SELCHP District Heating Network

Information for developers

Southwark
Council

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Content

1.0 Executive Summary

Veolia, as the operator of SELCHP District heating network, has been working with Southwark Council to expand the existing heat network enabling a decentralised solution to meeting space heating and hot water requirements throughout the borough, using low carbon waste heat sources such as South East London Combined Heat and Power facility - SELCHP.

Space heating and hot water demands will be supplied from low carbon thermal energy that is recovered at the facility and will be transported via a network of buried pipes – the "Primary Network" up to and including on-site substations. Energy in the form of hot water will be then transferred to each site's "Secondary Network" - pipework from the substation up to the end-user. Backup heating solutions across the network will provide overall resilience ensuring continuous supply.

Prior to Cabinet approval process expected in Autumn 2020, detailed heat mapping and energy master planning for a proposed exclusive district heating zone was conducted by external consultants on behalf of the London Borough of Southwark through GLA Decentralised Energy Enabling Project. The report highlights the strategic value of SELCHP facility and its low carbon intensity.

This document aims to support any party that would like to connect to SELCHP heat network, setting the pathway to achieve "zero" carbon in dense urban areas such Old Kent Road, whilst providing long-term adaptability to accommodate new emerging technologies and energy sources. Moreover, it provides the current and future carbon intensity of the heat network with auxiliary sources of heat either for top-up or backup.

2.0 Context

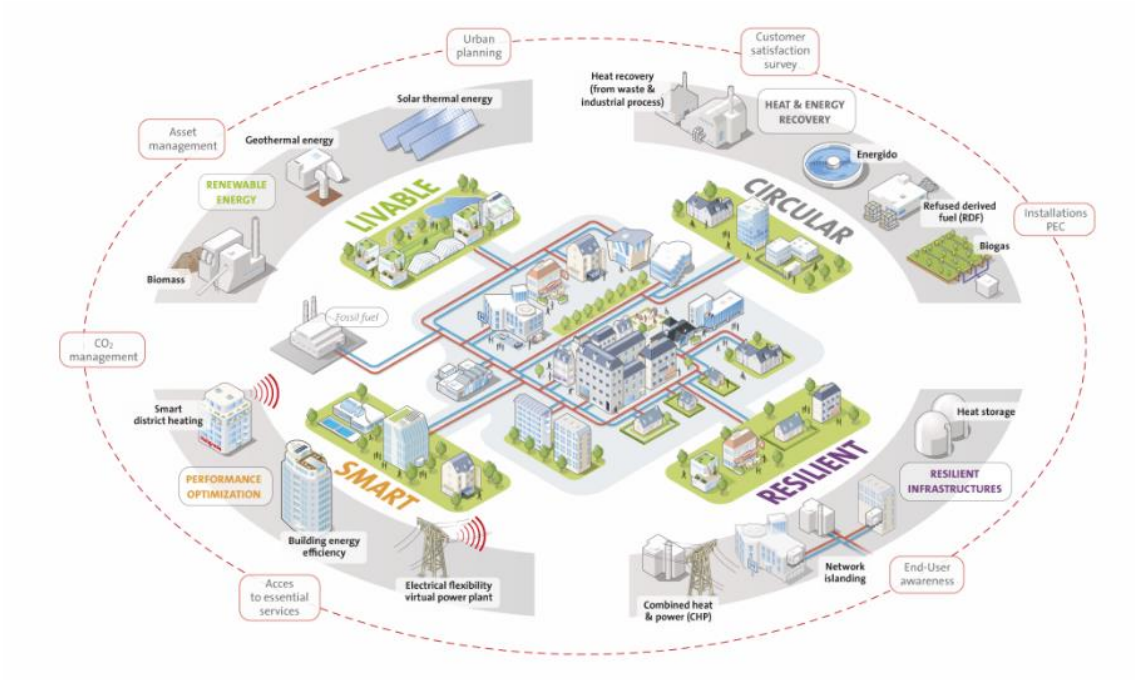
In 2013, the initial SELCHP District Heating network was agreed between Southwark Council and Veolia, for the supply of heat to four council housing estates, comprising nearly 2,700 properties. Since this network was commissioned, heat has been reliably supplied to the council's properties from a low-carbon source. Having now proven the concept, the Council would like to extend this heat network in order to reduce its reliance upon gas at other sites and reduce emissions of CO_2 and NO_X gases.

Throughout 2018 and 2019, the Council and its consultants conducted heat mapping, master-planning and detailed feasibility studies concerning the opportunities to expand the use of low-carbon heating in the borough. These studies have highlighted the strategic value of the SELCHP facility as the largest source of low-carbon waste heat in the area. It was found that expanding the existing SELCHP District Heat Network represented the lowest whole life cost means to achieving carbon, air quality and other policy objectives.

In April 2019, the Council, along with many others up and down the country, declared a Climate Emergency and committed to do all that it could to make both the Council and the borough carbon neutral by 2030. It is now actively preparing a borough-wide strategy for how this might be achieved. Although this work is far from complete, the Council knows that decarbonising its heat networks is going to be an essential element.

Beyond the carbon perspective, the Council is also driven by its ambition, and indeed its legal obligation, to achieve improvements to air quality in the borough. The impact of poor air quality on human health is significant and beyond doubt. Local air quality is a public health priority for Southwark and the Council has performance indicators regarding improving air quality listed in the current council plan.

The main atmospheric pollutants of concern in Southwark are Nitrogen Dioxide (NO_2) and Particulate Matter (PM). The main source of both pollutants locally is traffic emissions, however, large scale combustion plants, construction sites, and domestic heating also contribute significantly. Commercial and domestic gas heating is estimated to contribute nearly 30% of local NO_2 emissions which is why in its 2017 ‘Air Quality Strategy’ the borough set itself the target of increasing the number of Council homes using renewable energy from SELCHP by 50%[1]. This action is expected to reduce emissions of NO_2 and PM, in addition to facilitating a big step towards carbon neutrality.



Join us in our journey of ‘Resourcing the World’ [2]

In its role as Local Planning Authority, the Council must also consider its application of local, regional and national energy policy relating to new developments. This includes the current London Plan which strongly supports new developments connecting to existing heating and cooling networks (policy 5.6), the new draft London Plan which has similar stipulations (e.g. policy SI3.D) and the Southwark Local Plan which also reflects the priority of connecting to existing and planned decentralised energy networks (policy P62).

To confirm its intention to expand its use of low carbon heat from SELCHP, in July 2019 the Council’s cabinet approved the progression of detailed investigatory processes to establish investible proposals for the extension. Since that time, the business and environmental case for progressing the extension has become ever clearer.

3.0 Organisation Overview

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[1] Air Quality Strategy & Action Plan, April 2017, see action plan section 5.19

[2] Resourcing the World video: https://www.youtube.com/watch?v=OR7FBgAChwc&feature=youtu.be

3.1 Veolia Group

Veolia group is the global leader in optimised resource management. With nearly 169,000 employees worldwide, the Group designs and provides water, waste and energy management solutions that contribute to the sustainable development of communities and industries. Through its three complementary business activities, Veolia helps to access, preserve and to replenish resources.

Innovation is at the core of Veolia's strategy and culture towards building and shaping the circular economy: to manufacture green products, to produce green energy and to develop bespoke solutions for our clients.

Veolia has successfully delivered over 770 heating and cooling networks, including energy generation and carbon reduction solutions for the public and private sectors, specifically providing Natural Gas/Biomass and CHP solutions under long term performance based agreements.

As part of the London Energy Strategy, Veolia has been investing in the expansion of its existing and very successful District Heating Network from SELCHP energy from waste facility, located in South East London. Working in collaboration with both the Greater London Authority and the London Borough of Southwark has been crucial in overcoming various challenges.

Through Veolia Energy & Utility Services UK PLC we can offer a true end to end heating solution to each connected development, either through the proposed low carbon heat network, or any other alternative energy source. Whilst providing flexibility to achieve the energy requirements of our customers, Veolia, through its ESCO services, can take full responsibility for the network extension, risers and laterals within each connected development, delivering a guaranteed supply of heating and hot water to residents and end users.

Veolia can also provide all the normal services expected of an ESCo on the development side, such as:

- ✔ Guaranteed delivery of heat to the end users 24 hours per day 7 days per week, 365 days per year including all associated maintenance and plant replacement requirements;
- ✔ be responsible for all major plant replacements as and when required;
- ✔ be fully responsible for plant and equipment in the energy centre including keeping the building fabric in good repair, the district heating mains on the site, the rising main up to and including the heat meters (contained within the HIU);
- ✔ would continuously demonstrate and be responsible for compliance (i.e. reduced carbon emissions, local planning, legislation, Health and Safety, BS and EU regulations, etc.);
- ✔ provide a help desk and appropriate onsite maintenance facilities to answer any queries from the end users and deal with any technical issues that may arise on site. This shall also include regular preventative maintenance as required;
- ✔ pay particular attention to the standing losses of the system and will ensure that these are minimised at all times. This includes the monitoring and maintaining of insulation levels on the distribution pipe work and all such items up to the isolation points where the heating pipework enters the customers' premises. The system's performance/efficiency must be maintained

throughout the life of the contract and the cost of energy charged to the customers must be benchmarked against market rates for a traditional individual gas heating system.

We offer a transparent method for benchmarking market costs accordingly:

- ✔ The lowest average of the top six VAT exclusive 12 month, fixed, domestic, standing variable charge, gas supply tariff price per kWh (as published on www.uswitch.com or any other equivalent price comparison forum as agreed between Us from time to time). For variable tariff based upon X kWh gas for the Residential Supply per annum within the local postcode area at the date of this Supply Agreement and amended on every anniversary thereof;
- ✔ Production of annual invoices for the Dwelling Charges and the utility charges for each individual end user. Dwelling Charges will include costs for major plant replacement. Revenue collection and debt management for each individual end user;
- ✔ Meeting with, and providing the appropriate reporting, to the developer and the management company in accordance with an agreed meeting and reporting schedule. This shall include at a minimum reports on performance, demonstration of energy cost and standing cost calculations based on fuel costs;
- ✔ We would provide an accounts manager for the management of the service delivery.

The operation and maintenance requirements of the type and scale of these Developments are a core activity for Veolia and has been successfully implemented at numerous sites.

To establish viable solutions for energy generation schemes, Veolia has developed a comprehensive energy modelling system specifically for DHN applications. This system is capable of accurately profiling the heat and power demands of residential and commercial developments and applying generated heat and power outputs to the specific profiles, including hourly cost mapping of seasonal loads. The model also takes into account time of day heating and domestic hot water (DHW) demands in order that an accurate heat utilisation can be established and assumed over-utilisation risks identified. This way Veolia is confident that the carbon savings we predict are achievable and sustainable.

Operation and Service

Veolia Energy has over 50 years of experience in providing maintenance services to some of the country's largest Local Authorities, Housing Associations and private landlords. We also have a nationwide team of engineers. This established presence provides us with a unique capability to resource our contract from day one. We have a team of specialist engineers and a management structure that will maintain and repair the equipment throughout the length of the contract to the highest standards.

As a market leader in delivering energy solutions for the public and private sectors, we are eager to utilise our extensive knowledge and expertise to assist our customers. We also look to share the benefits of our experience which has been developed over many years of delivering similar energy projects across England, Scotland and Wales.

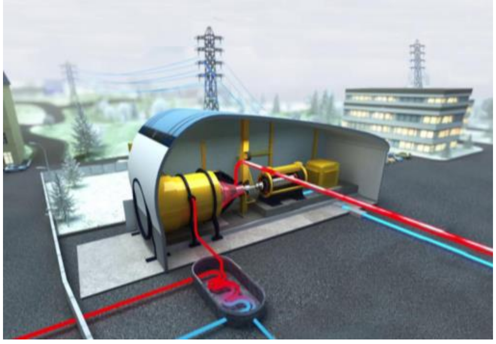
Further information about Veolia can be found on the UK website: https://www.veolia.co.uk/

3.2 Business Unit - SELCHP ERF Plant

In 1986, faced with the increasing scarcity and environmental problems of landfill, the London Boroughs of Lewisham, Southwark and Greenwich came together to search for a realistic alternative. In 1988, they formed a Consortium - South East London Combined Heat and Power - from which SELCHP[3] now takes its name.

SELCHP facility is located in Lewisham between New Cross Gate and Surrey Quays stations and processes over 430,000 tonnes of municipal waste per year from the neighbouring boroughs, exporting both electricity to the grid and heat to homes and businesses within Southwark. Veolia ES SELCHP Ltd is the operation and maintenance contractor.

Delivered waste is tipped into a bunker, where it is then placed into a feed hopper using a dedicated crane system. It then drops down a feed chute onto a sloped grate, where it is constantly turned to allow all combustion phases (such as drying, ignition and combustion itself) to happen simultaneously maintaining a constant high temperature. Through the process, SELCHP is able to recover metals and ash which is then transformed and reused. The steam produced by the combustion process is conveyed by a pipework system into the turbine to generate energy.



With the current design setup, the plant is capable of extracting 45MW of thermal energy and 35MW of electricity. Nevertheless, SELCHP has the potential to increase its total heat capacity through the recovery of heat at other plant locations or by implementing changes to the initial design such as: capturing heat at the back of the turbine @ 55°C, extracting available steam before the turbine, modifying its design and ultimately by implementing other technological add-ons. The total thermal capacity of the plant is 135MW with each boiler able to produce 67.5MW of steam.

The facility requires 3MW of electricity to operate during peak winter and with current heat demand, there is a marginal impact in the electricity production with the extraction of heat.

Although the current heat exported rarely exceeds 10MW, which is significantly lower than the installed capacity of 30MW, heat recovered at SELCHP has minimal impact on the electricity production, with a very high power/heat ratio (Z Factor). The limited impact is due to the use of the low pressure turbine port. With further heat extraction through remaining ports of the turbine (medium and high pressure), it is foreseen a reduction of electricity production reducing the Z factor. Impact on the electricity production is highly important because it has a direct implication on the heat price. The figure below shows a high level Process & Instrumentation Diagram (P&ID) of the entire energy downstream process.

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[3] A helpful overview of SELCHP's operations can be found through the link: https://youtu.be/xX8otzBB680

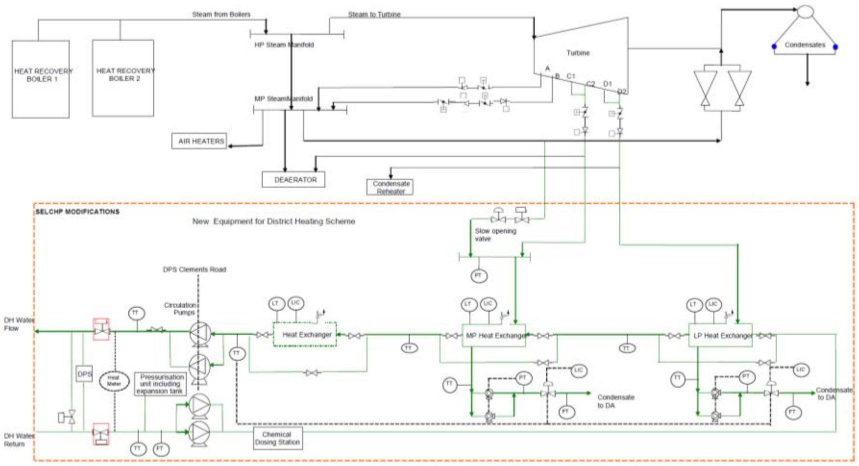

Figure 01 - High Level P&ID schematic of SELCHP energy recovery facility

4.0 Current District heating scheme

In 2013, working in partnership with the London Borough of Southwark, an agreement was established to supply space heating and hot water to 2,700 Southwark properties, through a 5km pipe network (2.5km trench). The system develops to northwest areas of SELCHP, growing towards Canada Water and Bermondsey, enabling other small third parties connections, replacing the need to install local energy centres.

The strategic scheme counters recent climate change bias by providing an option for low-carbon heat, avoiding the consumption of other fuel sources (i.e. gas) required to generate the same amount of energy. It has also proven very valuable in supporting the council to tackle fuel poverty by providing heat at a competitive cost. This is achieved through the recovery of energy at the Energy Recovery Facility - SELCHP, using mixed municipal waste as the main source of fuel. The two main by-products of this waste management approach - heat and electricity, are considered renewable energy sources with very low-carbon intensity.

This wide communal waste-to-energy approach helps decommission existing gas energy centers spread across the borough, cutting significantly the CO_2 emissions and increasing the overall air quality. The system has cut approximately 7,700 tonnes of CO_2 per year since it was commissioned.

The installed network leaves SELCHP by crossing the rail with a pipe size of DN 400 and has a total capacity of 42~45MW (as per powerpipe online catalogue). Along the route as more connections are made, pipework reduces in diameter reaching the furthest point downstream with a DN 200. Network drawings can be found in *Line Search before You Dig* website.

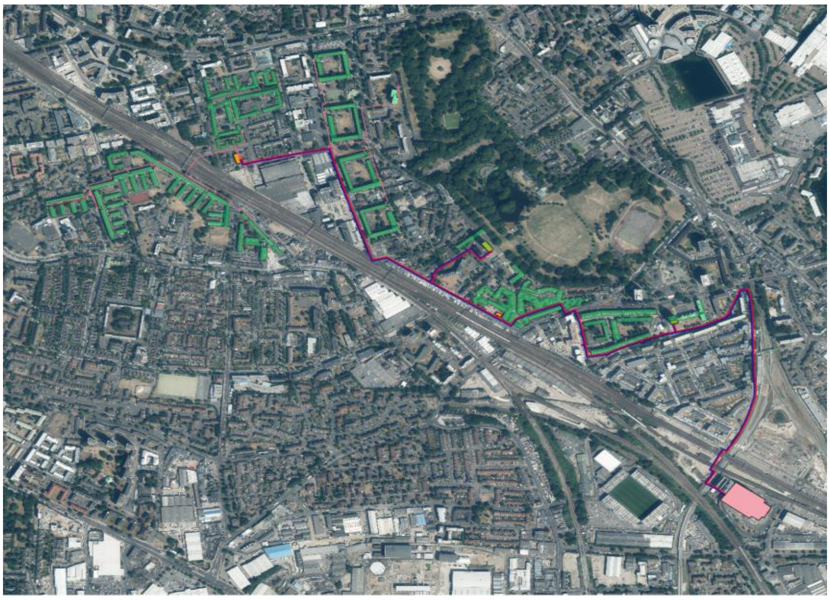

Figure 02 - Existing SELCHP District Heating Network

The existing network supplies heat to 3 boiler houses and 2 plant rooms with a total peak demand of 10MW during winter (~4MW summer) and a yearly heat consumption of 38GWh. The network is protected from secondary systems through heat exchanger units installed at each location, where it guarantees hydraulic separation between both networks. Those heat transfer units, albeit typically designed with duty and standby plates, can also be configured for summer and winter periods. Hence, the design capacity of each unit will vary depending on the heat demand, working specifications and design parameters.

Natural gas boilers connected to the primary and secondary network provides resilience as part of the Service Delivery Plan - Fail Safe[4] and Fall Back Plans[5] requested contractually by Southwark Council. With the primary network backup located downstream at Clements Road, they have the capacity to cover all peak demands and replace SELCHP if the need arises. With SELCHP's proven performance, running at 98% (see chapter 9 below) and with the additional critical resilience provisions, heat and hot water will be assured to the development's residents and businesses 24 hours per day, 365 days of the year.

