solar gains to reduce winter heating consumption, whereas the optimal G values reduce excessive solar gains, limiting the amount of unwanted internal heat gains during the warmer months.

Use of thermal mass and high ceilings to manage the heat within the building

5.10 Stage three of the hierarchy considers the management of heat within the building through exposed internal thermal mass and high ceilings. The existing and new buildings will have a medium thermal mass capacity, providing an appropriate level of energy storage to even out the extremes of internal gains and external temperature. Heat passes freely through the exposed ceilings at high level, reducing heat build-up. This ensures that during the summer months the building is able to release heat build-up, which occurs during the day, and at night during the cooler periods.

Passive ventilation

5.11 Stage four of the hierarchy considers passive ventilation methods as preferred means for the removal of heat build-up from the building. To maintain the Victorian character of the existing buildings on site, all windows within the existing buildings have been replaced with openable modern timber sash windows. These windows have been specified for all commercial and residential units within the refurbished buildings and are shown in Figure 7 and Figure 8 below.

5.12 All new build residential units have been specified with aluminium composite full height windows and balcony doors, to provide purge ventilation in accordance with Part F of the Building Regulations. Windows for the new built areas are shown in Figure 9.

Figure 7 – Refurbished Commercial & Residential Unit Windows – Railway Facing Elevation

Figure 8 – Refurbished Commercial & Residential Unit Windows – Southern Corner

Figure 9 – New Build Residential Unit Windows – Norther Corner

Mechanical ventilation

5.13 Highly efficient mechanical ventilation heat recovery (MVHR) system, with ventilation rates of 0.3l/s/m² for all new residential units and 1.2/s/m² for the commercial units, and minimum heat recovery efficiency of 88% has been included to ensure good levels of ventilation are achieved. All residential units within the existing building will only be specified with natural ventilation via openable windows. In addition, night time mechanical purge ventilation will be included to ensure that any heat build-up during the day in the warmer months can be efficiently expelled from the building during the night when temperatures drop.

5.14 At this early stage, the specification for the MVHR units are:

- **Residential units** – Vent Axia Kinetic Plus E or similar
- **Commercial units** – MVHR with a Specific Fan Power (SFP) of 0.5W/l/s or lower

5.15 The development has therefore followed the Cooling Hierarchy and as the next section of the report shows, without the inclusion of comfort cooling the commercial spaces will experience overheating.

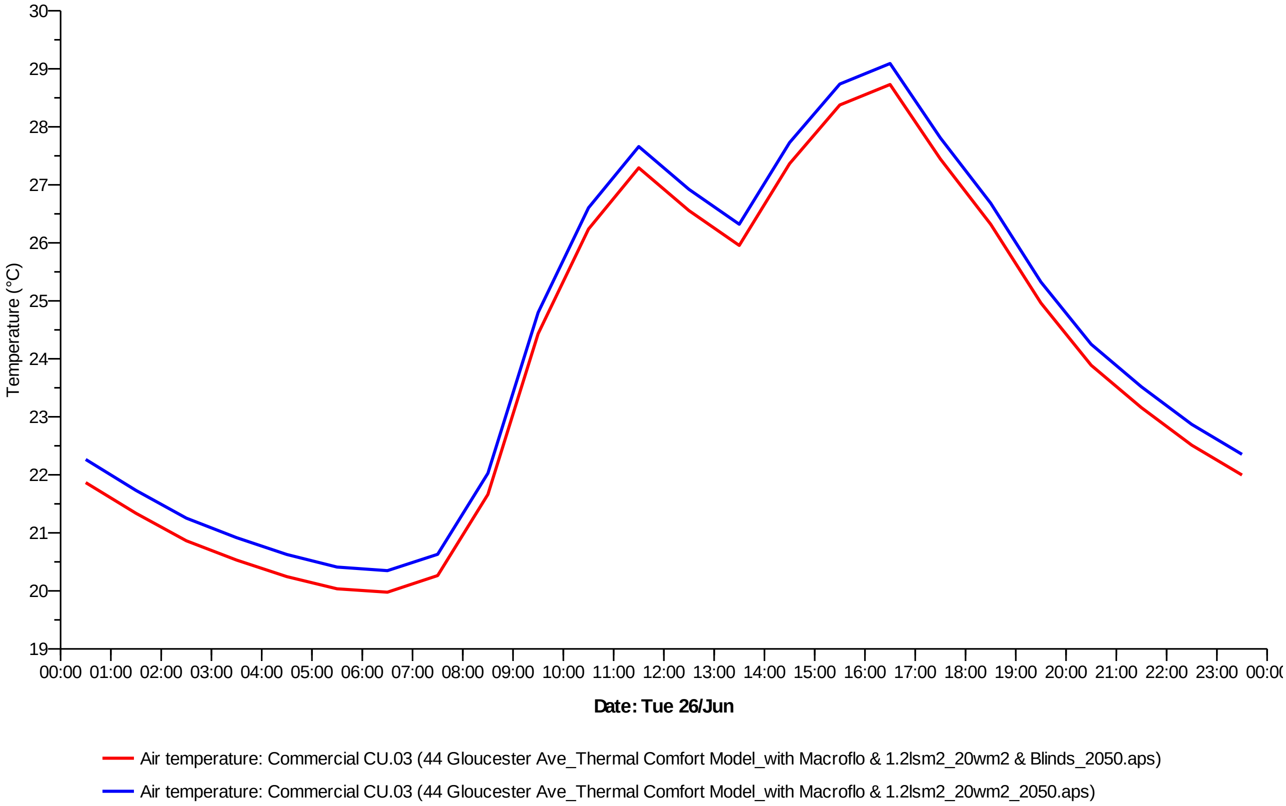
6.0 RESULTS OF OVERHEATING ANALYSIS

6.1 All habitable rooms within the selected sample residential units comply with the CIBSE TM52 overheating criteria. However, the analysis found that all commercial areas overheat during the summer months, failing at least two of the three CIBSE TM52 criteria.

6.2 Additional overheating prevention measures, including internal blinds, additional mechanical ventilation and solar shading, were modelled to test the degree of improvement in the commercial areas. The combination of these measures had a negligible impact, as did the individual measures and they were not significant enough to demonstrate compliance against the CIBSE TM52 criteria.

6.3 The graph below, for example, shows a commercial unit on the ground floor has a marginal reduction in the internal air temperatures modelled with blinds (in red), as compared to the one modelled without blinds (in blue). The highest peak in temperature is predicted to be experienced around 4:30pm.

Figure 10 – Graphical representation of internal temperatures (with and without blinds)



6.4 The constant internal gains from people, lighting and equipment contribute the greatest proportion of internal gain in the office areas. External or internal shading measures would therefore not adequately address the overheating issue inherent to the building and its intended use.

6.5 Therefore, due to the nature of the commercial space, and in order to maintain specific internal conditions, comfort cooling is recommended and has been proposed via a 4 pipe fan coil system with water cooled chillers located in the basement plantroom and associated dry air coolers on the roof.

6.6 Although all residential units are in compliance with the TM52 overheating assessment methodology, comfort cooling has been specified for the new build residential units to meet the market expectations for being high end luxury apartments.