5.0 District Heating growth plans

Over the past 20 years, there have been many challenges developing heat networks in South East London and from SELCHP mainly due to its location, being surrounded by rail infrastructure and environmental constraints such other utilities, contamination, etc. Throughout those years, SELCHP has released heat to the atmosphere that could have otherwise been captured and avoided releasing emissions from other heat sources such as gas boilers. Recently, by the implementation of new policies, heat hierarchy sets new priorities guaranteeing the use of waste heat as the most favourable solution. Despite not solving the main problems of availability of heat to offset major capital investments and covering high risks typically encountered in London, we have seen a shift with new governmental incentives being made available. Programmes such as Heat Network Investment Programme (HNIP) and Heat networks Delivery Unit (HNDU), have the potential to complement

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[4] Fail Safe (FS) - Temporary provision of heat by the use of portable boilers in the event of inability to supply heat from SELCHP or from the Fall Back Plan;

[5] Fall Back (FB) - Heat through backup systems (boilers) in the event of inability to supply heat from the SELCHP.

policies set by the new Mayor of London Plan, underpinning the two most important factors - Feasibility and Viability.

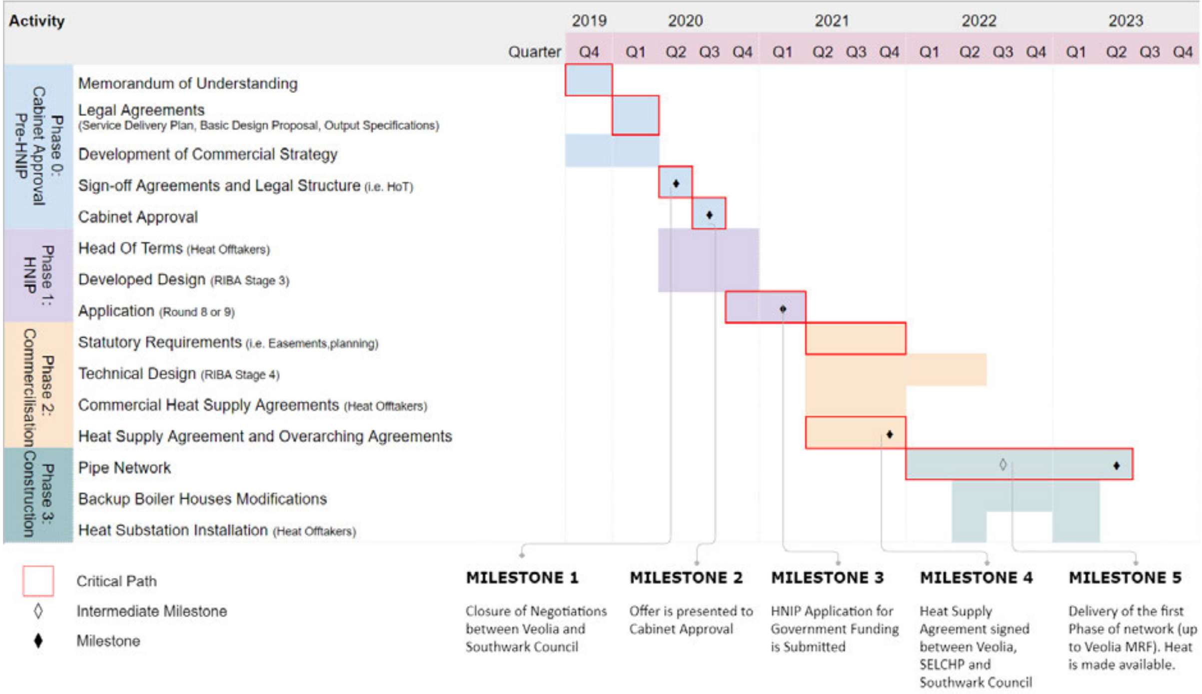
The joint efforts from Southwark and Veolia in the past year have produced a new strategic plan to grow the existing network, expanding towards North Peckham (see map below). Recently, Anthesis, an engineering consultancy firm appointed by GLA and Southwark Council, has been working on the energy strategies for the Old Kent Road Opportunity area, conducting techno-financial modelling and energy masterplanning assessments to identify the optimal energy solution. The study will be made available on the Southwark webpage.

The first connections of existing housing estates in the area will serve to improve the scheme viability. Additionally, delivering heat to these residences helps overcome the lack of heat availability in the Old Kent Road Opportunity area due to long term build-out. Furthermore, it also relieves those from high life-cycle costs, reducing the space required for their energy centres (if a substation replaces boilers). Notwithstanding, two significant sized energy centres have been identified along the route that could be converted and used as backup being located strategically within the proposed network. The integration of such solutions (see point 5.1) will guarantee 24h heat supply avoiding the need to have installed boilers locally at each connection point. In the future, such primary backup units could be used to have installed low-carbon primary energy centres.

Figure 03 -District Heating Network Expansion towards to Old Kent Road up to North Peckham

The factual delivery of the scheme should commence mid-2021 with a phase denominated commercialisation, followed by the construction of either district heating pipe network and energy centre retrofit. Whilst engagement with any interested party are important to start as early as possible, in order to guarantee some government funding at an early stage, Veolia and Southwark Council expects to establish all commercial supply agreements during the commercialisation phase. This is crucial to de-risk any capital investment introduced to construct the heat network extension to each client building. Such agreements will guarantee the heat offtake at each client boundary and any associated connection costs to be expected. It is during the commercialisation phase that all statutory, commercial and technical requirements are materialised.

Table 01 - Delivery Programme



- Memorandum of Understanding
- Legal Agreements (Service Delivery Plan, Basic Design Proposal, Output Specifications)
- Development of Commercial Strategy
- Sign-off Agreements and Legal Structure (i.e. HoT)
- Cabinet Approval
- Head Of Terms (Heat Offtakers)
- Developed Design (RIBA Stage 3)
- Application (Round 8 or 9)
- Statutory Requirements (i.e. Easements,planning)
- Technical Design (RIBA Stage 4)
- Commercial Heat Supply Agreements (Heat Offtakers)
- Heat Supply Agreement and Overarching Agreements
- Pipe Network
- Backup Boiler Houses Modifications
- Heat Substation Installation (Heat Offtakers)

MILESTONE 1 Closure of Negotiations between Veolia and Southwark Council

MILESTONE 2 Offer is presented to Cabinet Approval

MILESTONE 3 HNIP Application for Government Funding is Submitted

MILESTONE 4 Heat Supply Agreement signed between Veolia, SELCHP and Southwark Council

MILESTONE 5 Delivery of the first Phase of network (up to Veolia MRF). Heat is made available.

5.1 Resilience through backup system

SELCHP DHN resilience was initially designed based on the retrofit of existing boiler houses, avoiding any initial capital costs to install new backup equipment mainly for such small periods of time. Although the proposed DH expansion would follow a similar design approach, it would also accommodate any future implementation of low carbon technologies (i.e. heat pumps).

The current heat network backup is assured through primary boilers (and auxiliary equipment such as pumps) installed at Clements Road, and by the use of secondary boilers located at each housing estate. The natural gas backup boilers within each estate have rarely run and are expected to be operational only when planned maintenance activities at SELCHP are conducted (summer months). These outages are scheduled for a period of 2 weeks every other year. However, the system has been designed to comprise several operational modes, highlighting the most important:

- Help command: When SELCHP is unoperational, a control command is triggered giving control to other energy centres connected to the network; The plant is normally isolated from the network; Supply is guaranteed through primary boilers.
- Combined Mode: This is when SELCHP and Backup Boilers (either primary or secondary) are simultaneously operational.
- Manual Mode: This solution gives entire control to the user, operating each equipment individually. This is used during maintenance tasks or if eventually communication is lost between energy centres.

The proposed district heating expansion project at an early stage (up to 5 to 7 years) would envisage a similar approach, retrofitting existing boiler houses and utilise them either as a local backup and or primary systems. The use of two main significant size boiler houses (Brimmington and North Peckham) are well located within the network, would guarantee similar operational modes assuring a 24 hour heat supply.

Whilst we envisage in the future growth of the network and an increase of load demands, existing resilience systems (i.e. gas boilers) will become obsolete requiring full life cycle replacements. Subsequent replacement equipment will have to be engineered to be better integrated into an urban master plan, in order to accommodate the operation of a live ERF plant, heat network specifications, and any other existing sources supplying to the network.

The use of other technologies, including thermal storage, in conjunction with SELCHP will be part of a smart and circular economy which Veolia is striving to achieve, balancing and integrating all heat and power sources.

The figure below shows the main primary energy sources either of the existing network and to the proposed expansion scheme.

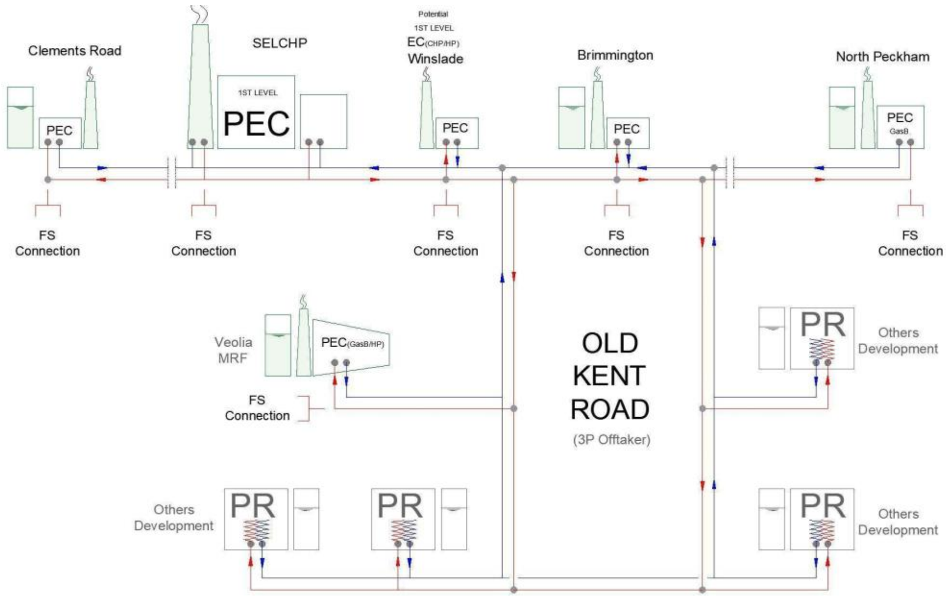


Figure 04 - District Heating Network Main Energy Centre and backup units

Future resilience solutions may comprise off but not be limited to:

- Boilers in public estates or Veolia sites spread across the borough that could feed the primary network; In the future these boiler houses may make use of other emerging technologies such as heat pumps or hydrogen;
- New boilers/heat pumps at North Peckham and Brimmington with a greater capacity;
- Primary thermal storage and local secondary thermal storage at each client site;
- Absorption heat pumps at SELCHP or other recovery technologies (supply would be limited by the pipe size);
- Several existing Boilers at other locations in Southwark that will become connected as part of a DHN development strategy Veolia and Southwark have been working on;
- Future possibility to have the DHN connected to other existing facilities recovering their waste heat or existing DHN networks supplying either Peak load or as a supporting backup solution;
- Use of portable temporary boilers to be connected to existing boiler houses.

Shutdowns and failures can be monitored and several KPI's may be contractually agreed. These elements can be part of the discussion if CW is willing to be connected to SELCHP DHN.

6.0 Long-term strategic plans and maturity of DHN

Despite the need to determine a carbon intensity for SELCHP DHN (chapter 8 and 9), in reality, an increase heat load supply from the ERF will have no increase in the emissions to air from the plant chimney. As the primary purpose of SELCHP is the disposal of municipal waste (constant mixture of fossil and biogenic), the energy recovery becomes a secondary by-product of this process. Therefore the emissions into the atmosphere are dependent on the waste throughout which is determined by the design of the EfW combustion process and independent of heat or electricity export. Nevertheless an increase of heat extraction at SELCHP would increase the overall power efficiency.

As SELCHP displaces grid electricity, the carbon factor associated with heat supplies will decrease in line with the grid carbon intensity. This means that SELCHP if considered as a power plant will continue to be highly competitive when compared with other heat sources either is SAP12 or SAP10.

Due to the carbon intensity of each technology, the backup systems become one of the most important components in the overall carbon intensity of the DHN network. In the event the DHN fails to expand and the network continues to supply heat using only the existing infrastructure, the impact of the overall carbon intensity is presented in Figure 09 below.

As we know, with the expansion of the DHN, the carbon intensity will vary depending on the systems introduced to the DHN to guarantee the 24h supply either through the primary backup and SELCHP performance.

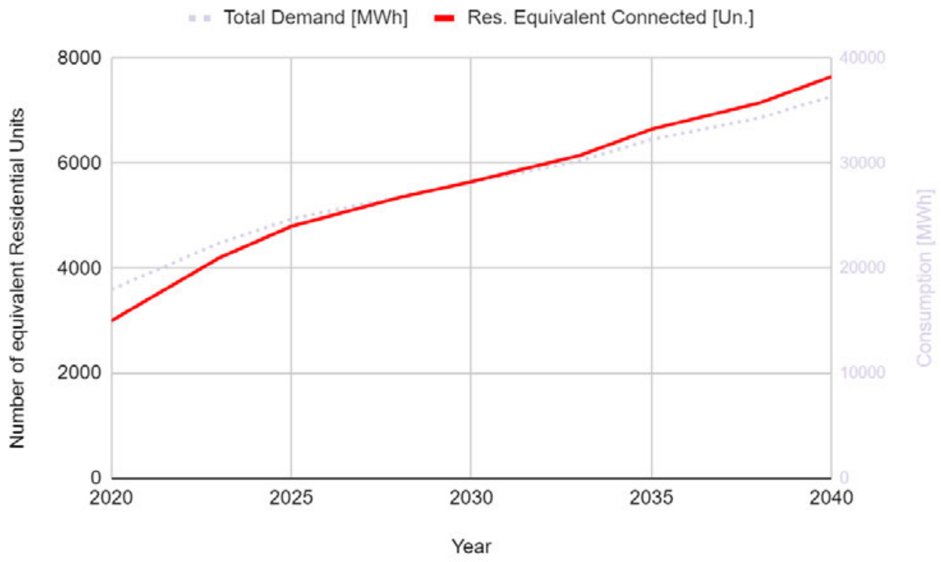


Figure 05 - High-level forecast of the total number of units[6] that could potentially be connected to SELCHP DHN (inc. Non-Res. as a Res. Equivalent) over the years

Flow and return temperatures of the primary network have an impact on the SELCHP system efficiency and Veolia expects temperatures of the primary network to change over the years. This change will be possible by refurbishing some of the existing systems connected at an early stage to the DHN either Southwark Council housing estates or any other that requires high operating temperatures. With an envisaged plan to bring the primary flow temperatures down in order to

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[6] Heat demand is based on Anthesis report and SELCHP connection enquiries. After 2028 it is assumed an increase in linear annual growth through additional connections.

accommodate other low carbon technologies, Veolia expects the temperatures of the DHN network to drop as per the following chart.

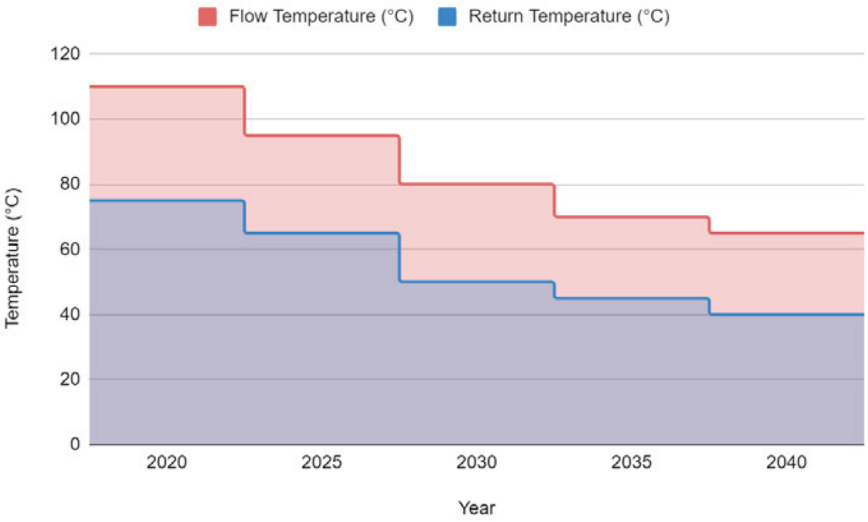

Figure 06 - Veolia expectation of the DH network temperature over time

At an initial phase Veolia intends to utilise the existing boilers at each public estate to operate as local or primary backup, avoiding the need to procure new equipment when heat demand is still relatively small. As more connections are made, an increase in heat revenues will allow for the introduction of other technologies such as heat pumps. In the following chart, it is possible to foresee when such technologies may be introduced.

Carbon intensity with the assumptions taken above would follow the following trend. It is important to identify that once the district heating is connected to SELCHP the overall carbon intensity drops to very low levels as waste heat from SELCHP provides the necessary heat demand for existing housing stock, replacing the requirement for gas boilers. As flow temperatures decrease to around 80°C by 2030, Veolia can then introduce heat pumps which will have a slight impact on the overall carbon emissions and overall DHN carbon intensity[7]. The overall carbon emissions will follow the trend.

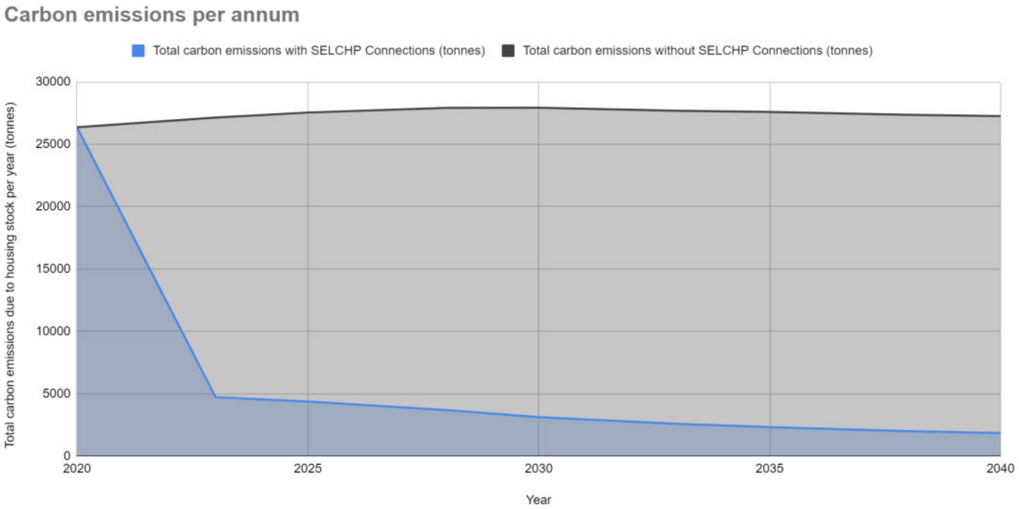

Figure 07 - Carbon emissions over time for the district heating network proposed in Figure 03

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[7] Heat Pump carbon intensity for Existing housing is based on grid long term marginal factors and for new build is as per SAP12/10.

7.0 GLA guidance and strategic significance of the SELCHP District Energy Expansion Scheme

The GLA's October 2018 version of the guidance document on preparing energy assessments encourages planning applications referable to the Mayor to use SAP 10 carbon emission factors when calculating carbon emission performance against London Plan targets.

https://www.london.gov.uk/what-we-do/planning/planning-applications-and-decisions/pre-planning-application-meeing-service-0

The guidance document also confirms that the continued use of SAP12 emissions factors will require justification to be included in energy assessments supporting planning applications. Based on these requirements Southwark and Veolia have held a number of discussions with GLA to agree a consistent approach for reporting carbon emissions performance through connection to the SELCHP DH scheme.