6.7 The performance specification of the water cooled chiller is shown in Table 4.

Table 4 - ASHP Performance Specification

	Specification
Chiller Energy Efficiency Ratio (EER)	4.65
Chiller European Seasonal Energy Efficiency Ratio (ESEER)	5.99

6.8 Tables 5 and 6 outline the results of the Dynamic Simulation Modelling for the residential and commercial areas.

6.9 Appendix A provides further detailed results, for each sample residential area and all commercial areas.

Table 5 -– CIBSE TM25 Results for Sample Residential Areas

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg. Hrs)	Criteria 3 (Max. Delta T)	Pass/Fail
			Should be less than 3%	Should be 6K or less	Should be 4K or less	
B2 G.03_Living	GR000003	100	0.1	1	1	Pass
B2 G.03 Bedroom	GR000000	100	0	0	0	Pass
B2 G.03 Bedroom	GR00005F	100	0	0	0	Pass
B1 G.01_Living	GR00000A	100	0	0	0	Pass
B1 G.01 Bedroom	GR000012	100	0	0	0	Pass
B1 G.01 Bedroom	GR00005E	100	0	0	0	Pass
A5 1.03_Living	GR00000E	100	1.3	13	3	Pass
A5 1.03 Bedroom	GR000017	100	0	0	0	Pass
A3 1.01_Living	GR00000F	100	1.4	21	4	Pass
A3 1.01 Bedroom	GR000061	100	0	0	0	Pass
A3 1.01 Bedroom	GR000063	100	0	0	0	Pass
C3 1.12_Living	GR000041	100	0.1	1	1	Pass
C3 1.12 Bedroom	GR00003F	100	0	0	0	Pass
C3 1.12 Bedroom	GR000068	100	0	0	0	Pass

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg. Hrs)	Criteria 3 (Max. Delta T)	Pass/Fail
			Should be less than 3%	Should be 6K or less	Should be 4K or less	
B5 1.07_Living	GR000047	100	0	0	0	Pass
B5 1.07 Bedroom	GR000066	100	0	0	0	Pass
B5 1.07 Bedroom	GR000067	100	0	0	0	Pass
B9 2.05_Living	GR00002D	100	0	0	0	Pass
B9 2.05 Bedroom	GR00004B	100	0	0	0	Pass
B12 2.09_Living	GR000056	100	0.2	2	1	Pass
B12 2.09 Bedroom	GR000010	100	0	0	0	Pass
B12 2.09 Bedroom	GR00006A	100	0	0	0	Pass
B17 3.05_Living	GR000057	100	0.3	3	1	Pass
B17 3.05 Bedroom	GR000036	100	0	0	0	Pass
B17 3.05 Bedroom	GR00006D	100	0	0	0	Pass
B15 3.03_Living	GR00005B	100	0	0	0	Pass
B15 3.03 Bedroom	GR00006F	100	0	0	0	Pass
B15 3.03 Bedroom	GR000038	100	0	0	0	Pass
B18_Living	GR000064	100	0	0	0	Pass

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg. Hrs)	Criteria 3 (Max. Delta T)	Pass/Fail
			Should be less than 3%	Should be 6K or less	Should be 4K or less	
B18 Bedroom	GR000071	100	0	0	0	Pass
B18 Bedroom	GR000073	100	0	0	0	Pass

Table 6 – CIBSE TM25 Results for Commercial Areas

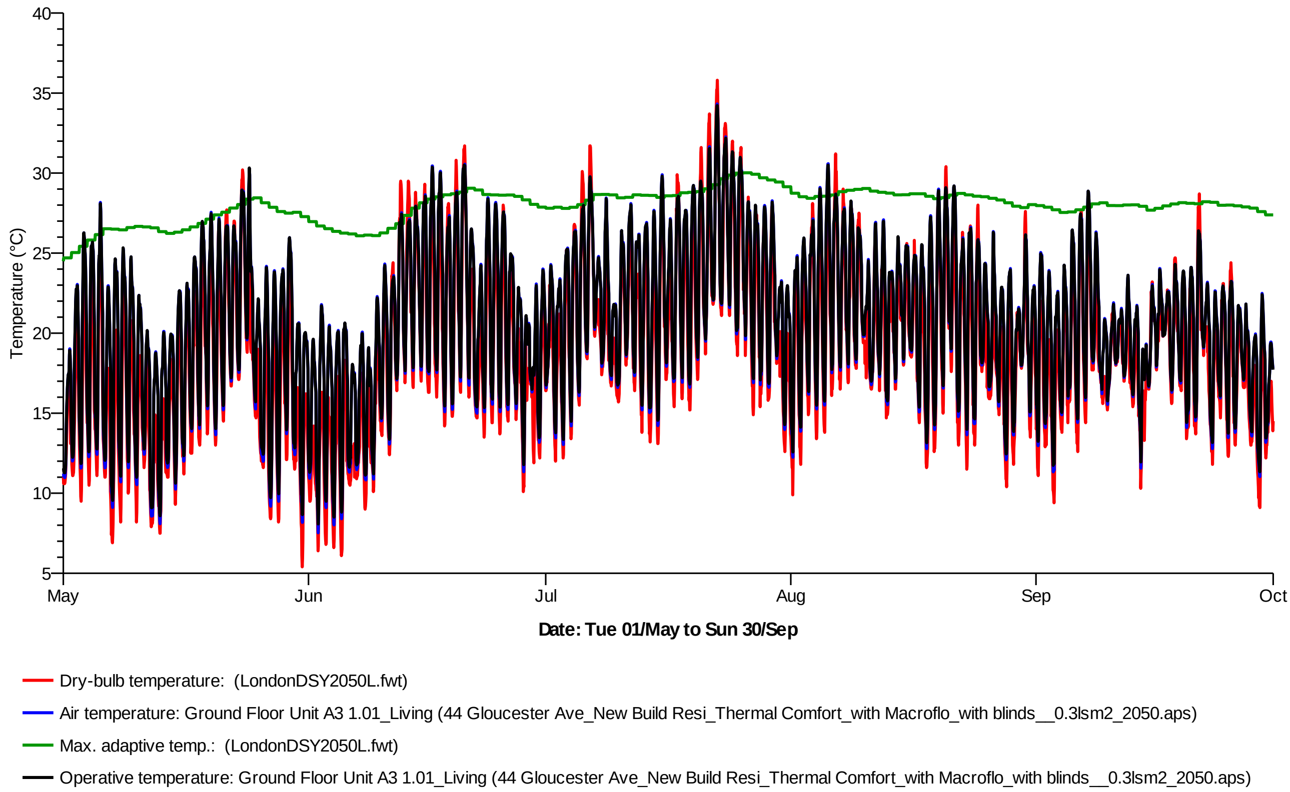
Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg. Hrs)	Criteria 3 (Max. Delta T)	Pass/Fail
			Should be less than 3%	Should be 6K or less	Should be 4K or less	
Commercial CU.0.2	BS000002	71.2	16.5	28	5	Fail
Commercial CU.0.3	BS000003	71.2	16.5	29	6	Fail
Commercial CU.0.4	BS000004	71.2	14.4	24	5	Fail
Commercial CU.1.1	GR000002	71.2	13.9	19	4	Fail
Commercial CU.1.2	GR000001	71.2	8.6	18	4	Fail
Commercial CU.1.3	GR000005	71.2	8.9	21	5	Fail
Commercial CU.1.4	GR000007	71.2	8.3	20	5	Fail
Commercial CU.1.5	GR000009	71.2	19.5	19	4	Fail

Commercial CU.0.1	BS00000D	71.2	9.4	13	3	Fail

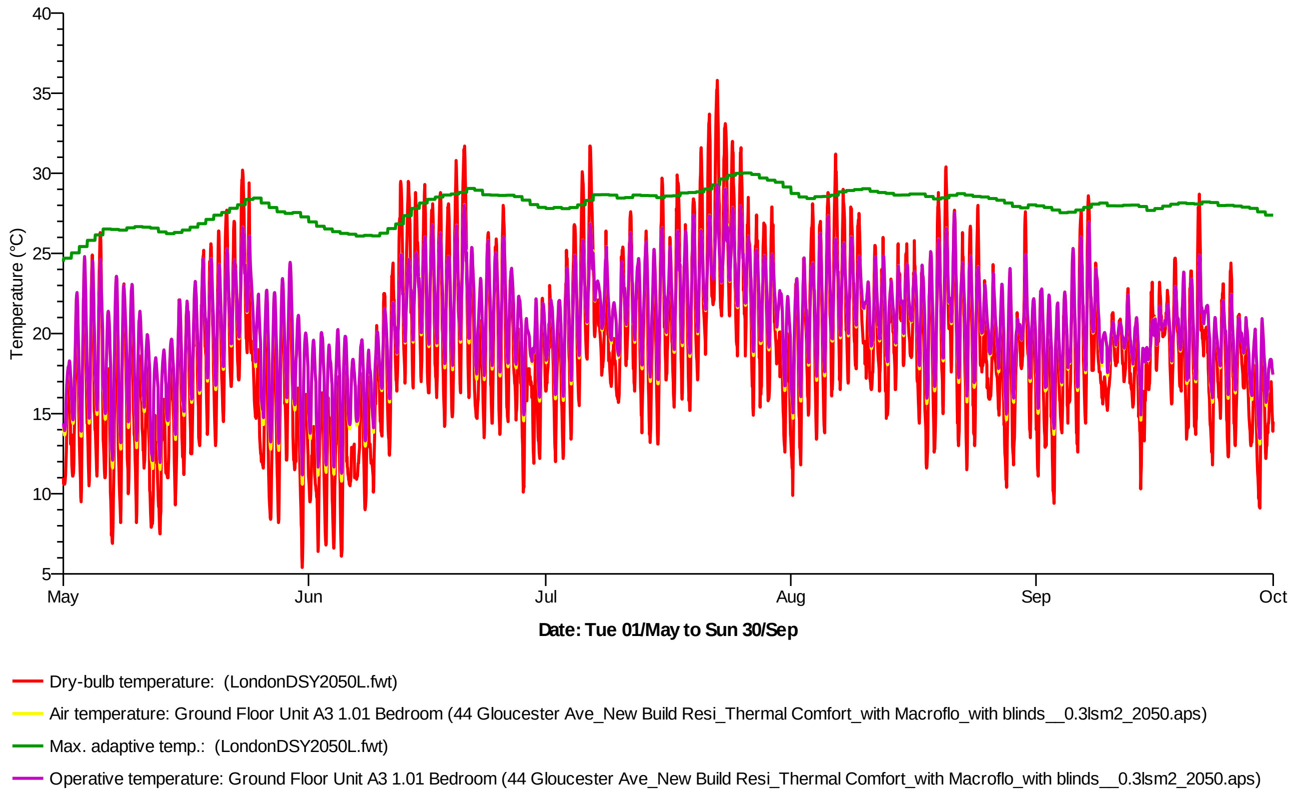
7.0 APPENDIX A – RESULTS OF OVERHEATING ANALYSIS

RESIDENTIAL – Worst Case Scenarios: Refurbished Unit A3

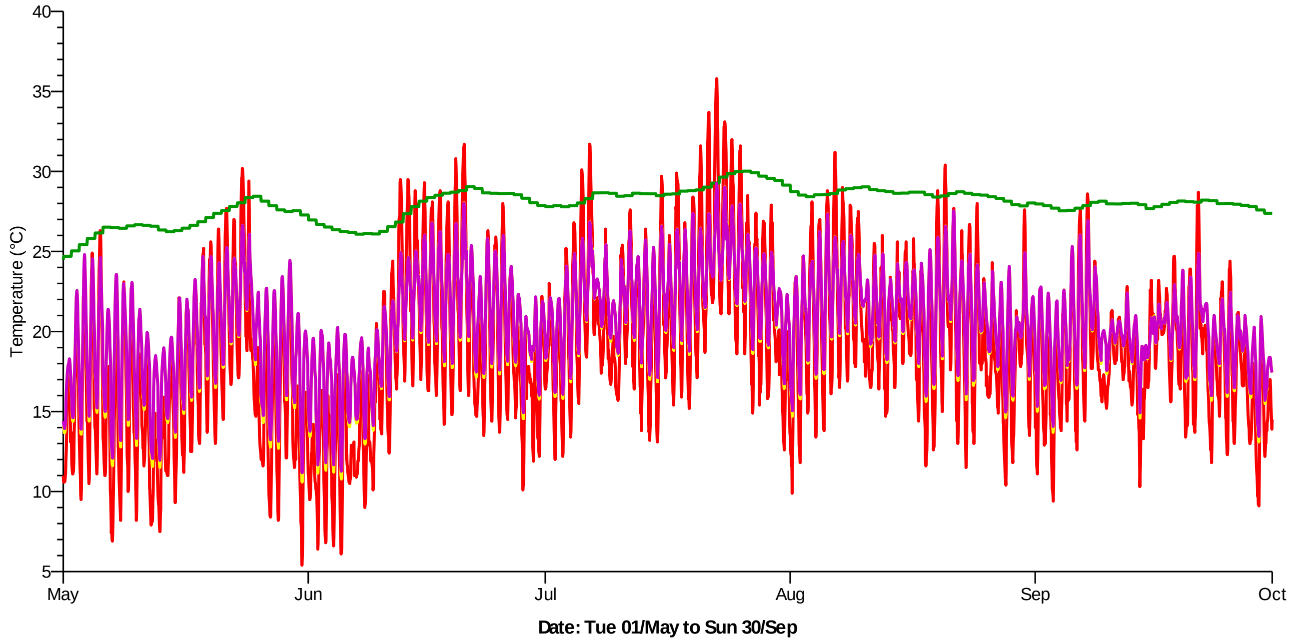
Unit A.03_Living Room



Unit A.03_Bedroom 1



Unit A.03_Bedroom 2



Dry-bulb temperature: (LondonDSY2050L.fwt)

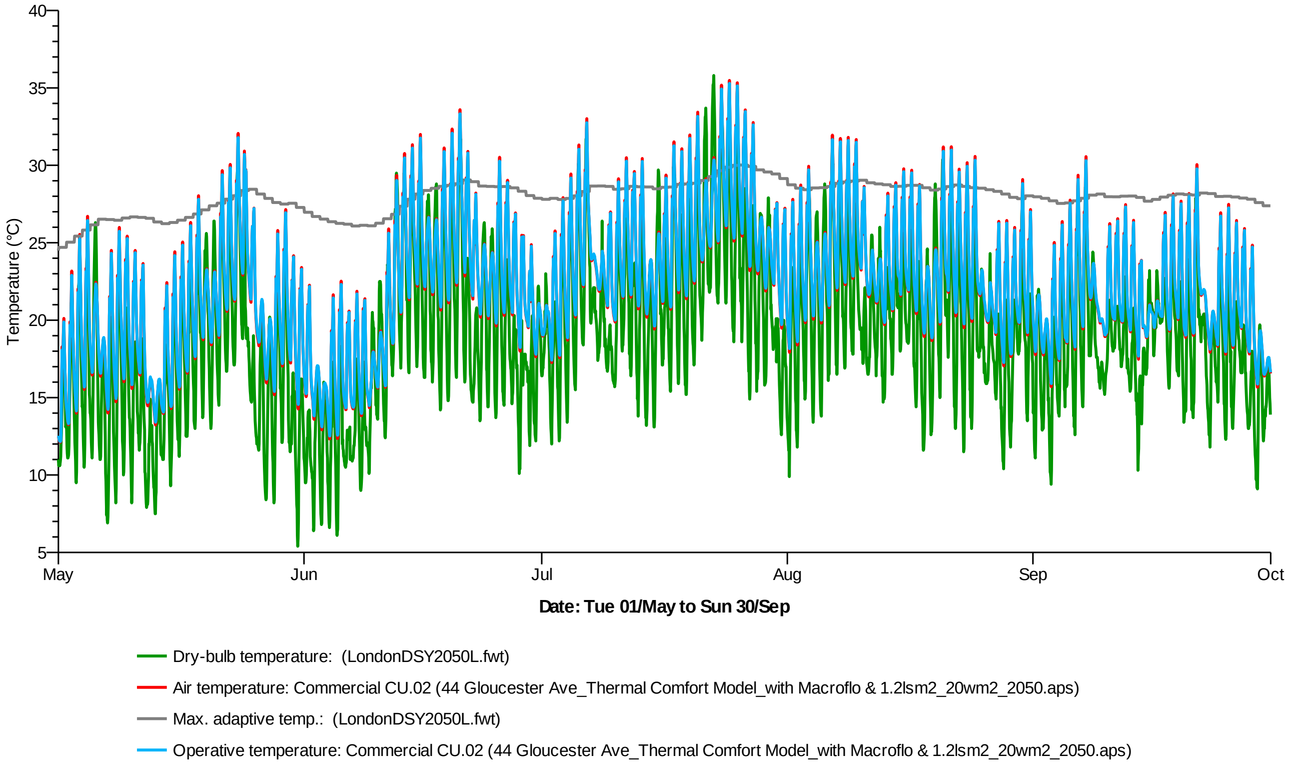
Air temperature: Ground Floor Unit A3 1.01 Bedroom (44 Gloucester Ave_New Build Resi_Thermal Comfort_with Macroflo_with blinds__0.3lsm2_2050.aps)