GLA have confirmed to Southwark and Veolia that the use of SAP12 will continue to be considered acceptable where development proposals provide a commitment to connect to the SELCHP DHN scheme. This decision reflects Southwark long term commitment to incorporate waste heat at the primary source of heat for the wider SELCHP DHN, with the existing and short term investments in CHP used only as an enabling technology as set out in the Southwark Old Kent Road Energy Strategy.

Old Kent Road energy master plan is expected to be finalised at the end of 2019 and will include overall carbon intensity for heat supplied from SELCHP and other sources if they become integrated with the heat network.

The decision also reflects the strategic significance of the wider district heating network balancing the alternative sources of energy available in the area. Acknowledging such a solution will deliver on the Mayor's ambition to implement large scale district heating and low carbon energy projects, as set out in the London Environment Strategy Objective 6.2.

8.0 Current carbon factor for heat supplied from SELCHP and long-term views of the carbon intensity at SELCHP

8.1 Challenge

Historically, SELCHP, with limited SAP knowhow, has provided developers the following carbon emissions – waste combustion of 0.047 emissions kg CO2 per kWh (SAP 2012 version 9.92). This has been very competitive when compared with on-site CHP and natural gas boilers. However, with recent shifts, the decarbonisation of the grid, heat pumps and SAP 2016 version 10's recent emissions kg CO2 per kWh giving 0.074 (56% increase), developers have questioned the value of any carbon savings offered by a SELCHP connection. This state of affairs runs contrary to the latest draft of the London Plan's Policy SI3 Energy infrastructure to utilise heat from energy from waste.

8.2 Current Carbon Intensity Solution (Electricity Displacement Model)

The current carbon intensity for SELCHP's district heating which has been used for Heat Networks Development Unit (HNDU) and Heat Networks Investment Project (HNIP) applications is based upon a model calculating the electricity displacement a heat network connection causes.

The heat exported to a District Heating Network (DHN) from an ERF causes a reduction in low carbon electricity exported to the grid. The carbon intensity of this heat is therefore based on the carbon intensity of additional electricity generation required to compensate for the reduction in export to the grid[8] and any additional fuel or electricity consumption for the heat exported to the heat network.

The reduction in electricity generation caused by the extraction of heat for a given generating station is related to its "Z-Factor" which is the ratio of generation reduction to heat extraction. For example a Z-Factor of 10 would mean that for every 10 kWh of heat extracted there is a reduction of 1 kWh of electricity exported.

The carbon intensity for this loss of electricity is based on the "Long Run Marginal Emissions Factor (LRMEF)", this means the carbon intensity of the energy sources used to make up the shortfall on the grid. A forecast for this figure is provided by BEIS and is discussed below. This model is suitable for the current network because it mainly supplies old public buildings which SAP is not applicable.

The following example illustrates a high-level calculation based on real data from SELCHP, Network and alternative energy centres (Backup boiler house).

- **2018 DH Connection Carbon Intensity Estimate based on the LRMEF**

  CIF_{2018}* = [(96.5% x $\text{CIF}_{\text{SELCHP}}$) + ((3.5% x $\text{CIF}_{\text{mains gas}}$)/(boiler efficiency**)) + (parasitic load x $\text{CIF}_{\text{LRMEF}}$)] x DLF***

  = [(0.965 x (1/10 x 0.2914) + (0.035 x 0.216 /0.85) + (0.01 x 0.2914)] x 1.05

  = 0.0419 kgCO_2/kWh

  where:

  $\text{CIF}_{\text{SELCHP}}$ = (1 heat unit /Z$_{\text{factor}}$) x $\text{CIF}_{\text{LRMEF}}$

Parasitic Load = 1% of the total heat generated

**For this calculation it has been conservatively assumed that 96.5% of heat is consumed while connected to SELCHP and 3.5% while SELCHP is shut down. (SELCHP's turbine availability in 2017 was 98.7%);*
***Assumed Boiler Efficiency of 85%;*
****Distribution Loss Factor (assumed 1.05 for primary network only - Bulk Supply) (SAP - Table 12c)*

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[8] Appendix D HNDU GHG Emissions Factors V1_1, HNDU,2018

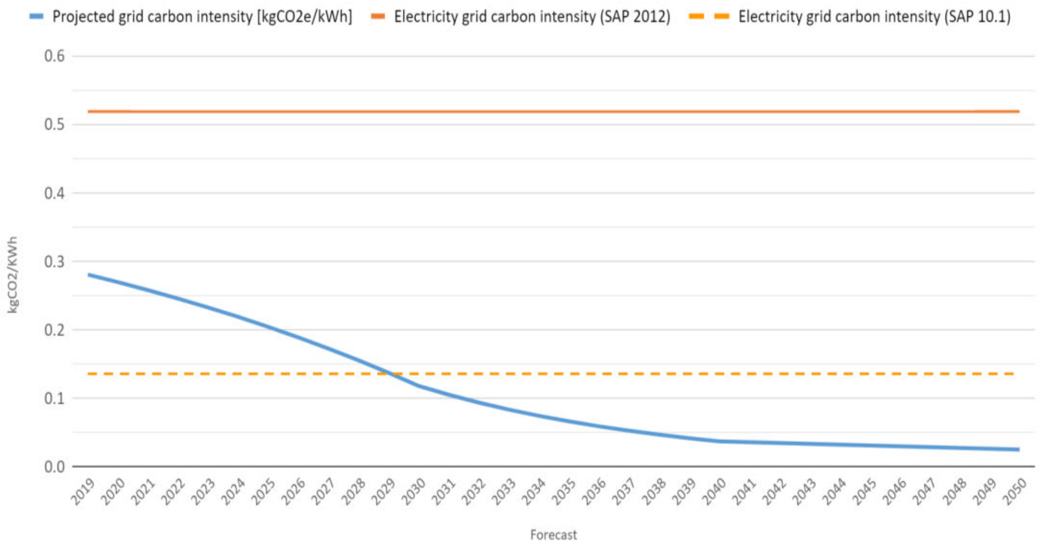

Figure 08 - Long Run Marginal Emissions Factor

8.3 Long Term Carbon Intensity

The carbon intensity of heat supplied into the future will depend on; the carbon intensity of the grid, the amount of heat exported from the ERF and the alternative heat source used during shutdowns.

8.4 Marginal Carbon Intensity Factor Outlook

As the grid is predicted to decarbonise, with an increased share of renewables, the carbon intensity of the heat produced from an ERF will also reduce similarly to waste heat from a power plant. The marginal carbon intensity of the grid is forecast to reach 118 g CO2/kWh by 2030[9] which, if achieved, would mean a CIF for heat of 0.0319 kg CO2/kWh using the SELCHP example above.

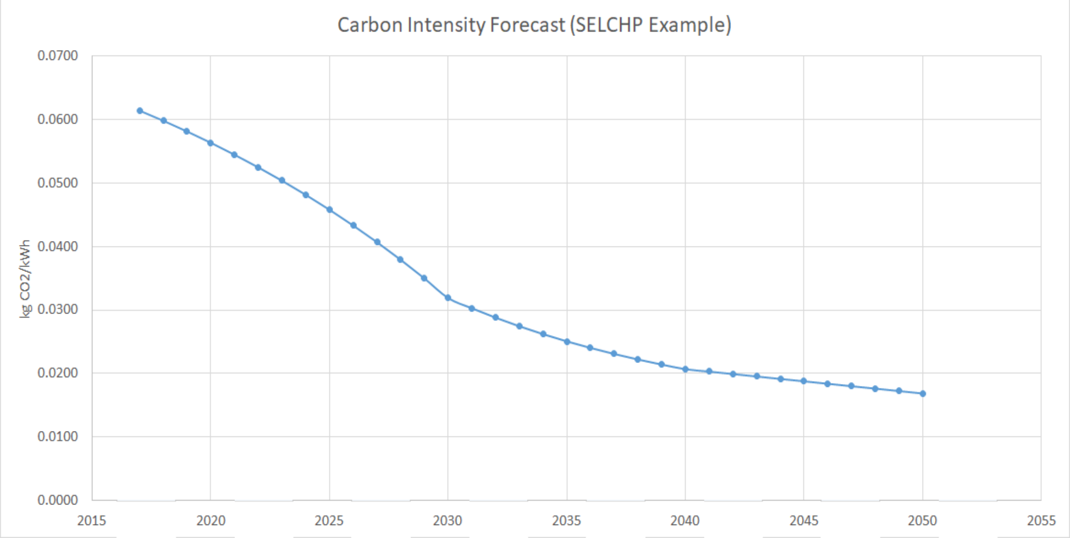

Figure 09 - Carbon Intensity Forecast for SELCHP DHN for current DH system

9.0 Proposed SAP approach for SELCHP ERF

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[9] Green Book Supplementary Guidance: Data tables 1 to 19: supporting the toolkit and the guidance, BEIS, 2019

In the sequence to what has been proposed by the Greater London Authority, SAP 2012 can continue to be used for any new development connecting to SELCHP district heating network, in line with their guidance letter (see Appendix 1) until new building regulations come in to place. Therefore, this chapter aims to assist energy strategies that consider connecting to a community heating scheme such as SELCHP heat network and clarifies the ambiguity in SAP12.

After supporting in many occasions energy strategies where the main heat source is waste heat captured from an energy recovery facility, Veolia has identified several constraints and difficulties consultants face when modelling SELCHP ERF in their SAP tool. Different results have been reached depending on the methodology used, and it has been identified that none of these approaches can be viewed as a representative model of an Energy Recovery Facility. SELCHP community heating scheme in SAP12 has been adapted by consultants when preparing their energy strategy using one of the three available approaches:

- Combined Heat and Power - CHP;
- Community heating schemes that recover waste heat from a power station;
- Heat from boilers - Waste combustion.

Recently after a meeting with BRE, it was understood and agreed that waste heat from a power station is the most appropriate solution to model SELCHP ERF even though the plant does not comply with the 35% power efficiency threshold. There remains ambiguity as to whether SELCHP should still be considered a power plant in SAP10 or if a bespoke calculation should be introduced, given that the carbon intensity factor most likely will drop following the trend of carbon intensity of the grid.

When modelling SELCHP in SAP12 as a power station, efficiency of 100% should be considered and the fraction of heat produced should take into account information in table 3 below (96.5% SELCHP and 3.5% gas boilers).

The fuel conversion factors up to 2030 are based on Part L 2013 which uses figures from SAP12. The use of SAP12 carbon emissions factors for new developments connecting to the SELCHP DHN will be reviewed following the next update to Part L of the Building Regulations expected in 2020 and Greater London Authority instructions.

Table 02 - Fuel conversion Factors taken from SAP - Table 12:

Fuel	SAP 2012 (kgCO2/kWh)	SAP 10.1 (kgCO2/kWh)
Combined Heat and Power	0.047	0.011
Waste heat from power stations	0.058	0.015
Heat from boilers - waste combustion	0.047	0.074
Electricity displaced from the grid	0.519	0.136

Although consultants for new developments should be using information provided above, the following table was prepared to demonstrate the carbon intensity factor Veolia considers suitable for SELCHP Energy Recovery Facility. It takes into account the performance of the plant for 2 scenarios - current demand and future demand. The two scenarios take into consideration the current load of 2700 public homes (38,000MWh) and a second scenario which considers the design capacity (300,000MWh).

Veolia proposed bespoke calculation of SELCHP Heat Network carbon intensity is as follows:

Table 03 - DHN Bespoke modelling

Ref	Description	Current System		Future Potential System		Units	Method
		SAP 2012	SAP 10.1	SAP 2012	SAP 10.1		
Ref	**Heat Delivered**						
(1)	Heat Delivered to HIU (within the dwelling)	1000	1000	1000	1000	kWh	HIU
	Losses						
(2)	SAP Distribution Loss factor (As per CP1)	1.05	1.30	1.05	1.30	-	SAP
	Heat Generated						
(3)	Heat Generated at SELCHP (96.5% fraction)	1013.25	1300.00	1050.00	1300.00	kWh	(1) x (2) x 96.5%
(4)	Heat produced by backup boilers (fraction 3.5%@85%eff.)	43.24	53.53	43.24	53.53	kWh	(1)x(3.5%)/(85%) x(2)
(5)	Total heat generated	1056.49	1353.53	1093.24	1353.53	kWh	(3) + (4)
	SELCHP Ratio						
(6)	Z Factor	10.00	10.00	5.80	5.80	-	Operations
	Efficiencies						
(7)	Overall power efficiency (Heat & Electricity)	0.25	0.25	0.39	0.39	%	Operations
	Electricity Losses						
(8)	Total waste heat recovered at SELCHP eligible for carbon intensity	101.33	130.00	181.03	224.14	kWh	(3) / (6)
(9)	Electricity loss for pumping (parasitic load)	10.56	13.54	10.93	13.54	kWh	(5) x 1%
	Emission Factors						
(10)	heat from boilers - mains gas	0.216	0.210	0.216	0.210	kgCO2/kWh	SAP
(11)	electricity displaced from grid	0.519	0.136	0.519	0.136	kgCO2/kWh	SAP
	Overall carbon intensity factor for SELCHP DHN						
(12)	Backup boilers	9.34	11.24	9.34	11.24	kgCO2	(10) x (4)
(13)	SELCHP eligible heat	58.07	19.52	99.63	32.32	kgCO2	(11) x (8+9)
(14)	Total emissions per annum	67.41	30.76	108.97	43.56	kgCO2	(12) + (13)
(15)	Carbon Intensity Factor per kWh delivered	0.067	0.031	0.109	0.044	kgCO2/kWh	(14) / (1)

Notes and assumptions

i. Heat supplied is based on current readings of the existing primary network year 2018;
ii. SELCHP can extract 53068 MWht with no impact in electricity production using Low pressure turbine port;

iii. SELCHP heat extraction from the turbine starts to impact electricity production above 10MW thermal (uses Medium pressure ports);
iv. Point 8 is taking into account only the electricity loss due to the extraction of heat from the turbine;
v. Z factor of 5.8 is if SELCHP is extracting the full current design capacity of 40MW thermal (LP, MP and High Pressure Port);
vi. Current Veolia DHN has used SERIES 2 pipes; All new primary networks are to be delivered as per current Heat Network Code of Practice;
vii. In peak winter Veolia considers a maximum heat loss of 10% on the primary network but primary losses are based SAP 2012 table 12C;
viii. Veolia secondary networks adoption guidelines - requires networks to be designed as per code of practice with maximum heat losses up to 15%;
ix. 3.5% backup boilers use is based on a conservative figure of 12 days a year for planned preventive maintenance at SELCHP;
x. Fuel used for SELCHP is municipal waste with a NCV of 9242 kJ/kg;
xi. Plant performance is taken from the live data and is audited yearly by the environmental agency and other third parties. This figure is based on the yearly availability of the plant.

The SELCHP bespoke carbon intensity calculation above is simplified by making the assumption that all new connections during the network expansion are new-built, and does not consider the percentage of newly-built and old public housing stock. Accounting for this split in the age of housing stock connected to the district heating network would significantly improve the overall carbon intensity factor because old buildings take into consideration the grid long-term marginal. Furthermore, this calculation also assumes the worst case scenario using gas backup boilers as a resilience solution, which is predicted to be replaced in the long-term by other green technologies (chapter 6).

10.0 Achieving zero carbon

It can be seen from the above that the SELCHP heat network is already a low carbon network, and one with a decreasing carbon intensity. In line with the Mayor of London's commitments, however, Veolia and Southwark Council would like the network to be completely zero carbon and will work towards achieving this by 2050 at the latest.

In the carbon models described above, there remains a residual carbon content in the network. This is linked to the small quantity of gas combustion employed for backup when the SELCHP facility is unavailable due to maintenance.

In order to achieve a truly zero carbon network, even back-up and reserve heat generation needs to be carbon neutral. In the medium term the Council will therefore look to replace its gas boilers which currently act as back-up with renewable heating systems such as heat pumps. In 2020/21 the Council is planning to install high temperature heat pumps at three pilot sites not connected to SELCHP. These will be based upon aquifer water as the heat source (i.e. open loop ground source). Through recent heat mapping and master planning processes, the Council has also been investigating other heat sources that could combine with heat pump technology, such as sewer heat recovery or London Underground heat recovery.

Current design philosophy for the extended SELCHP heat network is to employ two of the Council's largest boiler houses for overall system resilience. Rather than every connected site needing a backup system, there will be a small number of back-up energy centres that are capable of feeding heat back into the primary network as well as serving their own directly connected loads.

The two boiler houses under consideration both currently operate as MTHW systems up to 120°C (though normal operation is much lower than this) and therefore as well as investigating heat sources for heat pump operation, the Council is aware that it would need to reduce the temperatures of these systems to make them compatible with heat pumps. The process for investigating ways of reducing distribution temperatures as these sites has already begun but implementation is expected to take several years (as indicated in Figure 6). Temperature reduction strategies could include investment in connected plant rooms / thermal sub-stations (such as replacing old shell and tube heat exchangers with more efficient plate heat exchangers, and improving control and pumping arrangements) as well as investment in the connected dwellings themselves (e.g. new radiators, HIUs, or improved insulation levels).

Combining the dual approach of reducing primary network temperatures (enabled through investment in the higher temperature loads) with the introduction of high temperature heat pumps at different locations around the network, will enable the whole of SELCHP network to become fully zero carbon.

11.0 Contacts

Contact Details
Any queries on the use of the proposed document or in relation to the SELCHP District Heating network, please contact the following persons:

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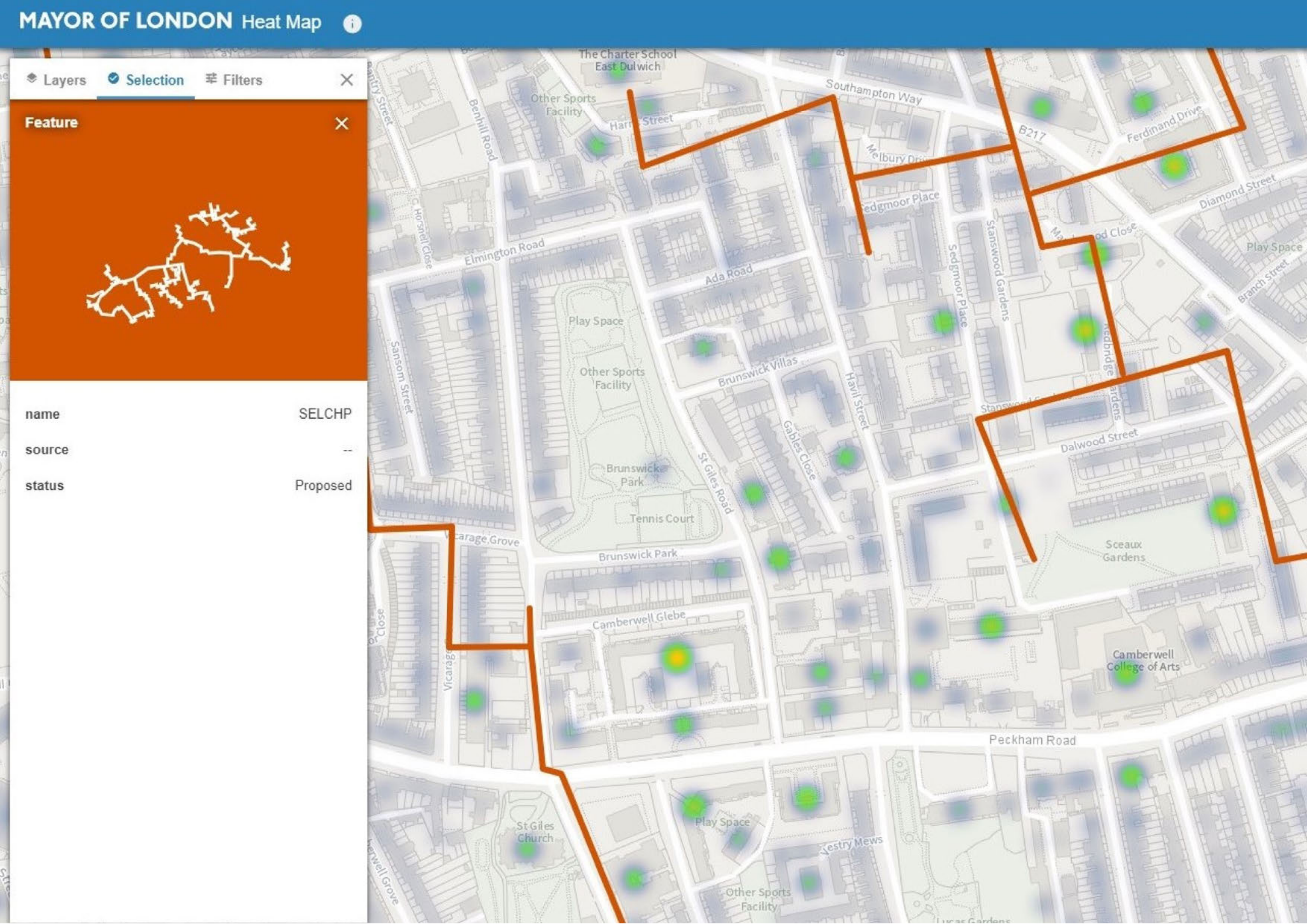
A. Appendices

A.1 GLA Letter confirming suitability of SAP12



name	SELCHP
source	--
status	Proposed

Appendix C

Renewable Energy Technologies Considered

The following Low Carbon Technologies (LCTs) have been considered with respect to the Bells Gardens site.