Max. adaptive temp.: (LondonDSY2050L.fwt)

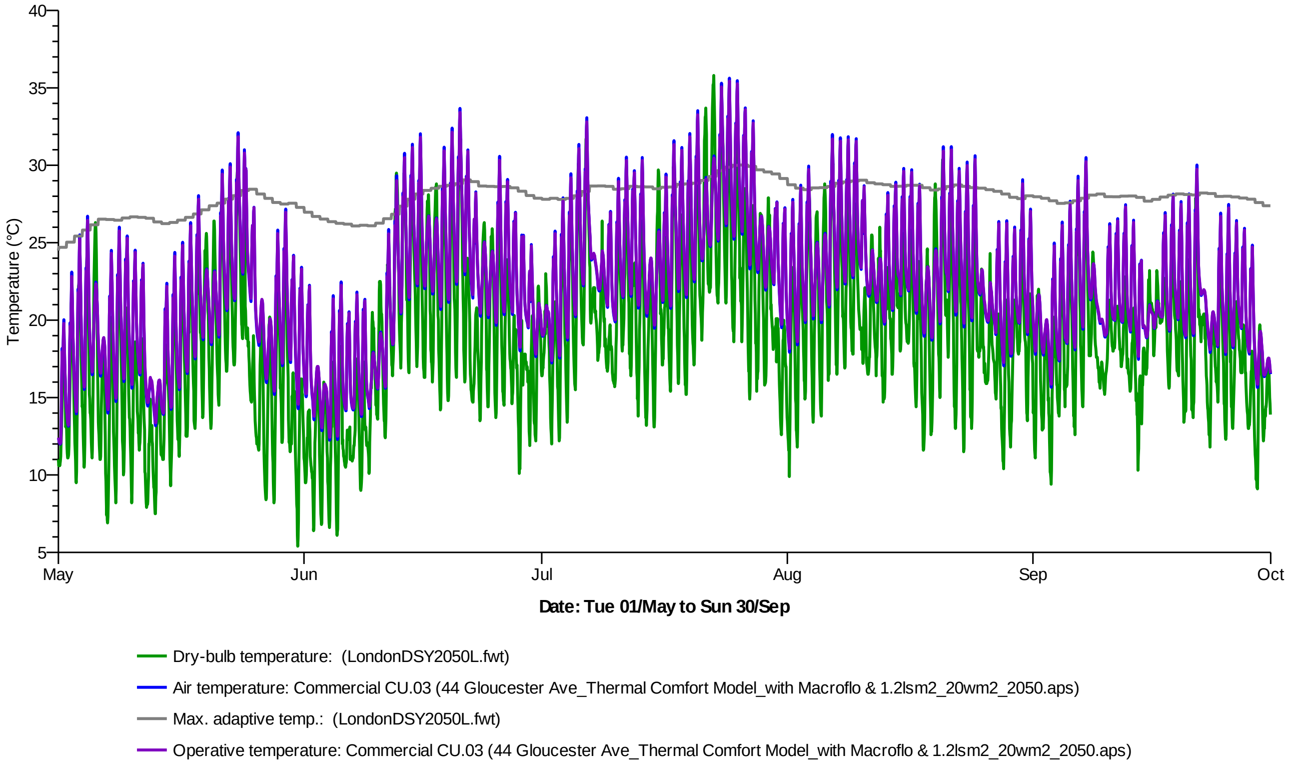
Operative temperature: Ground Floor Unit A3 1.01 Bedroom (44 Gloucester Ave_New Build Resi_Thermal Comfort_with Macroflo_with blinds__0.3lsm2_2050.aps)