C1 Wind Turbines

Wind turbines rely upon air pressure acting on a set of turbine blades. The turbine blades turn a rotor which provides the motive force for an electrical generator.

The siting of wind turbines is highly regulated and the noise generated by their operation is often an issue which needs careful consideration and consultation with local residents.

The introduction of SAP 10 carbon factors means that significantly larger (quantity or physical size) wind turbines are required to provide the equivalent carbon savings that were previously available using SAP2012 carbon factors.

The heating and hot water loads account for the majority of the energy use therefore the provision of wind turbines as the primary contributor of renewable energy at the site is not considered suitable.

C2 Solar Thermal

Solar Water heating systems use the sun's energy to heat water. A heat collector is mounted in direct sunlight (normally on a roof) and fluid runs through the collector gaining heat from the sun. A heat exchanger transfers the thermal energy to a hot water cylinder, where it is stored until required.

Collectors should ideally face south at an elevation of between 10° and 60°. The best degree of elevation will depend on the frequency and duration of the demand. Systems should be placed in a location that will be unshaded at all times of day.

Life expectancy for a solar water heating installation is c20 years.

Benefits of Solar thermal water heating include;

- The production of hot water (which is the primary energy requirement for the site)
- Low maintenance requirements

Considerations of Solar Thermal water heating include;

- Large area to achieve reasonable savings

Due to the large areas required, this technology is not best suited for high-rise developments which have a low roof to floor area ratio.

C3 Solar Photovoltaics

Solar Photovoltaics (PV) convert the energy produced by the sun into electricity. PV modules are most often provided as separate panels that can be mounted on roofs (most commonly), walls or at ground level. There are further less developed systems, that can be embedded with building materials (roof tiles for example) and roadways.

PV panels should ideally face between South-East and South-West at an elevation of 30-40°, however if positioned in a different orientation the panels will still work but will generate less electricity. Systems should be placed in a location that will be un-shaded at all times of the day.

Life expectancy of PV panels is c20 years.

Benefits of Solar Photovoltaics include;

- The production of free electricity
- Excess electricity can be sold to the grid (at a reduced price)
- Little maintenance is required, as PV panels have no moving parts

Considerations of Solar Photovoltaics include;

- Highly visual, therefore aesthetic and planning / listed building considerations

Due to the introduction of SAP 10 carbon factors, twice the area of PVs is required to generate the same carbon offsets as when SAP2012 carbon factors were applicable. Therefore PVs are not considered suitable as the primary renewable energy contributor at the site, however due to the ease of installation, they will be provided as a secondary renewable source to maximise the renewable energy contribution on site.

C4 Ground Sourced Heat Pumps

There are basically two types of Ground Sourced Heat Pumps (GSHP), open or closed.

'Closed' systems circulate water in a closed loop of pipework to and from the heat pump. This pipework runs in contact with either the ground or a water course and extracts geothermal energy from this contact. Closed systems fall into three main subcategories, vertical, horizontal or watercourse.

Vertical systems rely upon deep boreholes sunk around the site whilst horizontal systems rely upon the installation of a relatively shallow pipework grid c2m often referred to as 'slinkies'. Generally, boreholes require less plan area, but are considerably more costly than horizontal systems. Watercourse systems rely upon heat exchange mats being laid at the base of the watercourse.

For all closed systems, since the pipework is a closed loop no water is extracted from or discharged into the ground or the watercourse.

'Open' systems extract water from the ground (generally via an open bore hole) or a water course, pass this water through the heat pump and then discharge the water back to either the ground or the water course from which it was extracted. Thus, open systems actually extract water from the ground or water course whilst closed systems do not.

All heat pump systems work best in conjunction with low energy well-insulated buildings, ideally with underfloor heating. That said with a lowering in overall efficiency the newer generation of 'high temperature' GSHPs can produce the higher temperature water required for radiator systems with historic buildings such as Tottenham House.

Heat pumps are modular and as such almost any output size can be provided. Heat pumps can also be easily connected to a common header system allowing the system to be coupled to more "conventional boilers" such as oil or gas fired. This allows the designer to select a heat pump size to carry the base load with conventional boilers picking up the shortfall during high demand periods and also ensuring a high standby size in event of heat pump failure.

Benefits of GSHPs include;

- Clean, efficient and effective heating
- Can provide energy 24/7, 365 days a year
- SAP 10 Carbon factors mean substantial carbon savings can be demonstrated.
- "Hidden technology" with little or no external manifestation

Considerations of GSHPs;

- Large electric loads
- Best efficiencies are available at reduced output temperature.
- Large areas of slinkies or bores required to generate large amounts of heat.

Due to the high-rise nature of the development, there is limited area available for GSHPs and therefore this technology is not considered suitable as the primary energy source for the site,

C5 Air Sourced Heat Pumps

Air Source Heat Pumps (ASHPs) are similar to GSHPs except that they extract heat from the air rather than the ground. Like GSHP they can support both heating and domestic hot water services.

ASHPs do however have the great advantages of being very easy to install (i.e. with no extensive ground works) and are 3 times more energy efficient than gas or oil fired boilers, requiring no fuel store or piped fuel supply.

Benefits of ASHPs include;

- Clean, efficient and effective heating.
- Can provide energy 24/7, 365 days a year
- SAP 10 Carbon factors mean substantial carbon savings can be demonstrated.
- No on flues or onsite emissions.

Considerations of ASHPs;

- Large electric loads.
- External plant locations needed, in well ventilated areas.
- Noise considerations depending on location for installation.

Due to the use of SAP 10 carbon factors and the high efficiency of the ASHPs, these are considered as a highly effective and cost effective solution to reduce emissions at the site and are therefore being selected.

C6 Biomass Boilers

Biomass boilers can use a variety of fuels, including grasses, willow and wood pellets or chips. These systems can burn either wood waste (from carpenters' shops and the like) or timber grown specifically for this purpose such as willow, willow is usually chosen because it grows fast and for use as a fuel has a 5 year turnaround. These crops absorb Carbon from the atmosphere as they grow as such the systems are regarded as carbon neutral.

Biomass fuel is normally supplied as either wood chips or pellets. Chips are simply unprocessed wood chippings whilst pellets are extruded wood. Chips are less dense have a higher moisture content than pellets and therefore require a larger storage facility.

The storage and material handling aspects of chips are somewhat more difficult than pellets, however chips are considerably cheaper than pellets (chips are typically half the cost of pellets) and offer a greater carbon reduction than pellets.

Biomass boilers can be modular and as such almost any boiler size can be provided, however to limit capital cost and to reduce the complexity associated with the delivery of the fuel to multiple boilers it is most common for Biomass installations to take the form of a single large boiler.

Like high temperature GSHP, Biomass boilers can be coupled to more "conventional boilers" such as oil or gas fired.

Biomass is often a method of achieving relatively high percentages of renewable energies at relatively low cost.

Benefits of a Biomass boiler installation include;

- Can provide energy 24/7, 330 days a year
- Large reduction in carbon emissions

Considerations of a Biomass boiler installation include;

- Large fuel storage requirements
- Regular fuel delivery required
- Conventional rather than balanced flues must be employed, and this imposes restrictions on sitting and these can be quite visual.
- Flue cleansing systems required
- Fuel costs in recent years have been 'volatile'

Based on the restrictions on emissions for this site, this technology is not considered suitable for this development.

OVERHEATING ASSESSMENT

AT

SCEAUX GARDENS

FOR

WestonWilliamson+Partners

BY

vectordesign

BUILDING SERVICES CONSULTANTS

Church Farm Barns, Copson Lane, Stadhampton, Oxfordshire, OX44 7TZ
Tel. 01865 892300

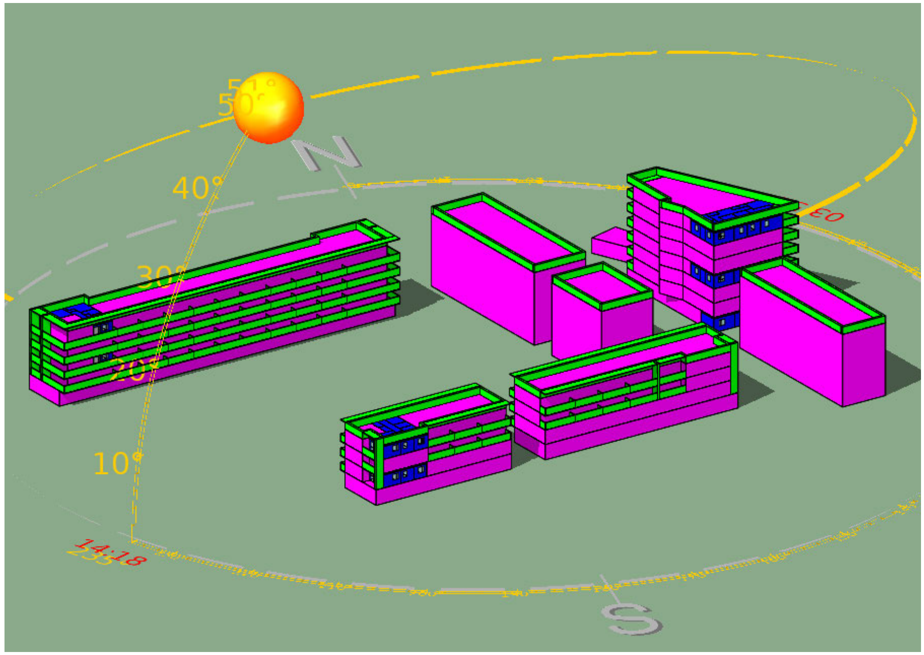
Report Ref: - 4114-4-2-REP-ME01-A - Overheating Assessment **April 2021**

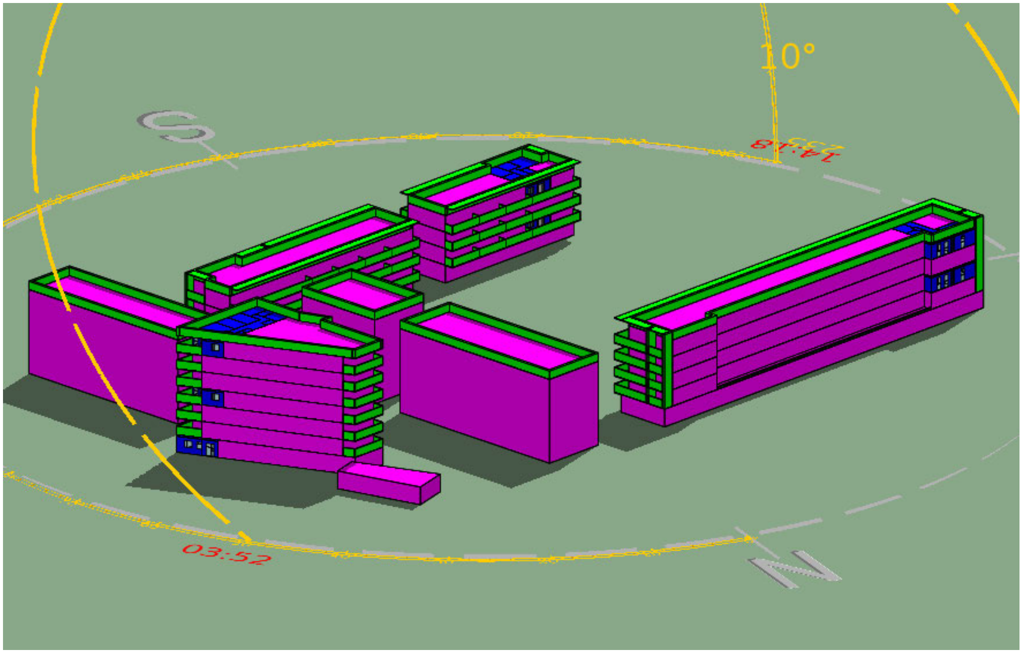
CONTENTS

INTRODUCTION

Vector Design have been appointed to undertake a TM59: 2017 'Design methodology for the assessment of overheating risk in homes' study, for the apartments within the proposed apartment blocks at Sceaux Gardens. The building was modelled utilising the dynamic thermal modelling software IES VE 2021, Version 2021.1.0.0, in accordance with the Draft Haringey Domestic Overheating Modelling Guidance.

A selection of dwellings across the development have been selected for modelling. A ground floor, middle floor and top floor apartment have been selected from the three apartment blocks, all with south or south-west aspects.





EXECUTIVE SUMMARY

The areas investigated have been thermally modelled and simulated using IES VE 2021, Version 2021.1.0.0 software against the CIBSE TM59 weather data files for an urban dataset (City of London weather centre).

All adjacent dwelling spaces, have been modelled in order to simulate their dynamic effect upon one another. Allowances have been profiled for internal heat gains, natural ventilation, and mechanical ventilation. The results of the thermal simulations have been used to predict the resultant air temperatures within the studied areas, under the scenarios below including the following overheating mitigation measures:

- Mechanical Supply & Extract Ventilation (MVHR) c/w summer by pass within each apartment providing ventilation in accordance with Building Regulations Part F System 4.
- External windows openable up to 90^0 – 90% openable free area*.
- External doors openable up to 90^0 – 90% openable free area*.

  ***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**
- Internal apartment doors – open during daytime periods (9 am to 10 pm).

The following modelling iterations have been undertaken to ascertain suitable overheating mitigation measures.

Option 01 - Baseline

Fixed external glazing with a solar shading G-value of 0.63.

Option 02 - Baseline + Mitigation Measure 1

Fixed external glazing with a solar shading G-value of 0.45.

Option 03 - Baseline + Mitigation Measure 1 + Mitigation Measure 2

Openable external glazing 90% openable area with a solar shading G-value of 0.45

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**

Occupant Control:
The three buildings are designed as detached tower apartment blocks. Openable windows are provided in each room – these can be operated by any occupant as use of them does not require any technical knowledge.

Expectation:
Each user will be able to control room temperature to their expectations by opening windows.

The table below indicates whether the scenarios listed within the Introduction meet the overheating criteria of CISBE TM59 against the mandatory compliance Design Summer Year (DSY1) (2020s weather pattern, high emissions, 50% percentile) - London_LWC_DSY1_2020High50.

Scenario 3 - Baseline Scenario + Mitigation Measure 1 + Mitigation Measure 2		
Room	**Criterion (a) result**	**Criterion (b) result**
All Bedrooms assessed.	14/14 PASS	14/14 PASS
All Living/Kitchen/Dining rooms assessed	14/14 PASS	N/A

The table below indicates whether the scenarios listed within the Introduction meet the overheating criteria of CISBE TM59 against the mandatory compliance Design Summer Year (DSY2) (2020s weather pattern, high emissions, 50% percentile) - London_LWC_DSY2_2020High50.

Scenario 3 - Baseline Scenario + Mitigation Measure 1 + Mitigation Measure 2		
Room	**Criterion (a) result**	**Criterion (b) result**
All Bedrooms assessed.	14/14 PASS	2/14 PASS (i)
All Living/Kitchen/Dining rooms assessed	14/14 PASS	N/A

(i) The results from the assessment show that only two bedrooms assessed pass criterion (b) (which is that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of the annual occupied hours) however from the results listed later in this report it can be seen that the failures are very marginal with the worst performing rooms having only 2% of their occupied hours above 26°C.

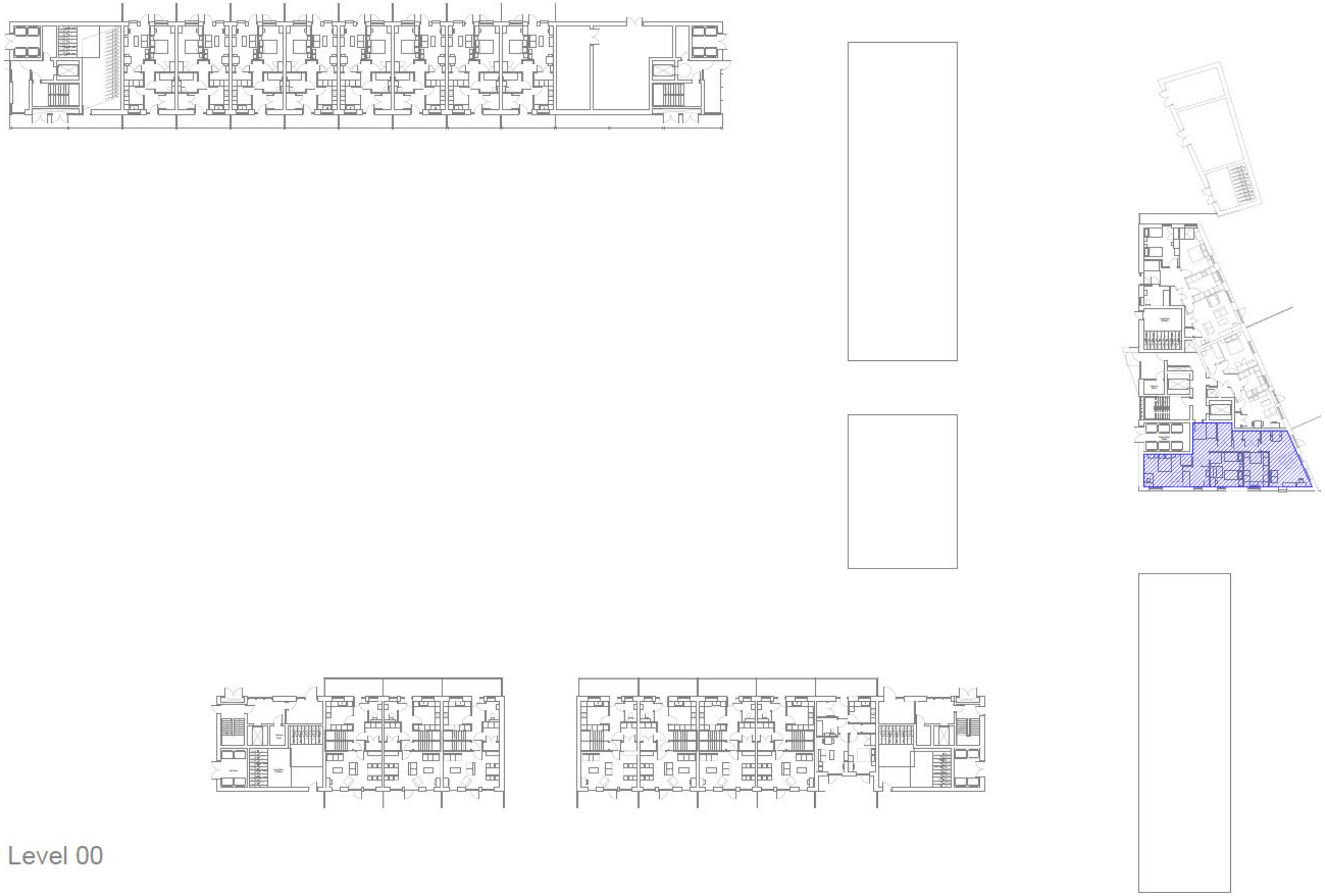
The table below indicates whether the scenarios listed within the Introduction meet the overheating criteria of CISBE TM59 against the mandatory compliance Design Summer Year (DSY3) (2020s weather pattern, high emissions, 50% percentile) - London_LWC_DSY3_2020High50.

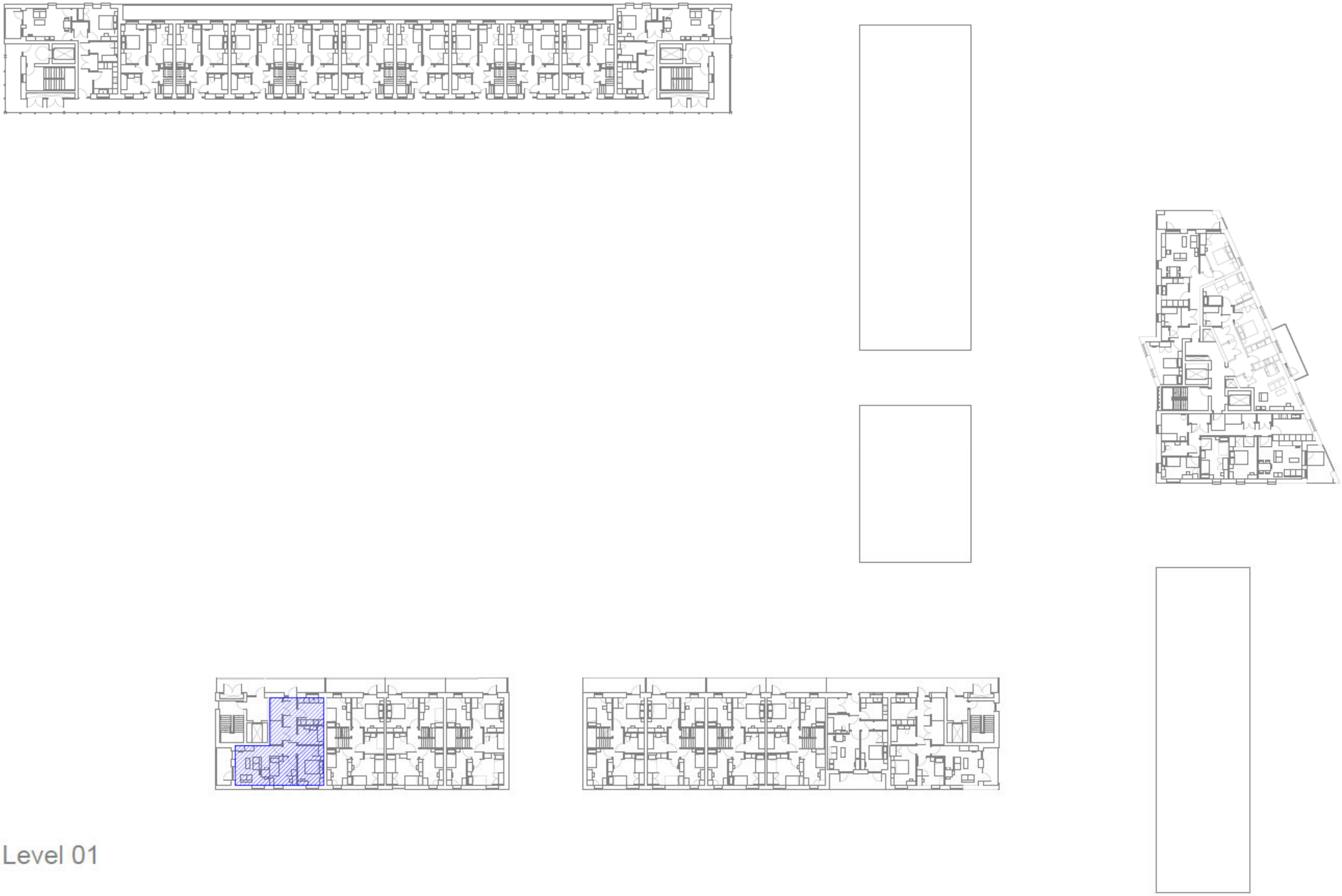
Scenario 3 - Baseline Scenario + Mitigation Measure 1 + Mitigation Measure 2		
Room	**Criterion (a) result**	**Criterion (b) result**
All Bedrooms assessed.	14/14 PASS	3/14 PASS (i)
All Living/Kitchen/Dining rooms assessed	14/14 PASS	N/A

(i) The results from the assessment show that only three bedrooms assessed pass criterion (b) (which is that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of the annual occupied hours) however from the results listed later in this report it can be seen that the failures are very marginal with the worst performing rooms having only 2% of their occupied hours above 26°C.

APARTMENTS & AREAS ANALYSED

The following apartments and corridors were studied:-

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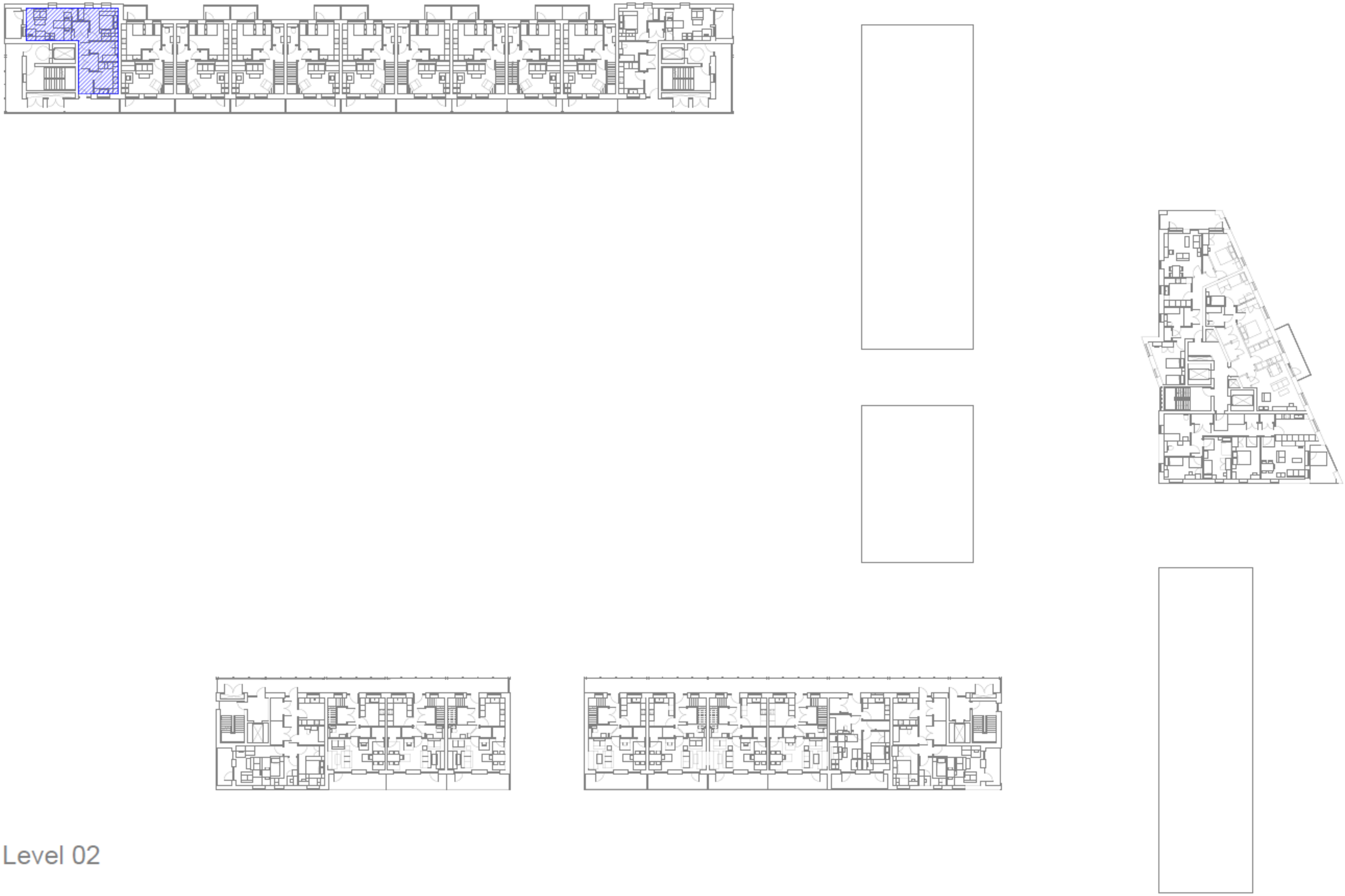

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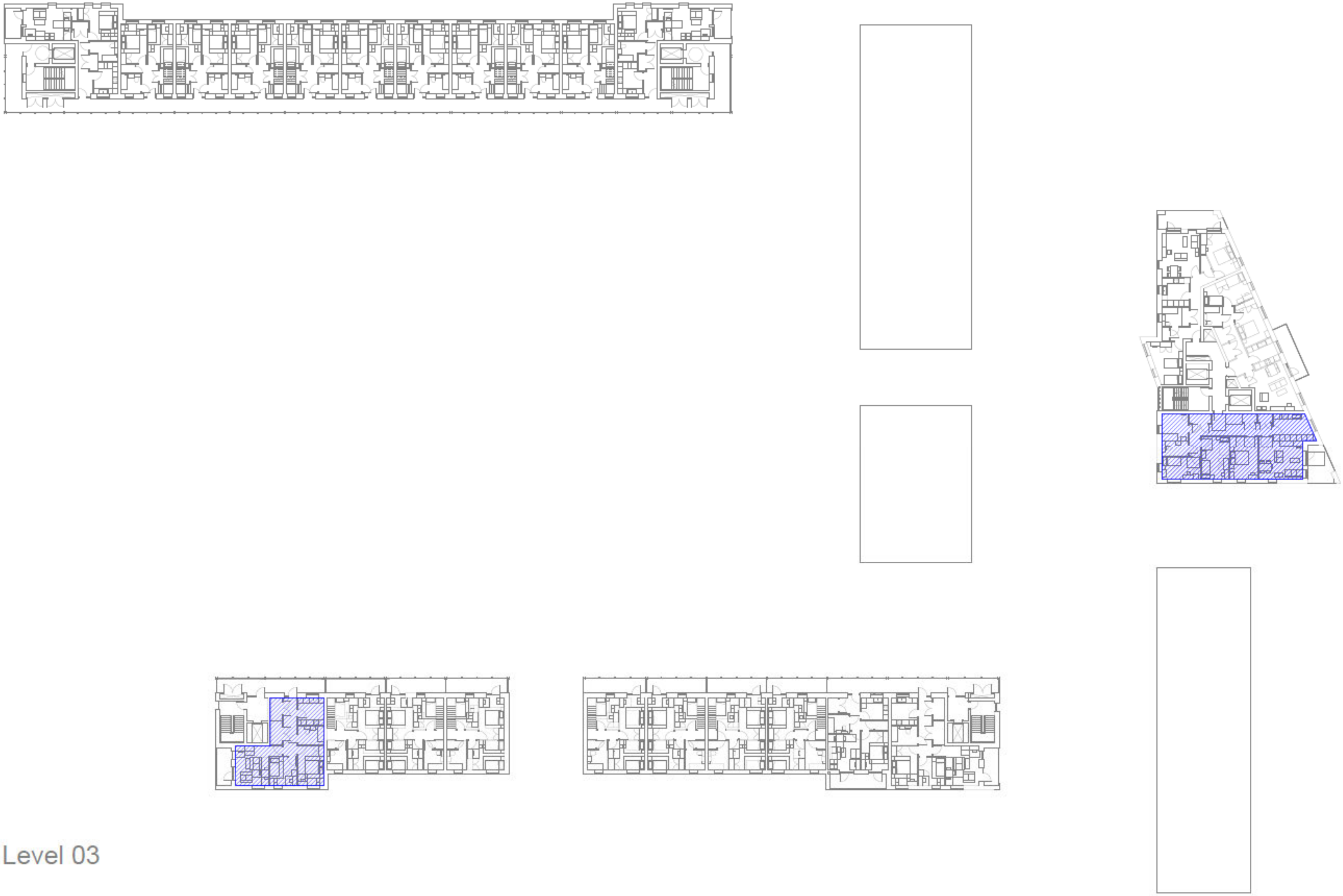

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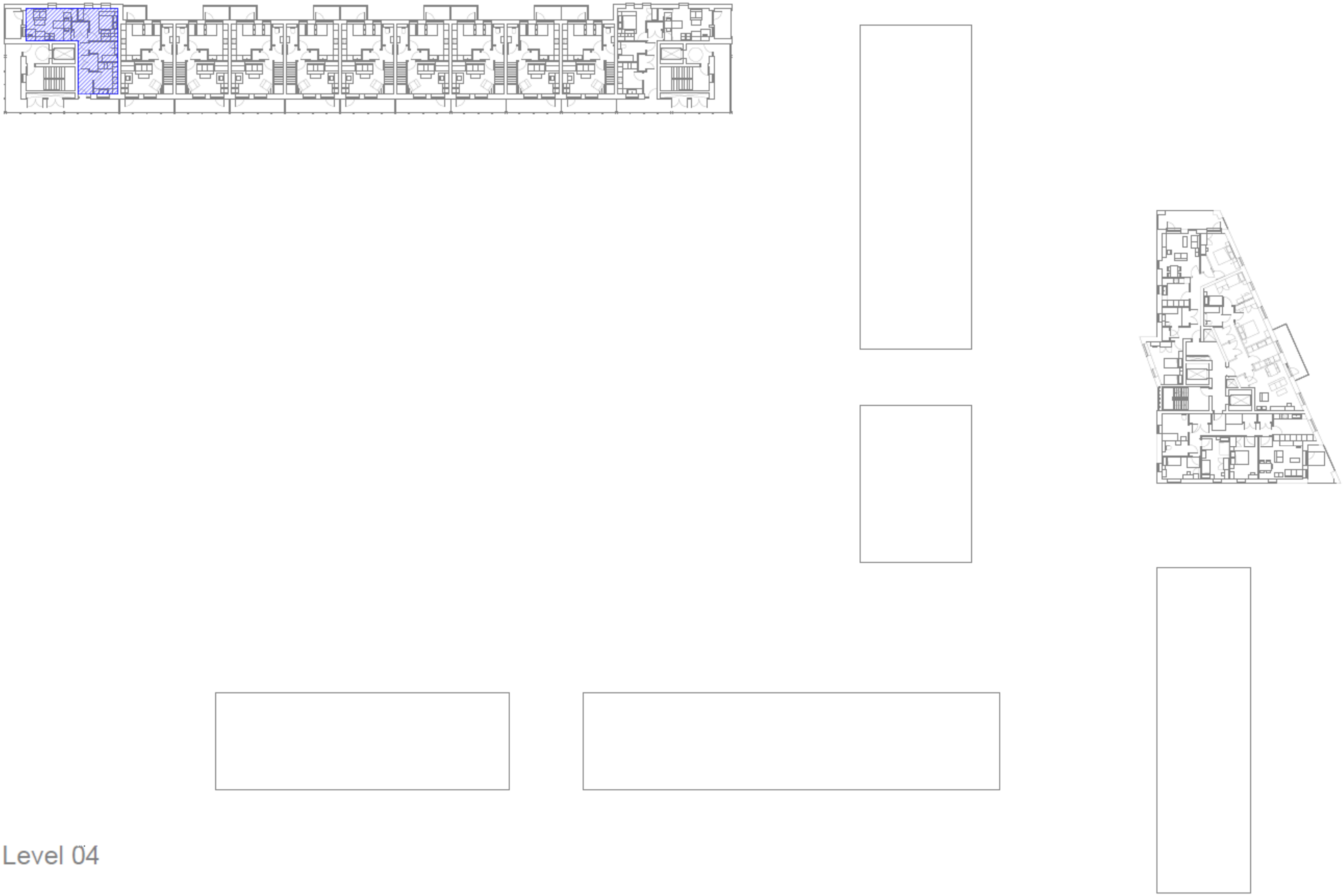

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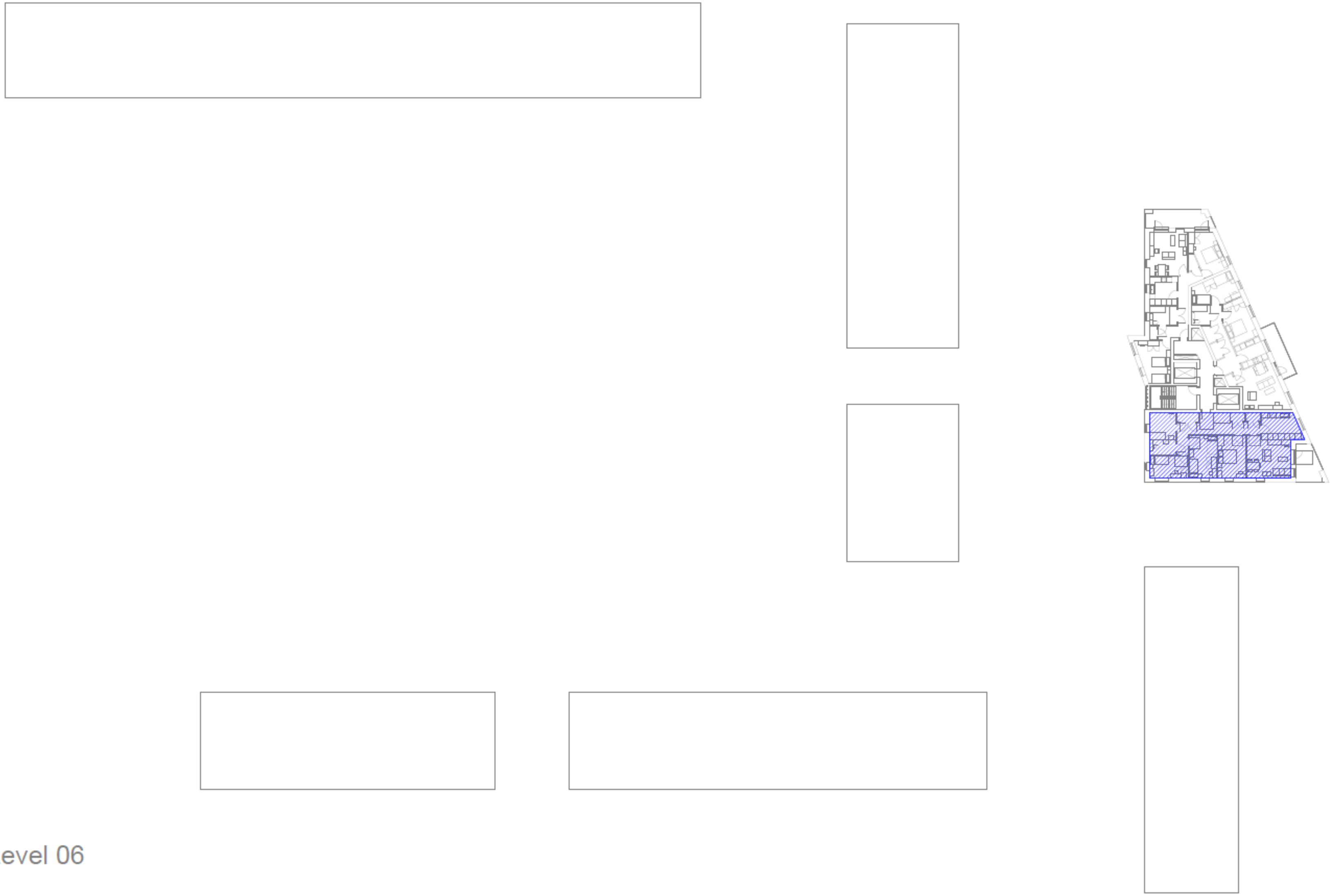

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OVER HEATING CRITERA

The areas studied have been assessed against following criteria for homes naturally ventilated via openable windows and provided with Mechanical Supply & Extract Ventilation (MVHR) from CIBSE TM59: 2017 'Design methodology for the assessment of overheating risk in homes:

a) Criterion 1- For living rooms, kitchens and bedrooms: The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K (1 °C)or more during the occupied hours of a typical non-heating season, from 1 May to 30 September. (CIBSE TM52 Criterion 1: Hours of exceedance).