COMMERCIAL RESULTS

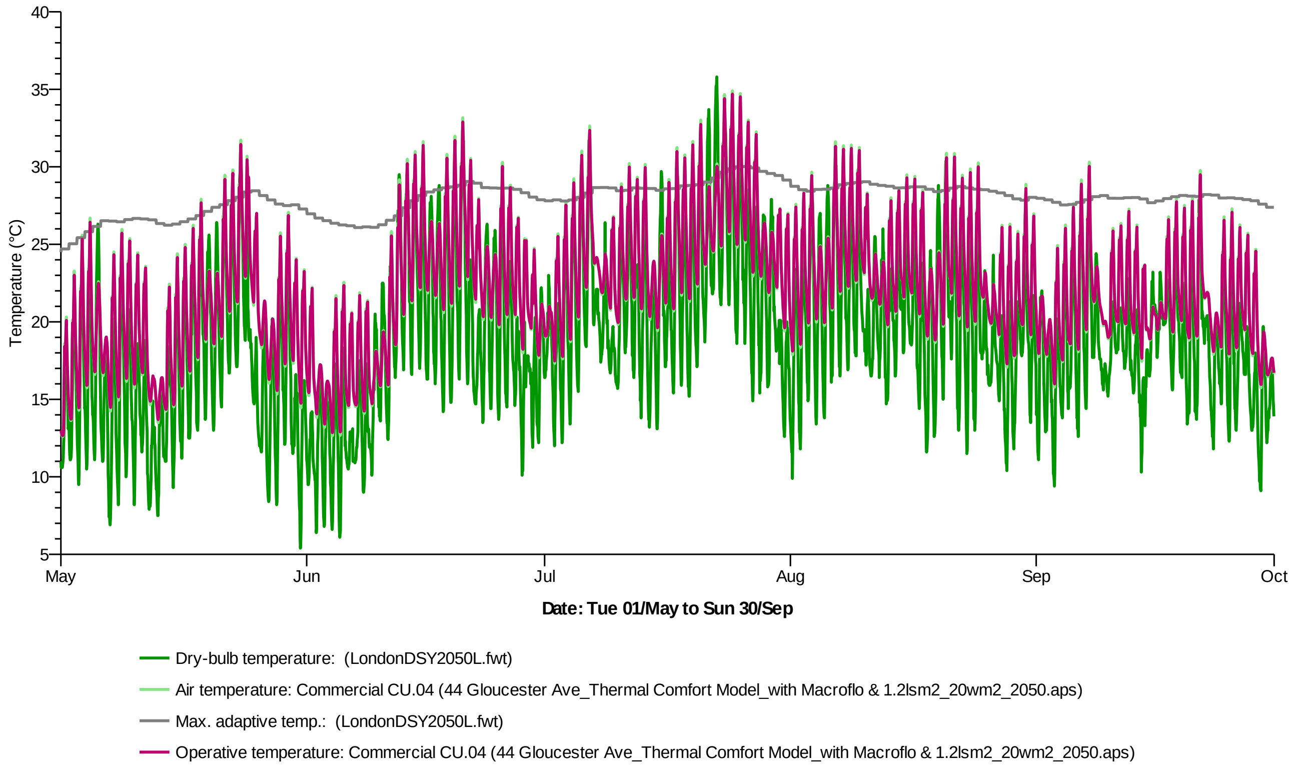
Basement Unit CU.02



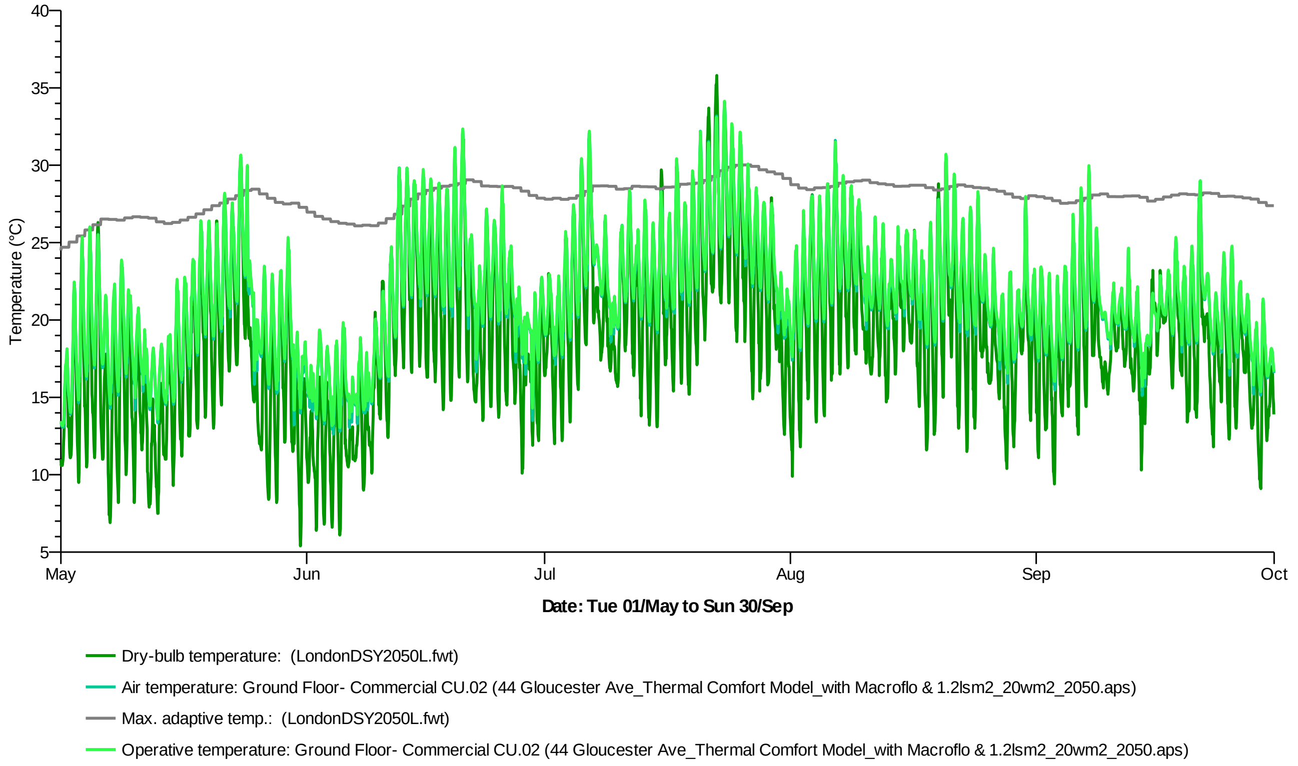
Basement Unit CU.03



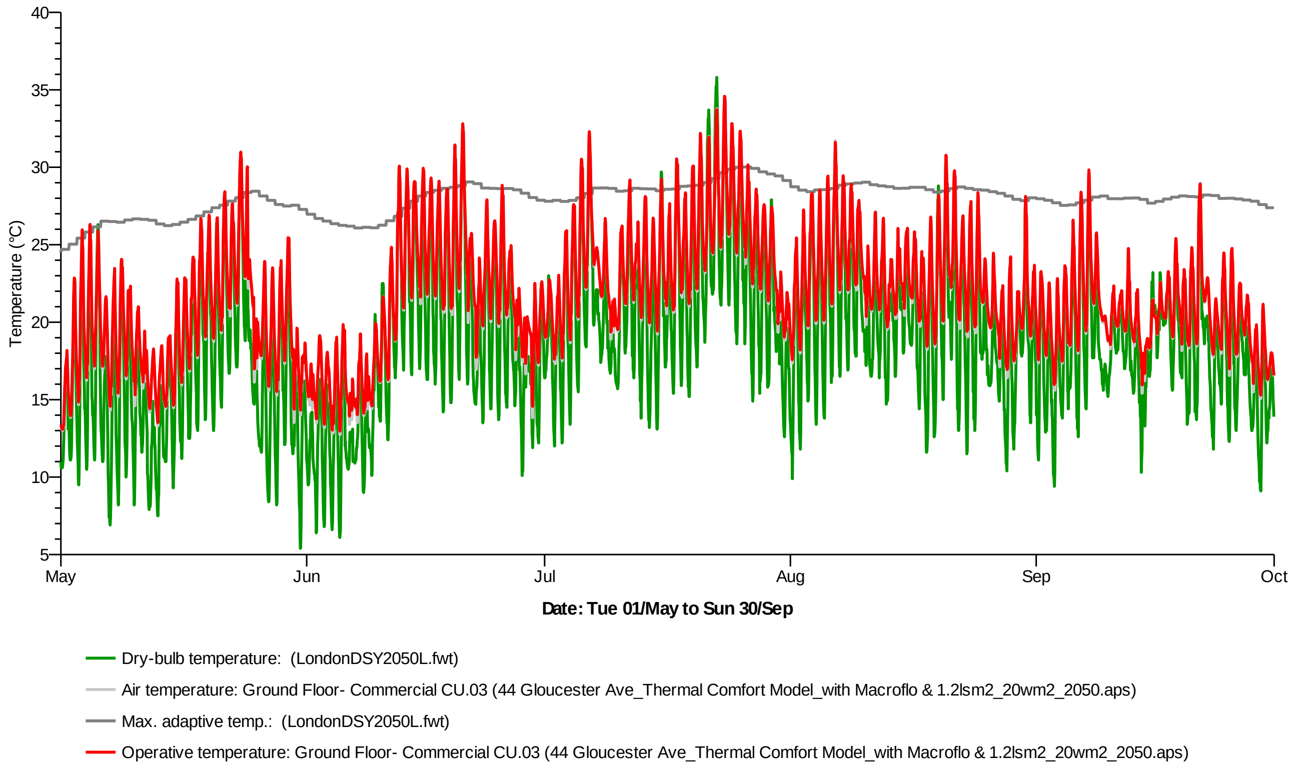
Basement Unit CU.04



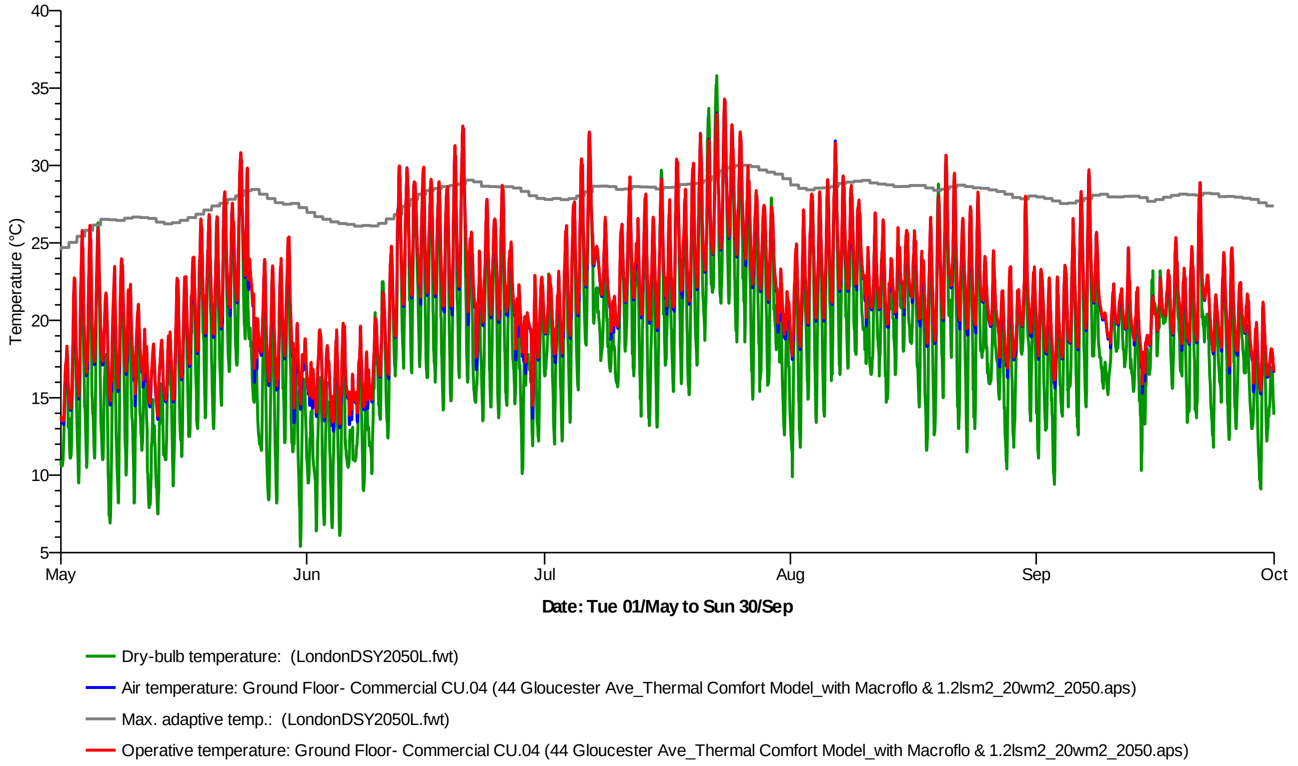
Ground Floor Unit CU.02



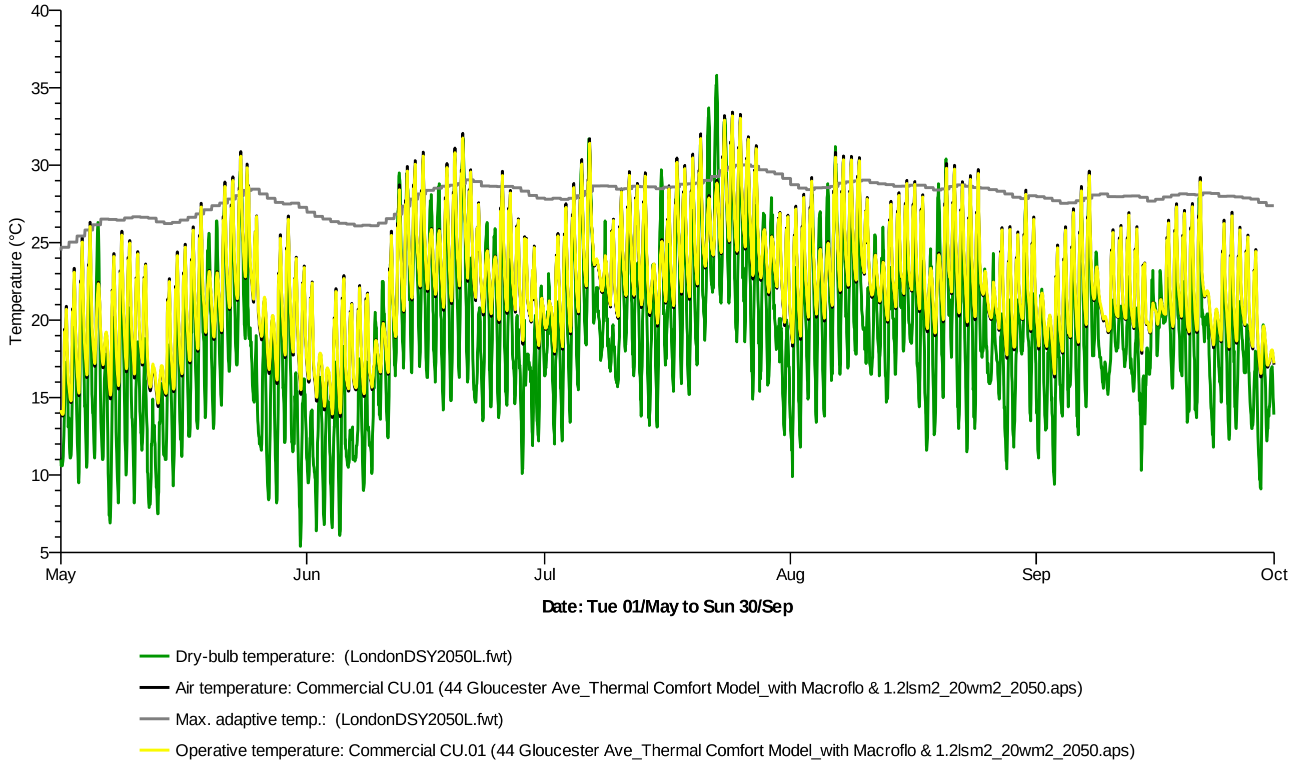
Ground Floor Unit CU.03



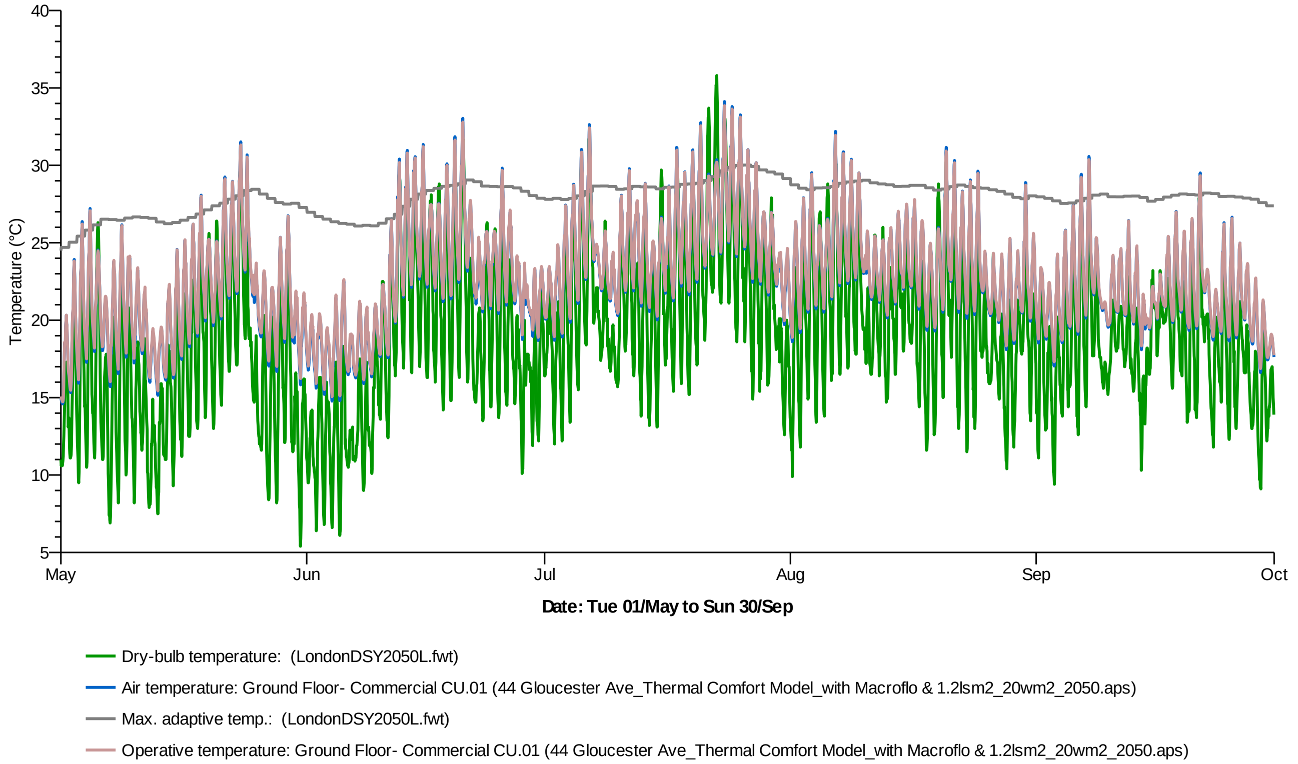
Ground Floor Unit CU.04

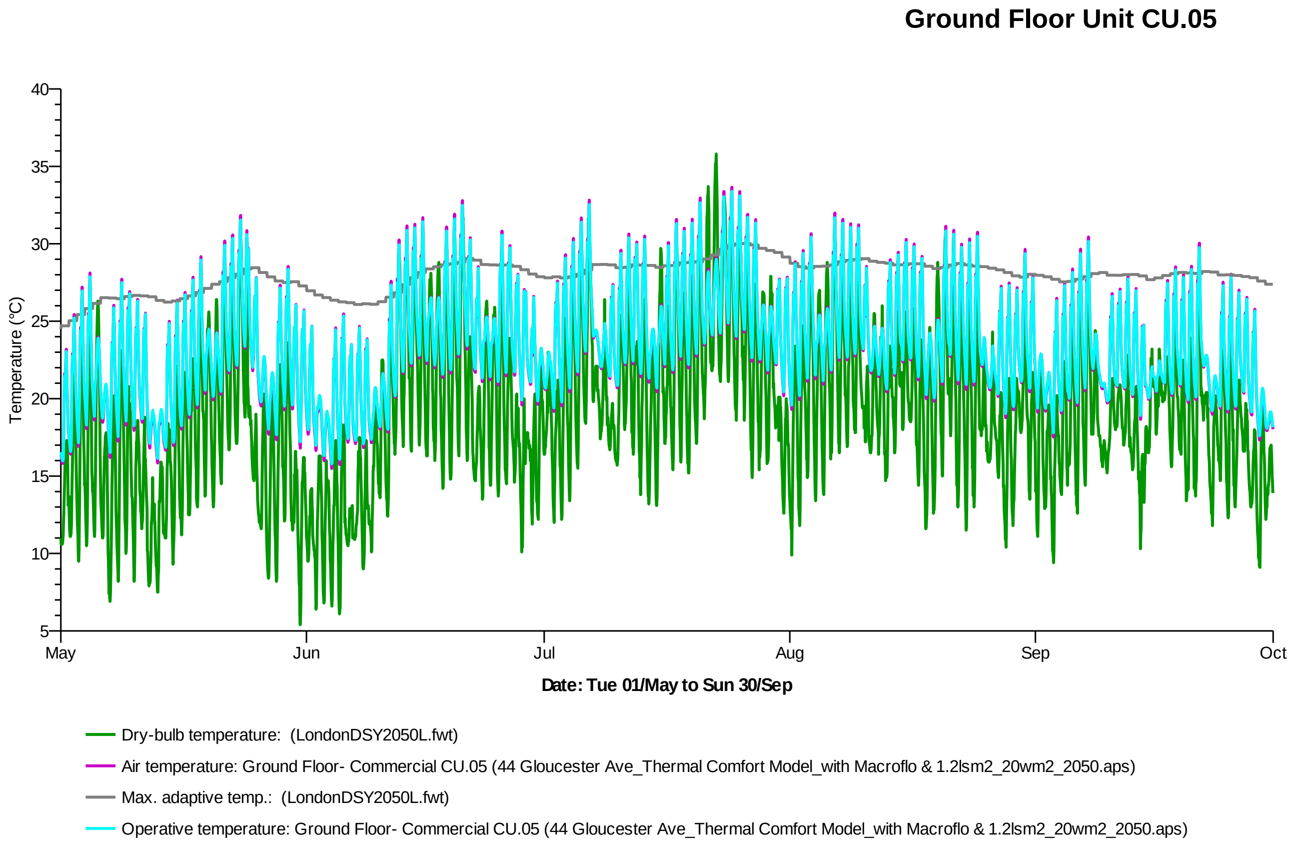


Basement Unit CU.01



Ground Floor Unit CU.01




Ground Floor Unit CU.05
Temperature (°C)
40
35
30
25
20
15
10
5
May
Jun
Jul
Aug
Sep
Oct
Date: Tue 01/May to Sun 30/Sep
Dry-bulb temperature: (LondonDSY2050L.fwt)
Air temperature: Ground Floor- Commercial CU.05 (44 Gloucester Ave_Thermal Comfort Model_with Macroflo & 1.2lsm2_20wm2_2050.aps)
Max. adaptive temp.: (LondonDSY2050L.fwt)
Operative temperature: Ground Floor- Commercial CU.05 (44 Gloucester Ave_Thermal Comfort Model_with Macroflo & 1.2lsm2_20wm2_2050.aps)

Appendix F – Other Appraised Renewable Technologies

F.1 Wind Turbines

F.1.1 Wind is one of the most cost-effective methods or generating renewable electricity. However wind is more suited to low density areas where there is more space necessary for maintenance, less turbulent wind patterns, and they are less likely to be the cause of noise and vibration to nearby properties. High density areas are not ideal with current wind turbine technology.