   Note: the operative temperature shall not exceed the threshold comfort temperature by more than 1 K (1 °C) for more than 3% of the annual hours.

   Living rooms and kitchens annual hours = 1989 hours per year, 13 hours a day for 153 days for the period of 1 May to 30 September. So 60 hours at 1 K (1 °C) above the threshold comfort temperature will be recorded as a fail.

   Bedroom annual hours = 3672 hours per year, 24/7 for the period of 1 May to 30 September. So 111 hours at 1 K (1 °C) above the threshold comfort temperature will be recorded as a fail.

b) Criterion 2 - For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours.

   Note: 1% of the annual hours between 10 pm and 7 am for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail. Bedroom annual hours = 3672 hours per year, 24/7 for the period of 1 May to 30 September.

The assessment has been carried against the mandatory compliance Design Summer Year (DSY1) (2020s weather pattern, high emissions, 50% percentile) - London_LWC_DSY1_2020High50.

BUILDING FABRIC

Parameter	U-Value
Building Fabric	
External Wall	0.15 W/m²k
Floor	0.10 W/m²K
Flat Roof	0.10 W/m²K
Windows – 10% Frame Factor	1.30 W/m²k
External Door	1.30 W/m²K
Window G-Value	Various Depending on Scenario
Air Test	3.5 m³/m²/hr @ 50 Pa

Based on an air permeability of 3.5 m³/m².h@50Pa CIBSE guide A table 4.21 determines an average infiltration rate of 0.25 ac/h for an apartment block of 1-5 storeys & 6-10 storeys which has been applied to the thermal model.

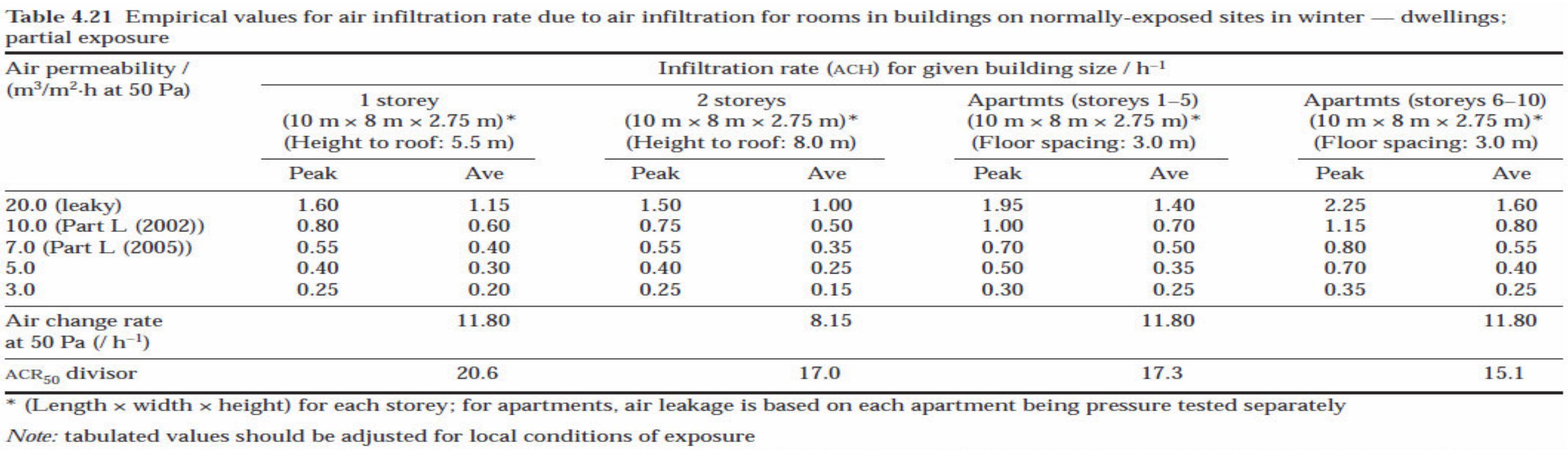


Table 4.21 Empirical values for air infiltration rate due to air infiltration for rooms in buildings on normally-exposed sites in winter — dwellings; partial exposure

Air permeability / ($m^3/m^2{\cdot}h$ at 50 Pa)	Infiltration rate (ACH) for given building size / h^{-1}							
	1 storey (10 m × 8 m × 2.75 m)* (Height to roof: 5.5 m)		2 storeys (10 m × 8 m × 2.75 m)* (Height to roof: 8.0 m)		Apartmts (storeys 1–5) (10 m × 8 m × 2.75 m)* (Floor spacing: 3.0 m)		Apartmts (storeys 6–10) (10 m × 8 m × 2.75 m)* (Floor spacing: 3.0 m)	
	Peak	Ave	Peak	Ave	Peak	Ave	Peak	Ave
20.0 (leaky)	1.60	1.15	1.50	1.00	1.95	1.40	2.25	1.60
10.0 (Part L (2002))	0.80	0.60	0.75	0.50	1.00	0.70	1.15	0.80
7.0 (Part L (2005))	0.55	0.40	0.55	0.35	0.70	0.50	0.80	0.55
5.0	0.40	0.30	0.40	0.25	0.50	0.35	0.70	0.40
3.0	0.25	0.20	0.25	0.15	0.30	0.25	0.35	0.25
Air change rate at 50 Pa (/ h^{-1})		11.80		8.15		11.80		11.80
ACR_{50} divisor		20.6		17.0		17.3		15.1

* (Length × width × height) for each storey; for apartments, air leakage is based on each apartment being pressure tested separately

Note: tabulated values should be adjusted for local conditions of exposure

HEAT GAINS & GAIN PROFILES

The following TM59 default occupancy, equipment profile data and lighting gains has been used within the assessment:-

Unit/ room type	Occupancy	Equipment load
Studio	2 people at 70% gains from 11 pm to 8 am 2 people at 100% gains from 8 am to 11 pm	Peak load of 450 W from 6 pm to 8 pm*. 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room/kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room	1 person at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
1-bedroom apartment: kitchen	1 person at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
2-bedroom apartment: living room/kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-bedroom apartment: living room	2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
2-bedroom apartment: kitchen	2 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
3-bedroom apartment: living room/kitchen	3 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3-bedroom apartment: living room	3 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
3-bedroom apartment: kitchen	3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm base load of 50 W for the rest of the day
Double bedroom	2 people at 70% gains from 11 pm to 8 am 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm 1 person at full gains in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single bedroom (too small to accommodate double bed)	1 person at 70% gains from 11 pm to 8 am 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours
Communal corridors	Assumed to be zero	Pipework heat loss only; see section 3.1 above

Lighting Internal Gains

A lighting gain for the areas above have been entered into the model as 2 W/m² from 6 pm to 11 pm.

Additional Gains

A heat gain 66W for the HIU within each apartment has been included within the assessment.

MECHANICAL VENTILATION

Appartment Ventilation

Although the apartments will be predominately naturally ventilated, each is likely to have continuous mechanical extract ventilation via an MEV unit. MEV ventilation rate figure has been taken from building regulations Part F – Ventilation table 5.1a for each apartment.

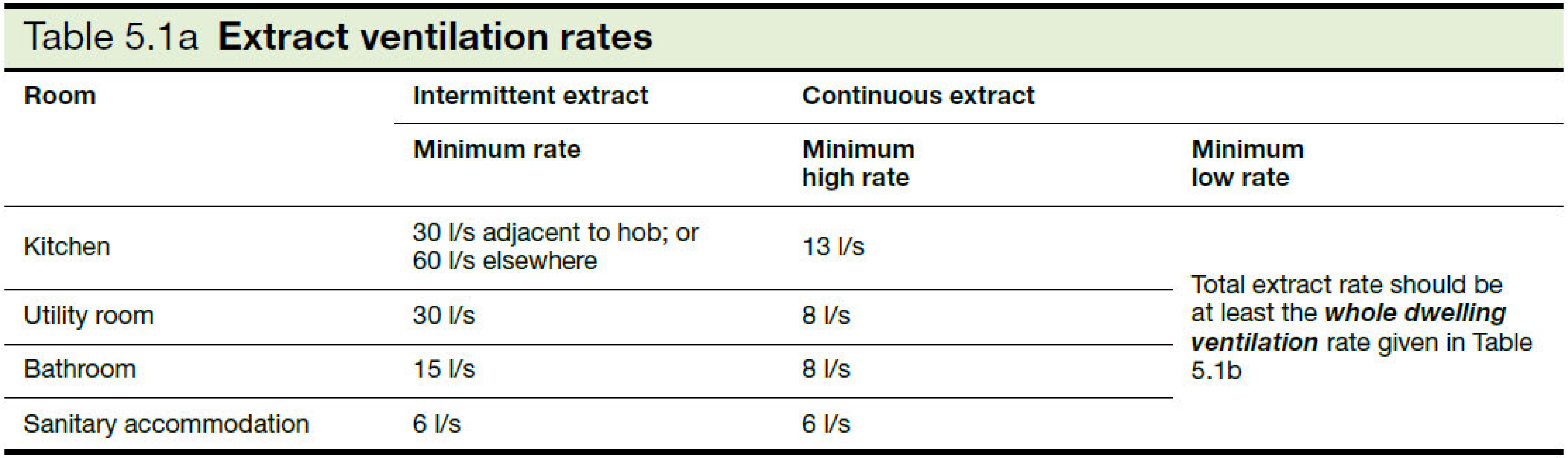


Table 5.1a **Extract ventilation rates**

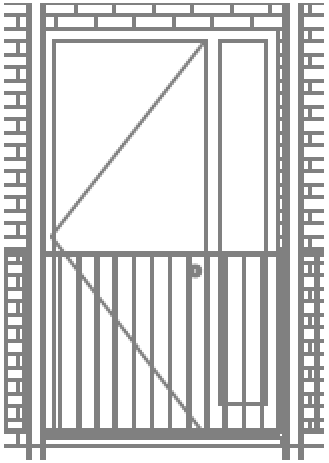
Room	**Intermittent extract**	**Continuous extract**	
	Minimum rate	**Minimum high rate**	**Minimum low rate**
Kitchen	30 l/s adjacent to hob; or 60 l/s elsewhere	13 l/s	Total extract rate should be at least the ***whole dwelling ventilation*** rate given in Table 5.1b
Utility room	30 l/s	8 l/s	
Bathroom	15 l/s	8 l/s	
Sanitary accommodation	6 l/s	6 l/s	

OPENINGS

Windows & Doors

From the elevations there are the following window sets – all with 10% frame factor.

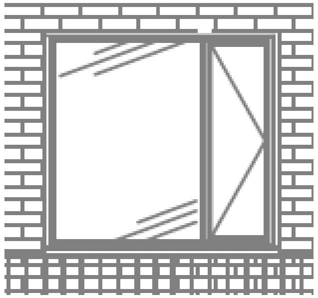
Front door to apartment with fixed window to the right hand side



Openable by 90^0 – 90% openable free area*

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**

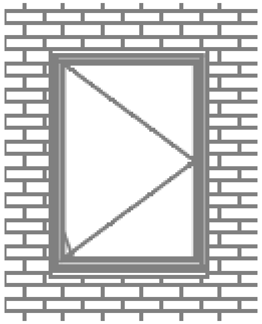
Kitchen window, left part fixed right part openable



Openable by 90^0 – 90% openable free area*

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**

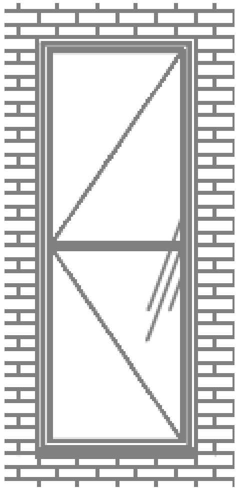
Half height openable window



Openable by 90^0 – 90% openable free area*

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**

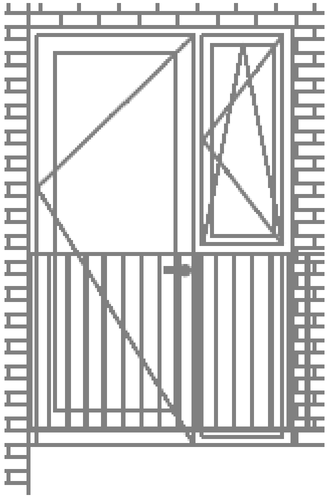
Full height openable window



Openable by 90^0 – 90% openable free area*

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**

Balcony door with openable half height window to the right



Openable by 90^0 – 90% openable free area*

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**

Internal Doors

The internal doors have been modelled for each apartment. For the assessment these doors are left open during the daytime and closed when the occupants are asleep. The internal doors are open from 9 am to 10pm.

ADAPTIVE OVERHEATING REPORTS – MANDATORY WEATHER FILE London_LWC_DSY1_2020High50

(DSY1) OPTION 1

The software model has been utilised to assess the risk of overheating against CIBSE TM59: 2017 ‘Design methodology for the assessment of overheating risk in homes’. The following report summaries have been generated against

Option 01 – Baseline

Fixed external glazing with a solar shading G-value of 0.63.

IES INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59: Design methodology for the assessment of overheating risk in homes

Results file name: 4114 - Sceaux Gardens Option 01 - FW G=0.63.aps

Summer Elevated Air Speed: 0.1m/s

CIBSE TM59 overheating methodology assesses against two criteria, (a) and (b):

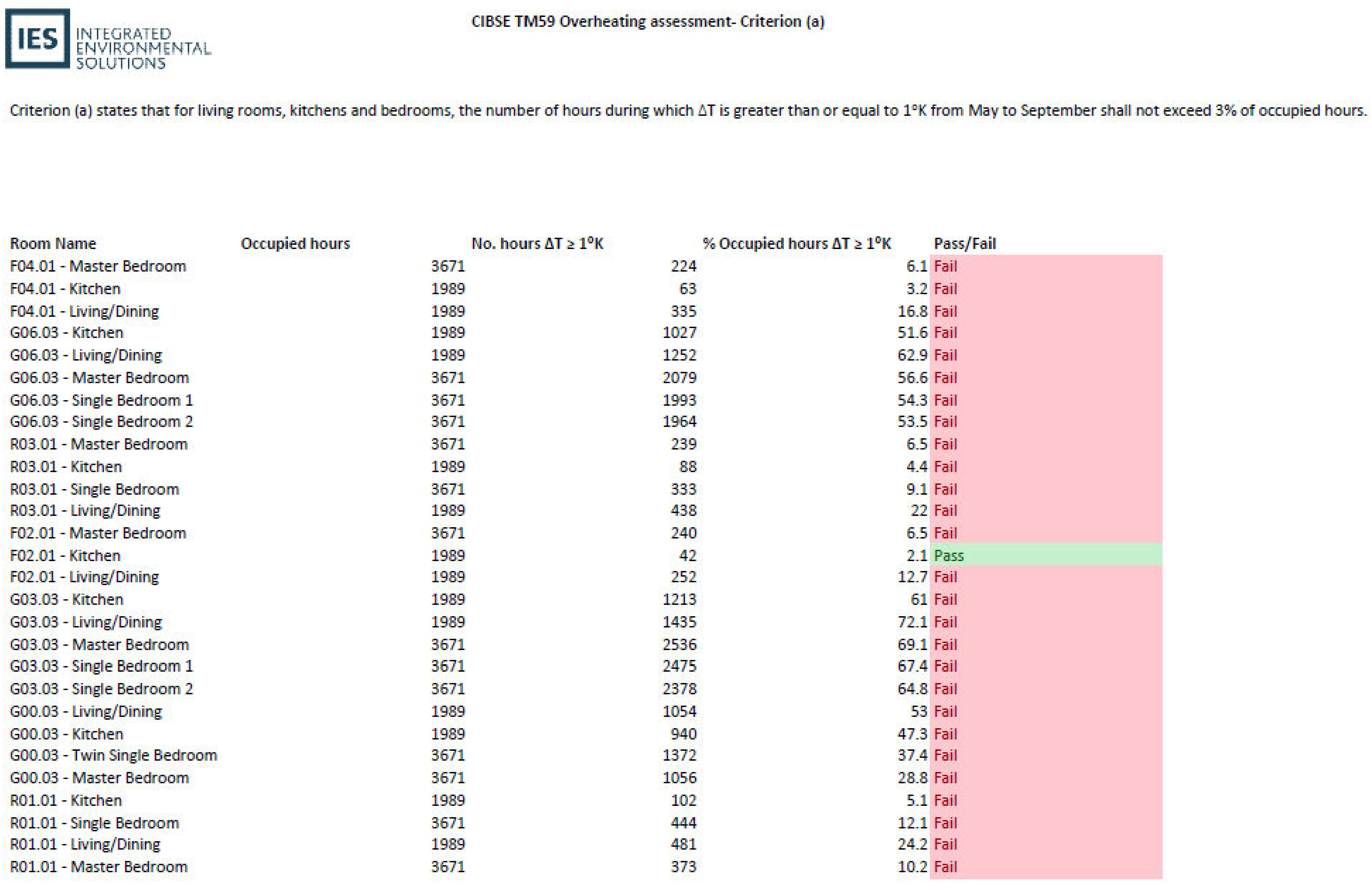
- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).

TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them.

While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	**Criterion (a) result**	**Criterion (b) result**	**Overall TM59 result**
F04.01 - Master Bedroom	Fail	Fail	Fail
F04.01 - Kitchen	Fail	NA	Fail
F04.01 - Living/Dining	Fail	NA	Fail
G06.03 - Kitchen	Fail	NA	Fail
G06.03 - Living/Dining	Fail	NA	Fail
G06.03 - Master Bedroom	Fail	Fail	Fail
G06.03 - Single Bedroom 1	Fail	Fail	Fail
G06.03 - Single Bedroom 2	Fail	Fail	Fail
R03.01 - Master Bedroom	Fail	Fail	Fail
R03.01 - Kitchen	Fail	NA	Fail
R03.01 - Single Bedroom	Fail	Fail	Fail
R03.01 - Living/Dining	Fail	NA	Fail
F02.01 - Master Bedroom	Fail	Fail	Fail
F02.01 - Kitchen	Pass	NA	Pass
F02.01 - Living/Dining	Fail	NA	Fail
G03.03 - Kitchen	Fail	NA	Fail
G03.03 - Living/Dining	Fail	NA	Fail
G03.03 - Master Bedroom	Fail	Fail	Fail
G03.03 - Single Bedroom 1	Fail	Fail	Fail
G03.03 - Single Bedroom 2	Fail	Fail	Fail
G00.03 - Living/Dining	Fail	NA	Fail
G00.03 - Kitchen	Fail	NA	Fail
G00.03 - Twin Single Bedroom	Fail	Fail	Fail
G00.03 - Master Bedroom	Fail	Fail	Fail
R01.01 - Kitchen	Fail	NA	Fail
R01.01 - Single Bedroom	Fail	Fail	Fail
R01.01 - Living/Dining	Fail	NA	Fail
R01.01 - Master Bedroom	Fail	Fail	Fail

Corridor name	**Significant overheating risk?**
No corridors to be analysed	NA

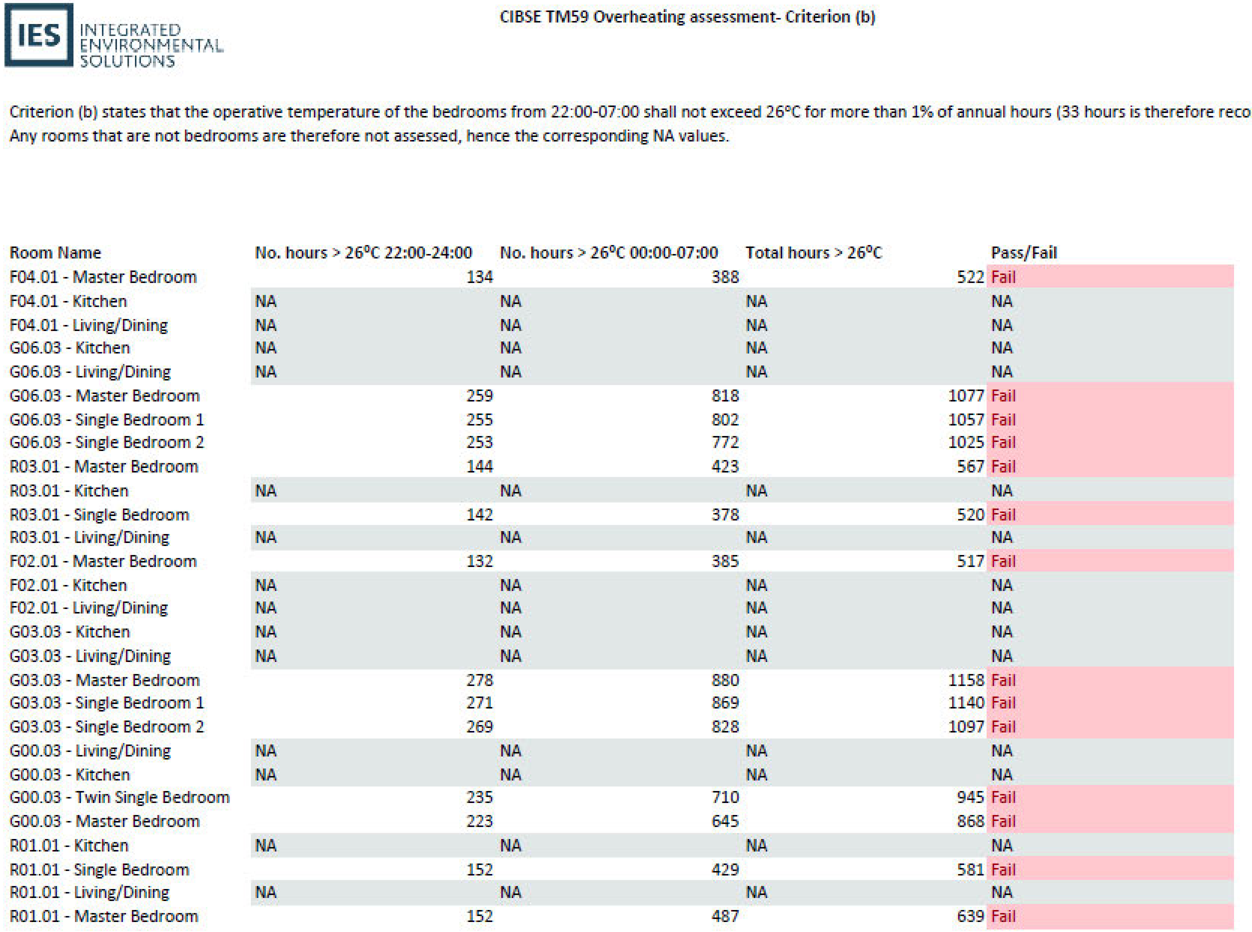


INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59 Overheating assessment- Criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.

Room Name	Occupied hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Pass/Fail
F04.01 - Master Bedroom	3671	224	6.1	Fail
F04.01 - Kitchen	1989	63	3.2	Fail
F04.01 - Living/Dining	1989	335	16.8	Fail
G06.03 - Kitchen	1989	1027	51.6	Fail
G06.03 - Living/Dining	1989	1252	62.9	Fail
G06.03 - Master Bedroom	3671	2079	56.6	Fail
G06.03 - Single Bedroom 1	3671	1993	54.3	Fail
G06.03 - Single Bedroom 2	3671	1964	53.5	Fail
R03.01 - Master Bedroom	3671	239	6.5	Fail
R03.01 - Kitchen	1989	88	4.4	Fail
R03.01 - Single Bedroom	3671	333	9.1	Fail
R03.01 - Living/Dining	1989	438	22	Fail
F02.01 - Master Bedroom	3671	240	6.5	Fail
F02.01 - Kitchen	1989	42	2.1	Pass
F02.01 - Living/Dining	1989	252	12.7	Fail
G03.03 - Kitchen	1989	1213	61	Fail
G03.03 - Living/Dining	1989	1435	72.1	Fail
G03.03 - Master Bedroom	3671	2536	69.1	Fail
G03.03 - Single Bedroom 1	3671	2475	67.4	Fail
G03.03 - Single Bedroom 2	3671	2378	64.8	Fail
G00.03 - Living/Dining	1989	1054	53	Fail
G00.03 - Kitchen	1989	940	47.3	Fail
G00.03 - Twin Single Bedroom	3671	1372	37.4	Fail
G00.03 - Master Bedroom	3671	1056	28.8	Fail
R01.01 - Kitchen	1989	102	5.1	Fail
R01.01 - Single Bedroom	3671	444	12.1	Fail
R01.01 - Living/Dining	1989	481	24.2	Fail
R01.01 - Master Bedroom	3671	373	10.2	Fail



CIBSE TM59 Overheating assessment- Criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).
Any rooms that are not bedrooms are therefore not assessed, hence the corresponding NA values.

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
F04.01 - Master Bedroom	134	388	522	Fail
F04.01 - Kitchen	NA	NA	NA	NA
F04.01 - Living/Dining	NA	NA	NA	NA
G06.03 - Kitchen	NA	NA	NA	NA
G06.03 - Living/Dining	NA	NA	NA	NA
G06.03 - Master Bedroom	259	818	1077	Fail
G06.03 - Single Bedroom 1	255	802	1057	Fail
G06.03 - Single Bedroom 2	253	772	1025	Fail
R03.01 - Master Bedroom	144	423	567	Fail
R03.01 - Kitchen	NA	NA	NA	NA
R03.01 - Single Bedroom	142	378	520	Fail
R03.01 - Living/Dining	NA	NA	NA	NA
F02.01 - Master Bedroom	132	385	517	Fail
F02.01 - Kitchen	NA	NA	NA	NA
F02.01 - Living/Dining	NA	NA	NA	NA
G03.03 - Kitchen	NA	NA	NA	NA
G03.03 - Living/Dining	NA	NA	NA	NA
G03.03 - Master Bedroom	278	880	1158	Fail
G03.03 - Single Bedroom 1	271	869	1140	Fail
G03.03 - Single Bedroom 2	269	828	1097	Fail
G00.03 - Living/Dining	NA	NA	NA	NA
G00.03 - Kitchen	NA	NA	NA	NA
G00.03 - Twin Single Bedroom	235	710	945	Fail
G00.03 - Master Bedroom	223	645	868	Fail
R01.01 - Kitchen	NA	NA	NA	NA
R01.01 - Single Bedroom	152	429	581	Fail
R01.01 - Living/Dining	NA	NA	NA	NA
R01.01 - Master Bedroom	152	487	639	Fail

(DSY1) OPTION 02

The software model has been utilised to assess the risk of overheating against CIBSE TM59: 2017 ‘Design methodology for the assessment of overheating risk in homes’. The following report summaries have been generated against

Option 02 - Baseline + Mitigation Measure 1

Fixed external glazing with a solar shading G-value of 0.45.

CIBSE TM59: Design methodology for the assessment of overheating risk in homes

Results file name: 4114 - Sceaux Gardens Option 02 - FW G=0.40.aps

Summer Elevated Air Speed: 0.1m/s

CIBSE TM59 overheating methodology assesses against two criteria, (a) and (b):

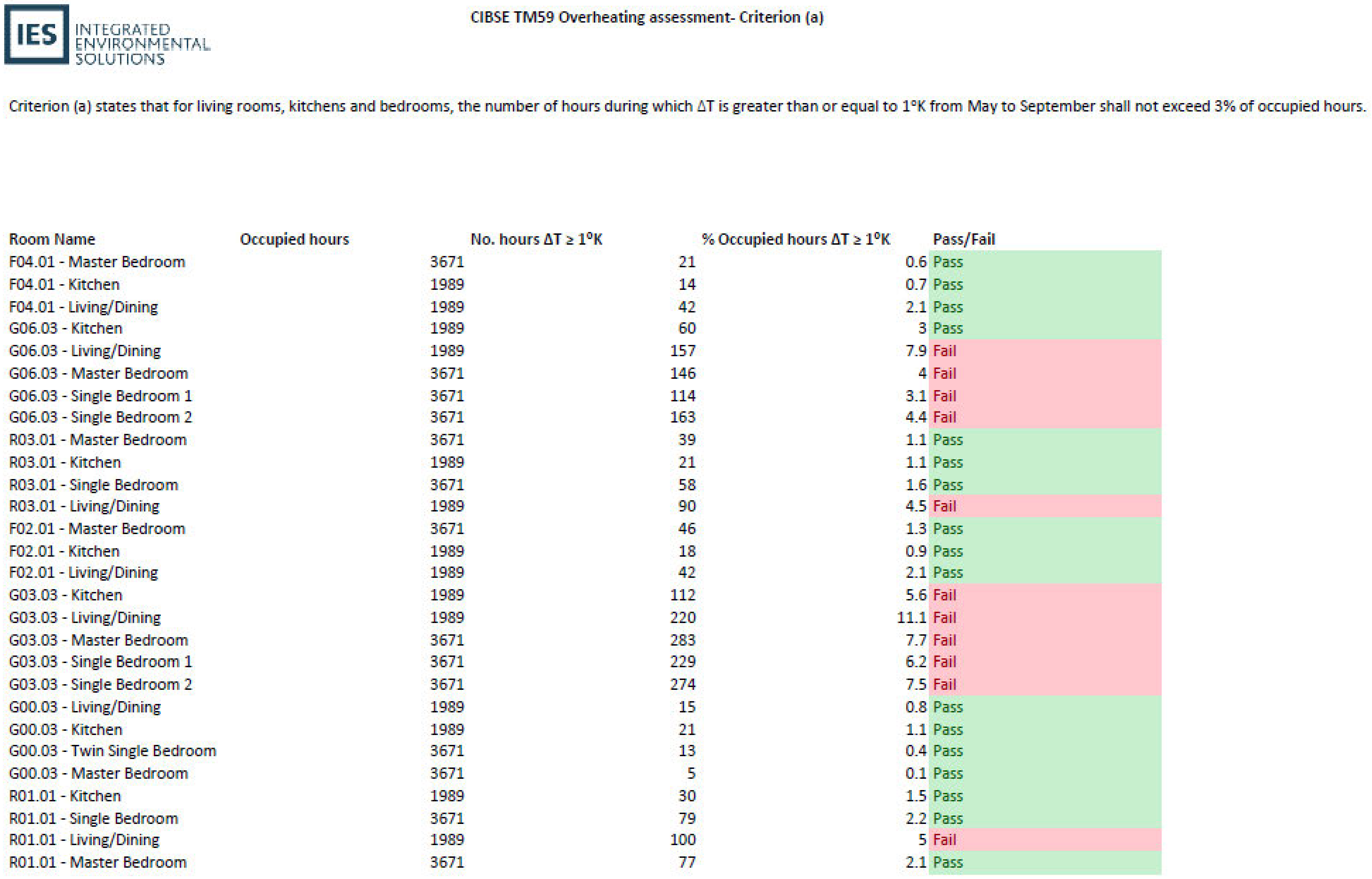
- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).

TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them.

While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Criterion (a) result	Criterion (b) result	Overall TM59 result
F04.01 - Master Bedroom	Pass	Fail	Fail
F04.01 - Kitchen	Pass	NA	Pass
F04.01 - Living/Dining	Pass	NA	Pass
G06.03 - Kitchen	Pass	NA	Pass
G06.03 - Living/Dining	Fail	NA	Fail
G06.03 - Master Bedroom	Fail	Fail	Fail
G06.03 - Single Bedroom 1	Fail	Fail	Fail
G06.03 - Single Bedroom 2	Fail	Fail	Fail
R03.01 - Master Bedroom	Pass	Fail	Fail
R03.01 - Kitchen	Pass	NA	Pass
R03.01 - Single Bedroom	Pass	Fail	Fail
R03.01 - Living/Dining	Fail	NA	Fail
F02.01 - Master Bedroom	Pass	Fail	Fail
F02.01 - Kitchen	Pass	NA	Pass
F02.01 - Living/Dining	Pass	NA	Pass
G03.03 - Kitchen	Fail	NA	Fail
G03.03 - Living/Dining	Fail	NA	Fail
G03.03 - Master Bedroom	Fail	Fail	Fail
G03.03 - Single Bedroom 1	Fail	Fail	Fail
G03.03 - Single Bedroom 2	Fail	Fail	Fail
G00.03 - Living/Dining	Pass	NA	Pass
G00.03 - Kitchen	Pass	NA	Pass
G00.03 - Twin Single Bedroom	Pass	Fail	Fail
G00.03 - Master Bedroom	Pass	Fail	Fail
R01.01 - Kitchen	Pass	NA	Pass
R01.01 - Single Bedroom	Pass	Fail	Fail
R01.01 - Living/Dining	Fail	NA	Fail
R01.01 - Master Bedroom	Pass	Fail	Fail

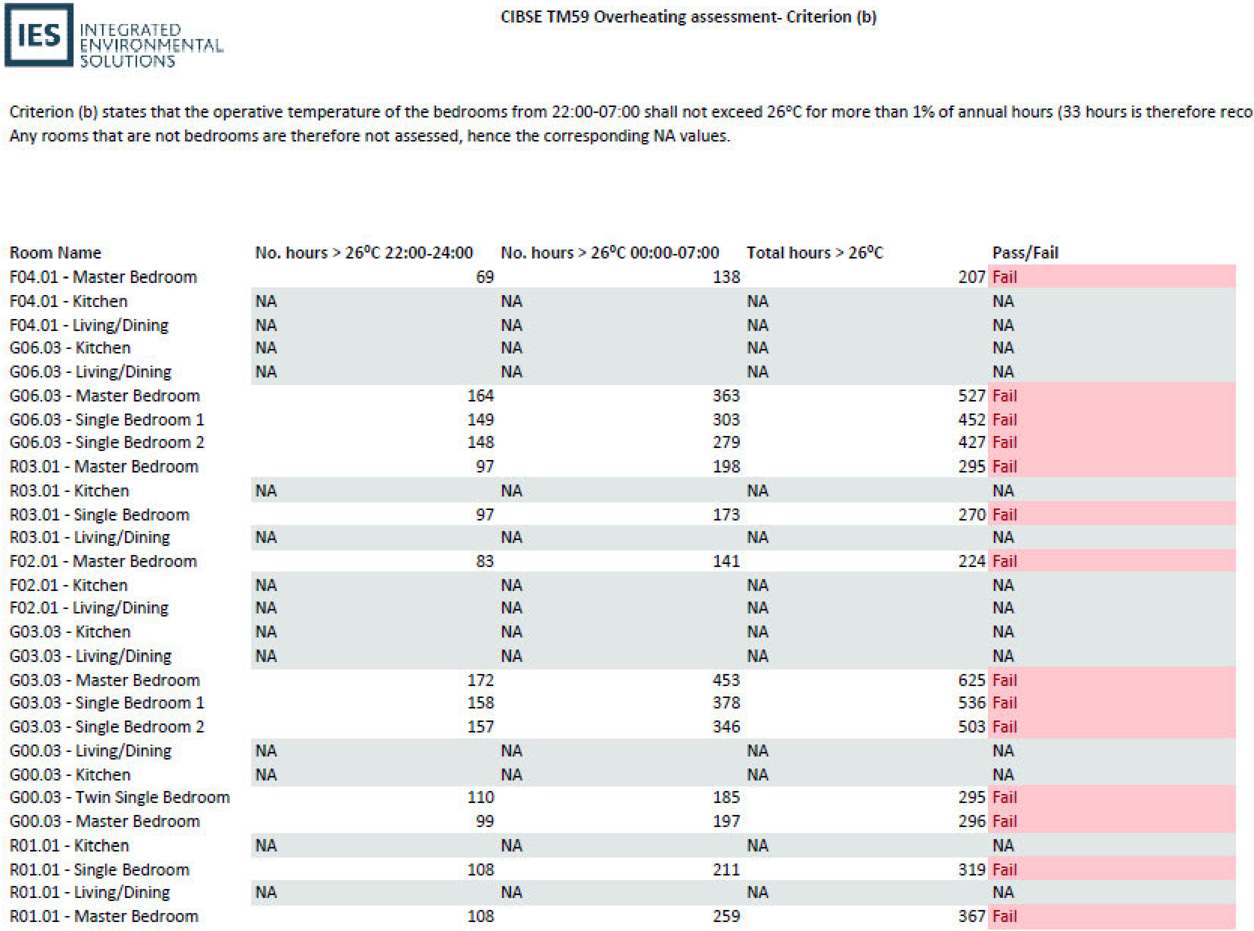
Corridor name	Significant overheating risk?
No corridors to be analysed	NA



CIBSE TM59 Overheating assessment- Criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.

Room Name	Occupied hours	No. hours ΔT ≥ 1⁰K	% Occupied hours ΔT ≥ 1⁰K	Pass/Fail
F04.01 - Master Bedroom	3671	21	0.6	Pass
F04.01 - Kitchen	1989	14	0.7	Pass
F04.01 - Living/Dining	1989	42	2.1	Pass
G06.03 - Kitchen	1989	60	3	Pass
G06.03 - Living/Dining	1989	157	7.9	Fail
G06.03 - Master Bedroom	3671	146	4	Fail
G06.03 - Single Bedroom 1	3671	114	3.1	Fail
G06.03 - Single Bedroom 2	3671	163	4.4	Fail
R03.01 - Master Bedroom	3671	39	1.1	Pass
R03.01 - Kitchen	1989	21	1.1	Pass
R03.01 - Single Bedroom	3671	58	1.6	Pass
R03.01 - Living/Dining	1989	90	4.5	Fail
F02.01 - Master Bedroom	3671	46	1.3	Pass
F02.01 - Kitchen	1989	18	0.9	Pass
F02.01 - Living/Dining	1989	42	2.1	Pass
G03.03 - Kitchen	1989	112	5.6	Fail
G03.03 - Living/Dining	1989	220	11.1	Fail
G03.03 - Master Bedroom	3671	283	7.7	Fail
G03.03 - Single Bedroom 1	3671	229	6.2	Fail
G03.03 - Single Bedroom 2	3671	274	7.5	Fail
G00.03 - Living/Dining	1989	15	0.8	Pass
G00.03 - Kitchen	1989	21	1.1	Pass
G00.03 - Twin Single Bedroom	3671	13	0.4	Pass
G00.03 - Master Bedroom	3671	5	0.1	Pass
R01.01 - Kitchen	1989	30	1.5	Pass
R01.01 - Single Bedroom	3671	79	2.2	Pass
R01.01 - Living/Dining	1989	100	5	Fail
R01.01 - Master Bedroom	3671	77	2.1	Pass



IES INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59 Overheating assessment- Criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).
Any rooms that are not bedrooms are therefore not assessed, hence the corresponding NA values.