Feasibility

F.1.2 Installation of wind turbines is neither feasible nor suitable for 44 Gloucester Avenue. There are a number of concerns with wind turbines in an urban environment including; visual impact, noise, cost, maintenance and space. Although calculations for the modelled systems indicate that wind systems contribute to carbon reductions, it must be noted that under dense urban environments the energy outputs generated by wind turbines can be quite unpredictable. This is mainly due to the neighbouring buildings acting as obstructions causing turbulence to the incoming wind flow. The site would need to be evaluated appropriately (over a period of 12 months) using wind speed monitoring & recording devices in order to give an accurate prediction in terms of energy output derived by the real wind speed measurements recorded on site.

F.1.3 In addition to these concerns, the actual energy output of any turbines installed is likely to be much lower than the modelled outputs due to turbulence created in the urban environment.

F.1.4 Wind turbines have a long lifetime with relatively little maintenance required, and when considering life cycle costs, even with the feed in tariff and energy savings considered they have a longer payback time than other renewable technologies.

F.1.5 Therefore, wind turbines have been determined to be unsuitable for the development at 44 Gloucester Avenue.

F.2 Biomass Heating

F.2.1 Wood is the most commonly used form of biomass fuel, and can either be burned in solid fuel boilers for central heating applications, or for raising steam for power generation in large installations.

F.2.2 Typically, biomass installations are sized to meet a base heat load with peak load and load variations to be met from gas-fired boilers. Biomass boilers operate most efficiently and are therefore most cost effective when working continuously at full load, they do not respond well to rapidly fluctuating demand. When assessing the feasibility of a biomass installation, storage space and biomass delivery requirements need to be taken into account.

Feasibility

F.2.3 Although the calculations typically show that a biomass boiler could provide a higher level of carbon reductions than gas boilers, the main operational concerns are raised in relation to air quality, storage capacity and logistics of parking for delivery of wood pellets/chips etc.

F.2.4 Air quality is another major concern with biomass heating due to NOx (Nitrogen Oxides) and Particulate Matter (PM10) emissions.

F.2.5 The entire LBC is designated as an Air Quality Management Area (AQMA), with current technology, biomass fuelled boiler may negatively impact on air quality which is deemed inappropriate in an Air Quality Management Area unless abatement technology can provide sufficient mitigation.

F.2.6 Biomass systems also require space for storage and delivery of fuel. Additionally, fuel delivery carries implications for parking, increased emissions and pressure from transport. In the context of the current layout, there is insufficient space able to be allocated for the biomass storage facility.

F.2.7 When considering life cycle costs, there are higher maintenance requirements than other forms of renewable energy, fuel costs are predicted to rise and the value of net lettable space required for storage must be considered.

F.2.8 When considering noise impact, the impact of fuel deliveries must be considered, otherwise, the impact is similar to conventional plant.

F.2.9 Therefore, it is determined that a biomass heating solution cannot be practically implemented and is not suitable for the development at 44 Gloucester Avenue.

F.3 Solar Thermal

F.3.1 Solar Thermal hot water heating systems harvest energy from the sun to heat water. The solar heating collectors are generally positioned on the roof of a building, they can also be wall mounted, although with reduced efficiency. A fluid within the panels, heats up by absorbing solar radiation. The fluid is then used to heat up new water which is stored in a separate water cylinder.

F.3.2 As an alternative to PVs, implementing Solar Hot Water (SHW) can deliver carbon saving to new hot water generation for space heating as well as for new hot water production.

Feasibility

F.3.3 CHP and solar thermal both provide hot water as all or a proportion of the base load hot water demand. CHP and solar thermal would therefore be competing for the same base load. As the CHP system modelled is sized to provide the base load new hot water demand for the development, to run the CHP system in conjunction with solar thermal would result in lower efficiencies for both systems and lower carbon reductions than are available with the CHP/PV option. Therefore, it is determined that the solar thermal water heating option is not a feasible solution for the development at Royal Docks.

F.4 Ground Source Heat Pump (GSHP)

F.4.1 In the UK, soil temperatures stay at a constant temperature of around 11-12°C, throughout the year. Ground source heat pumps take this low temperature energy and concentrate it into more useful, higher temperatures, to provide space heating and water heating. The process is similar to that used in refrigerators. A fluid is circulated through pipes in the ground absorbing the heat from the soil, the fluid is passed through a heat exchanger in the pump which extracts the heat from the fluid and increases it via a compression cycle. This is then used to provide heating and heat new hot water.

Feasibility

F.4.2 It has been determined that connection to existing or installation of new Ground Source Heat Pump plant is not a feasible option for the 44 Gloucester Avenue.

F.4.3 In principle the deposits underlying the site could be suitable for an open loop GSHP system but the viability of this option, would be dependent on the thermal demand to make it cost effective. The installation of GSHP is one of the most costly options for this site, boreholes would need to be drilled to around 100m depth.

F.4.4 Additionally a further detailed analysis of conflicts with existing systems, ground conditions and soil conductivity would be required before determining whether or not the required levels of carbon savings could be achieved and in order to assess the potential for hydraulic connectivity.

F.4.5 Land use, plant space and physical security for the ground collectors and the heat pump units also need to be taken into consideration. For horizontal collector systems, a potentially large area is required for the collector pipework. This area should be free of trees which will cause problems for installation of the pipework. It can be beneath the building but it is most effective in an open area. For borehole or vertical collectors, land requirements are reduced but still significant as the boreholes must be a minimum of five metres apart. Due to the large area required for boreholes exterior to the buildings, construction programme impact and cost impact a GSHP is not considered to be a feasible option for the site.

F.4.6 Noise impact of heat pumps is considered to be negligible although concerns have been raised where older systems are poorly maintained and become noisy.

F.4.7 Taking all of these considerations into account, it is judged that GSHP is not a suitable or affordable technology for 44 Gloucester Avenue.

Appendix G – Summary of Input Parameters

Specifications	Consented Scheme (September 2015)	Revised Scheme (2016)
FABRIC DETAILS		
External Wall U-value - Retained / Upgraded (Residential)	0.50	2.10
External Wall U-value - Retained / Upgraded (Commercial)	0.50	0.50
External Wall U-value - New Build (Block B)	0.15	0.15
External Wall U-value - New Build (Block D)	0.15	0.14
Ground Floor / Exposed Floor U-value - Retained/Upgraded	0.25	0.25
Ground Floor / Exposed Floor U-value - New Build	0.10	0.10
Roof U-value - Retained / Upgraded	0.18	0.18
Roof U-value - New Build	0.10	0.10
Windows U-values - Retained / Upgraded	2.00	2.00
Windows U-values - New Build	1.20	1.40
Windows U-values - New Build (Sunny Mews and Network facing elevations)	1.20	1.80
Thermal bridging	Accredited construction details, insulated balcony connectors e.g. Schoeck Isokorb or similar, Lintels with linear thermal conductivity (Psi) of 0.08 W/mK or lower (e.g. Keystone Hi-therm lintel or similar)	Accredited construction details, insulated balcony connectors e.g. Schoeck Isokorb or similar, Lintels with linear thermal conductivity (Psi) of 0.08 W/mK or lower (e.g. Keystone Hi-therm lintel or similar)
Air Permeability - Retained / Upgraded	10.00	10.00
Air Permeability - New Build	5.00	5.00

Specifications	Consented Scheme (September 2015)	Revised Scheme (2016)
M&E SYSTEMS		
Space Heating System (Flats) - New & Refurbished	Individual Gas Boilers	Community boiler with 97.9% seasonal efficiency
Space Heating System (House)	Individual Gas Boilers	Gas boiler, 89.5% SEDBUK 2009 efficiency, radiators, time and temperature zone control, weather compensator
Space Heating System (Commercial) - New & Refurbished	High Efficiency Gas Boiler	Community boiler with 97.9% seasonal efficiency to feed 4 pipe FCU
DHW System (Flats) -New & Refurbished	Individual Gas Boilers	Community boiler with 97.9% seasonal efficiency with HIU located in each dwelling
DHW System (House)	Individual Gas Boilers	Indirect cylinder 210 L, heat loss 1.9 kWh/24h
DHW System (Commercial) - New & Refurbished	Electric Point of use water heaters	Electric Point of use water heaters
Ventilation System (Flats) - New	Local extract fans for Toilets and Kitchen	MVHR Vent Axia Kinetic Plus E
Ventilation System (Flats) - Refurbished	Naturally Ventilated with fully openable windows	Naturally Ventilated with fully openable windows
Ventilation System (House)	Local extract fans for Toilets and Kitchen	MVHR Vent Axia Kinetic Plus E
Ventilation System (Commercial) - New & Refurbished	MVHR	MVHR system with 88% Heat recovery efficiency and SFP of 0.5 W/l.s or lower
Cooling (Flats) - New Build facing Railway Tracks only	None	Comfort cooling via Water Cooled Chiller with SEER of 4.65
Cooling (Flats) - Other New Build & Refurbished	None	None
Cooling (House)	None	Individual VRF condenser unit (A+ rated)
Cooling (Commercial) - New & Refurbished	Comfort cooling via Chiller?	Cooling via Water Cooled Chiller with SEER of 4.65
Water Consumption	105 litres per person per day or less	105 litres per person per day or less
Energy Efficient Lighting - All Residential	100%	100%
Energy Efficient Lighting - All Commercial	Energy efficient lighting with Occupant sensors	Luminaire efficacy 85 lm/W, photoelectric control, metering with 'out of range' alarm
PV system	78.4 m² of 15% efficiency PV panels with total system power of 11.8 KWp	36 No panels @333 Wp with total system power of 11.9 kWp output facing south orientation at 30 degrees
Carbon Savings	**44.3%**	**40.7%**