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
F04.01 - Master Bedroom	69	138	207	Fail
F04.01 - Kitchen	NA	NA	NA	NA
F04.01 - Living/Dining	NA	NA	NA	NA
G06.03 - Kitchen	NA	NA	NA	NA
G06.03 - Living/Dining	NA	NA	NA	NA
G06.03 - Master Bedroom	164	363	527	Fail
G06.03 - Single Bedroom 1	149	303	452	Fail
G06.03 - Single Bedroom 2	148	279	427	Fail
R03.01 - Master Bedroom	97	198	295	Fail
R03.01 - Kitchen	NA	NA	NA	NA
R03.01 - Single Bedroom	97	173	270	Fail
R03.01 - Living/Dining	NA	NA	NA	NA
F02.01 - Master Bedroom	83	141	224	Fail
F02.01 - Kitchen	NA	NA	NA	NA
F02.01 - Living/Dining	NA	NA	NA	NA
G03.03 - Kitchen	NA	NA	NA	NA
G03.03 - Living/Dining	NA	NA	NA	NA
G03.03 - Master Bedroom	172	453	625	Fail
G03.03 - Single Bedroom 1	158	378	536	Fail
G03.03 - Single Bedroom 2	157	346	503	Fail
G00.03 - Living/Dining	NA	NA	NA	NA
G00.03 - Kitchen	NA	NA	NA	NA
G00.03 - Twin Single Bedroom	110	185	295	Fail
G00.03 - Master Bedroom	99	197	296	Fail
R01.01 - Kitchen	NA	NA	NA	NA
R01.01 - Single Bedroom	108	211	319	Fail
R01.01 - Living/Dining	NA	NA	NA	NA
R01.01 - Master Bedroom	108	259	367	Fail

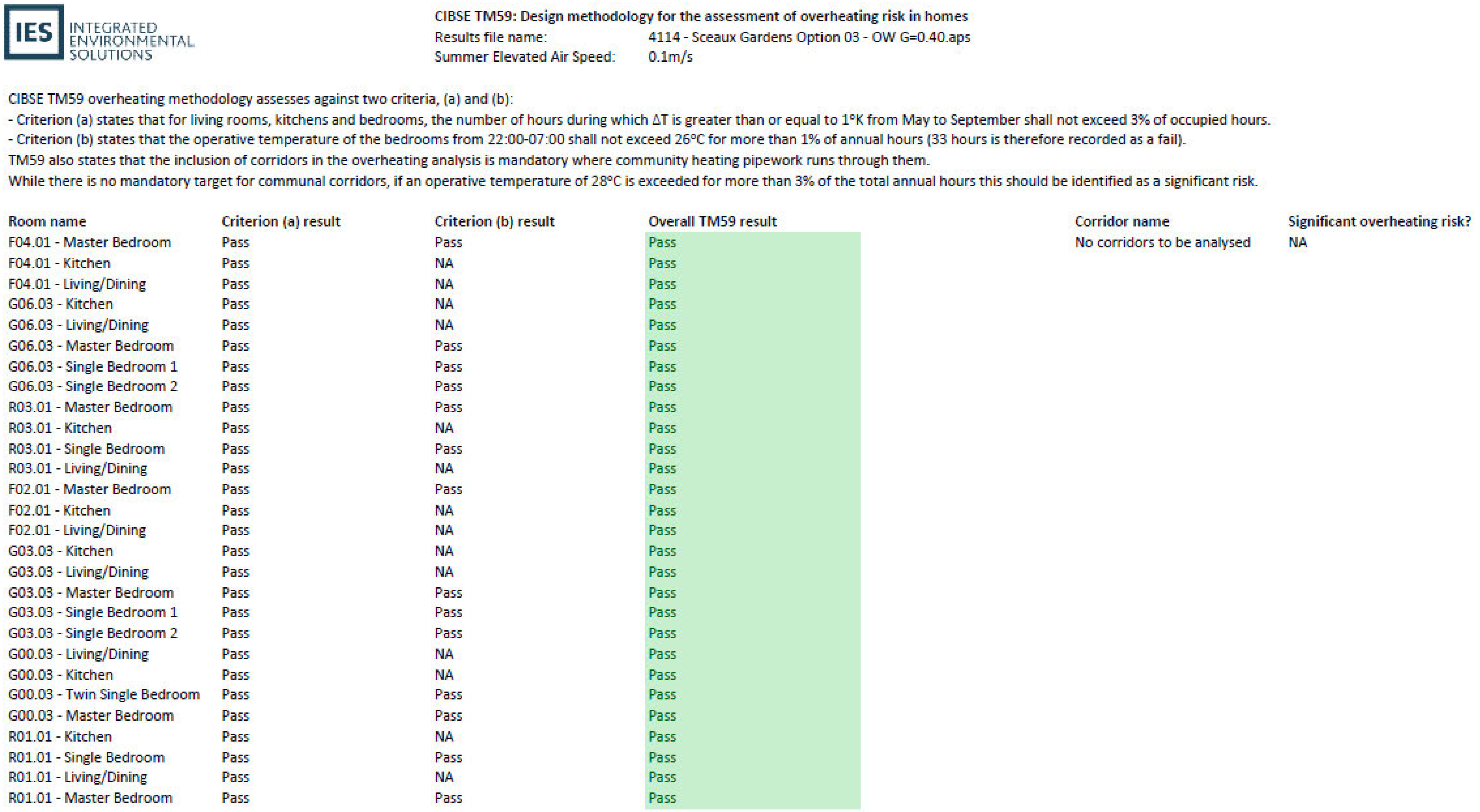
(DSY1) OPTION 03

The software model has been utilised to assess the risk of overheating against CIBSE TM59: 2017 ‘Design methodology for the assessment of overheating risk in homes’. The following report summaries have been generated against

Option 03 - Baseline + Mitigation Measure 1 + Mitigation Measure 2

Openable external glazing 90% openable area with a solar shading G-value of 0.45

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**



IES INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59: Design methodology for the assessment of overheating risk in homes

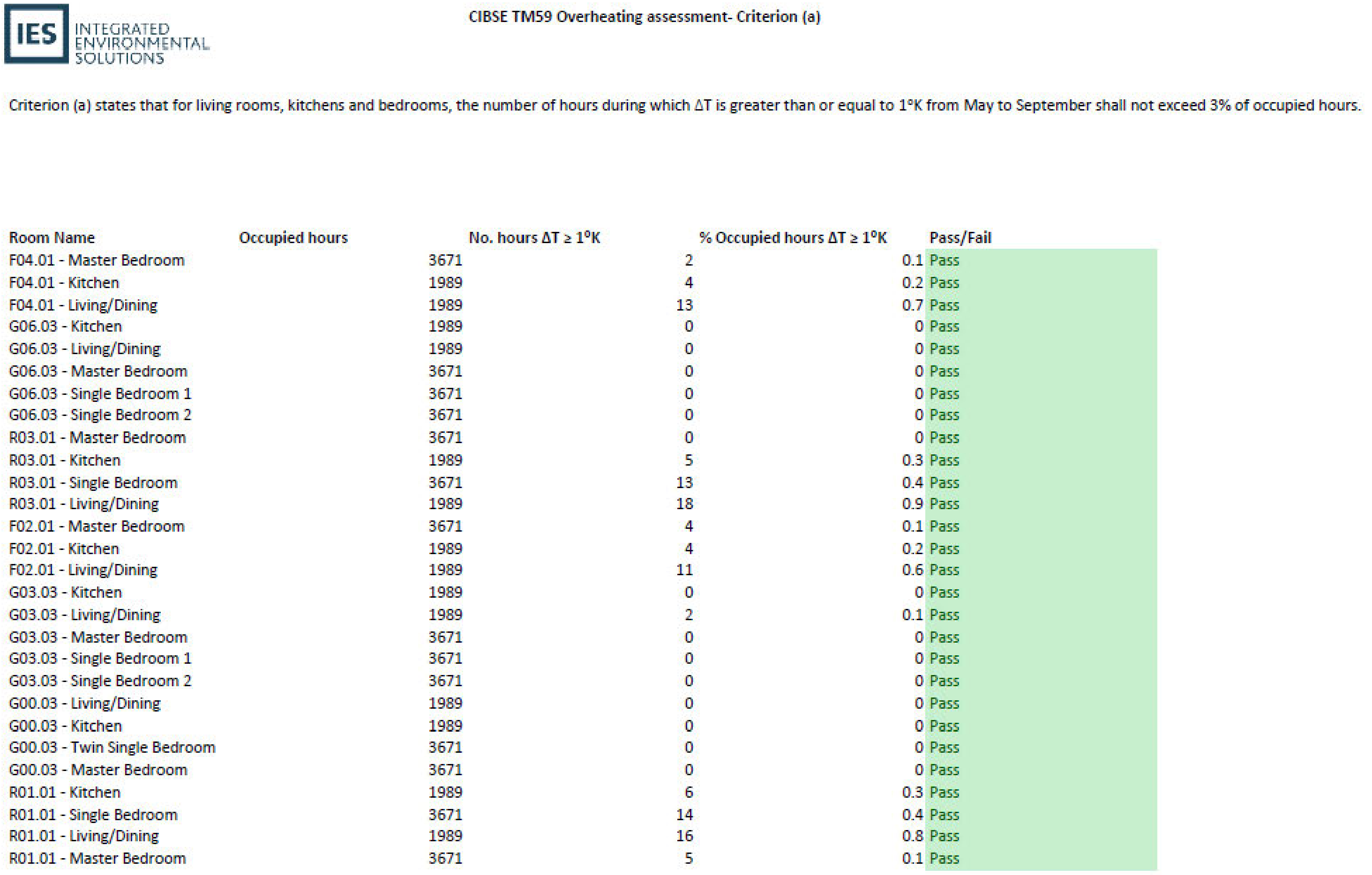
Results file name: 4114 - Sceaux Gardens Option 03 - OW G=0.40.aps
Summer Elevated Air Speed: 0.1m/s

CIBSE TM59 overheating methodology assesses against two criteria, (a) and (b):
- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).

TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them.
While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Criterion (a) result	Criterion (b) result	Overall TM59 result
F04.01 - Master Bedroom	Pass	Pass	Pass
F04.01 - Kitchen	Pass	NA	Pass
F04.01 - Living/Dining	Pass	NA	Pass
G06.03 - Kitchen	Pass	NA	Pass
G06.03 - Living/Dining	Pass	NA	Pass
G06.03 - Master Bedroom	Pass	Pass	Pass
G06.03 - Single Bedroom 1	Pass	Pass	Pass
G06.03 - Single Bedroom 2	Pass	Pass	Pass
R03.01 - Master Bedroom	Pass	Pass	Pass
R03.01 - Kitchen	Pass	NA	Pass
R03.01 - Single Bedroom	Pass	Pass	Pass
R03.01 - Living/Dining	Pass	NA	Pass
F02.01 - Master Bedroom	Pass	Pass	Pass
F02.01 - Kitchen	Pass	NA	Pass
F02.01 - Living/Dining	Pass	NA	Pass
G03.03 - Kitchen	Pass	NA	Pass
G03.03 - Living/Dining	Pass	NA	Pass
G03.03 - Master Bedroom	Pass	Pass	Pass
G03.03 - Single Bedroom 1	Pass	Pass	Pass
G03.03 - Single Bedroom 2	Pass	Pass	Pass
G00.03 - Living/Dining	Pass	NA	Pass
G00.03 - Kitchen	Pass	NA	Pass
G00.03 - Twin Single Bedroom	Pass	Pass	Pass
G00.03 - Master Bedroom	Pass	Pass	Pass
R01.01 - Kitchen	Pass	NA	Pass
R01.01 - Single Bedroom	Pass	Pass	Pass
R01.01 - Living/Dining	Pass	NA	Pass
R01.01 - Master Bedroom	Pass	Pass	Pass

Corridor name	Significant overheating risk?
No corridors to be analysed	NA

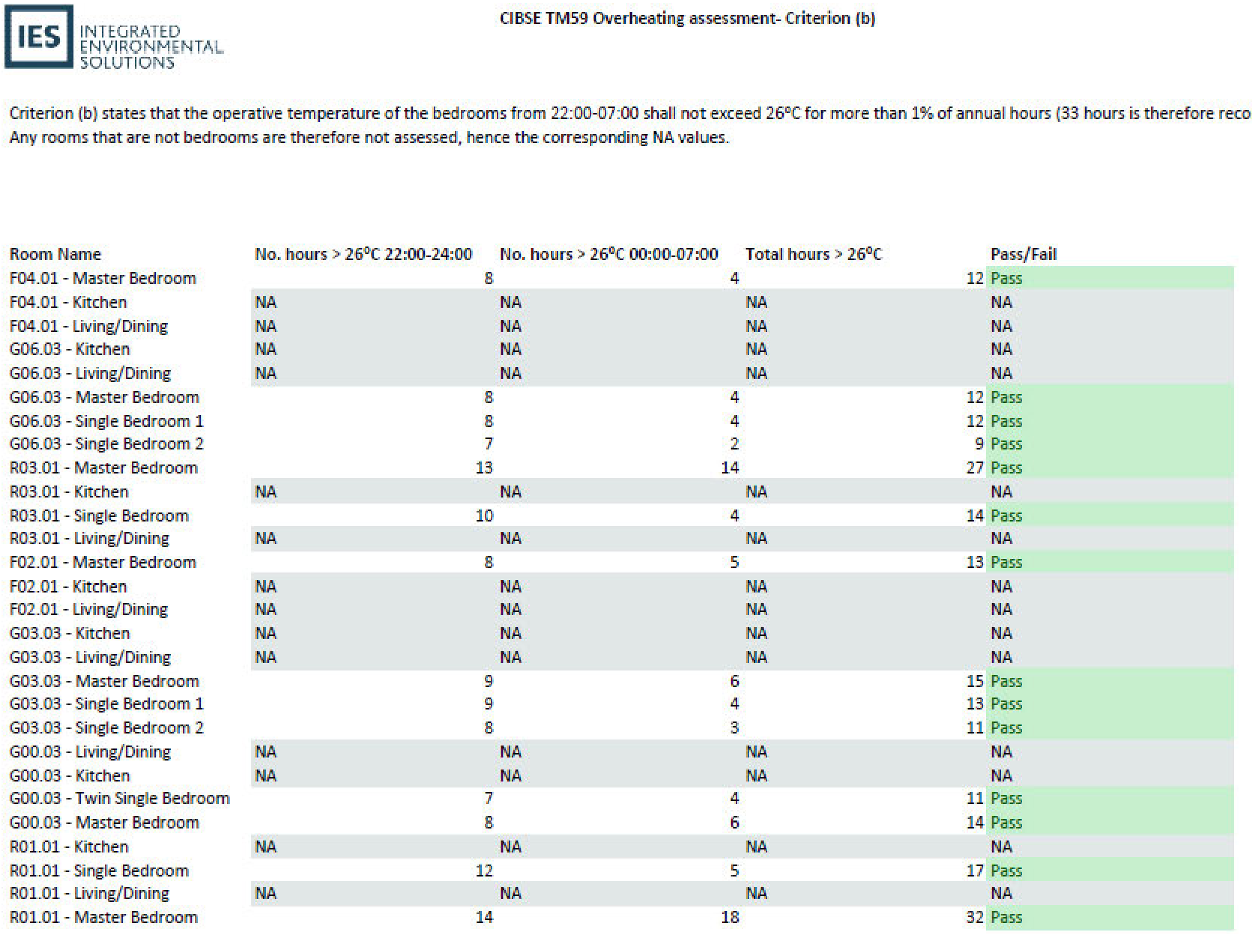


IES INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59 Overheating assessment- Criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.

Room Name	Occupied hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Pass/Fail
F04.01 - Master Bedroom	3671	2	0.1	Pass
F04.01 - Kitchen	1989	4	0.2	Pass
F04.01 - Living/Dining	1989	13	0.7	Pass
G06.03 - Kitchen	1989	0	0	Pass
G06.03 - Living/Dining	1989	0	0	Pass
G06.03 - Master Bedroom	3671	0	0	Pass
G06.03 - Single Bedroom 1	3671	0	0	Pass
G06.03 - Single Bedroom 2	3671	0	0	Pass
R03.01 - Master Bedroom	3671	0	0	Pass
R03.01 - Kitchen	1989	5	0.3	Pass
R03.01 - Single Bedroom	3671	13	0.4	Pass
R03.01 - Living/Dining	1989	18	0.9	Pass
F02.01 - Master Bedroom	3671	4	0.1	Pass
F02.01 - Kitchen	1989	4	0.2	Pass
F02.01 - Living/Dining	1989	11	0.6	Pass
G03.03 - Kitchen	1989	0	0	Pass
G03.03 - Living/Dining	1989	2	0.1	Pass
G03.03 - Master Bedroom	3671	0	0	Pass
G03.03 - Single Bedroom 1	3671	0	0	Pass
G03.03 - Single Bedroom 2	3671	0	0	Pass
G00.03 - Living/Dining	1989	0	0	Pass
G00.03 - Kitchen	1989	0	0	Pass
G00.03 - Twin Single Bedroom	3671	0	0	Pass
G00.03 - Master Bedroom	3671	0	0	Pass
R01.01 - Kitchen	1989	6	0.3	Pass
R01.01 - Single Bedroom	3671	14	0.4	Pass
R01.01 - Living/Dining	1989	16	0.8	Pass
R01.01 - Master Bedroom	3671	5	0.1	Pass



IES INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59 Overheating assessment- Criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding NA values.

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
F04.01 - Master Bedroom	8	4	12	Pass
F04.01 - Kitchen	NA	NA	NA	NA
F04.01 - Living/Dining	NA	NA	NA	NA
G06.03 - Kitchen	NA	NA	NA	NA
G06.03 - Living/Dining	NA	NA	NA	NA
G06.03 - Master Bedroom	8	4	12	Pass
G06.03 - Single Bedroom 1	8	4	12	Pass
G06.03 - Single Bedroom 2	7	2	9	Pass
R03.01 - Master Bedroom	13	14	27	Pass
R03.01 - Kitchen	NA	NA	NA	NA
R03.01 - Single Bedroom	10	4	14	Pass
R03.01 - Living/Dining	NA	NA	NA	NA
F02.01 - Master Bedroom	8	5	13	Pass
F02.01 - Kitchen	NA	NA	NA	NA
F02.01 - Living/Dining	NA	NA	NA	NA
G03.03 - Kitchen	NA	NA	NA	NA
G03.03 - Living/Dining	NA	NA	NA	NA
G03.03 - Master Bedroom	9	6	15	Pass
G03.03 - Single Bedroom 1	9	4	13	Pass
G03.03 - Single Bedroom 2	8	3	11	Pass
G00.03 - Living/Dining	NA	NA	NA	NA
G00.03 - Kitchen	NA	NA	NA	NA
G00.03 - Twin Single Bedroom	7	4	11	Pass
G00.03 - Master Bedroom	8	6	14	Pass
R01.01 - Kitchen	NA	NA	NA	NA
R01.01 - Single Bedroom	12	5	17	Pass
R01.01 - Living/Dining	NA	NA	NA	NA
R01.01 - Master Bedroom	14	18	32	Pass

ADAPTIVE OVERHEATING REPORTS – FUTURE WEATHER FILES DATA SETS

London_LWC_DSY2_2020High50

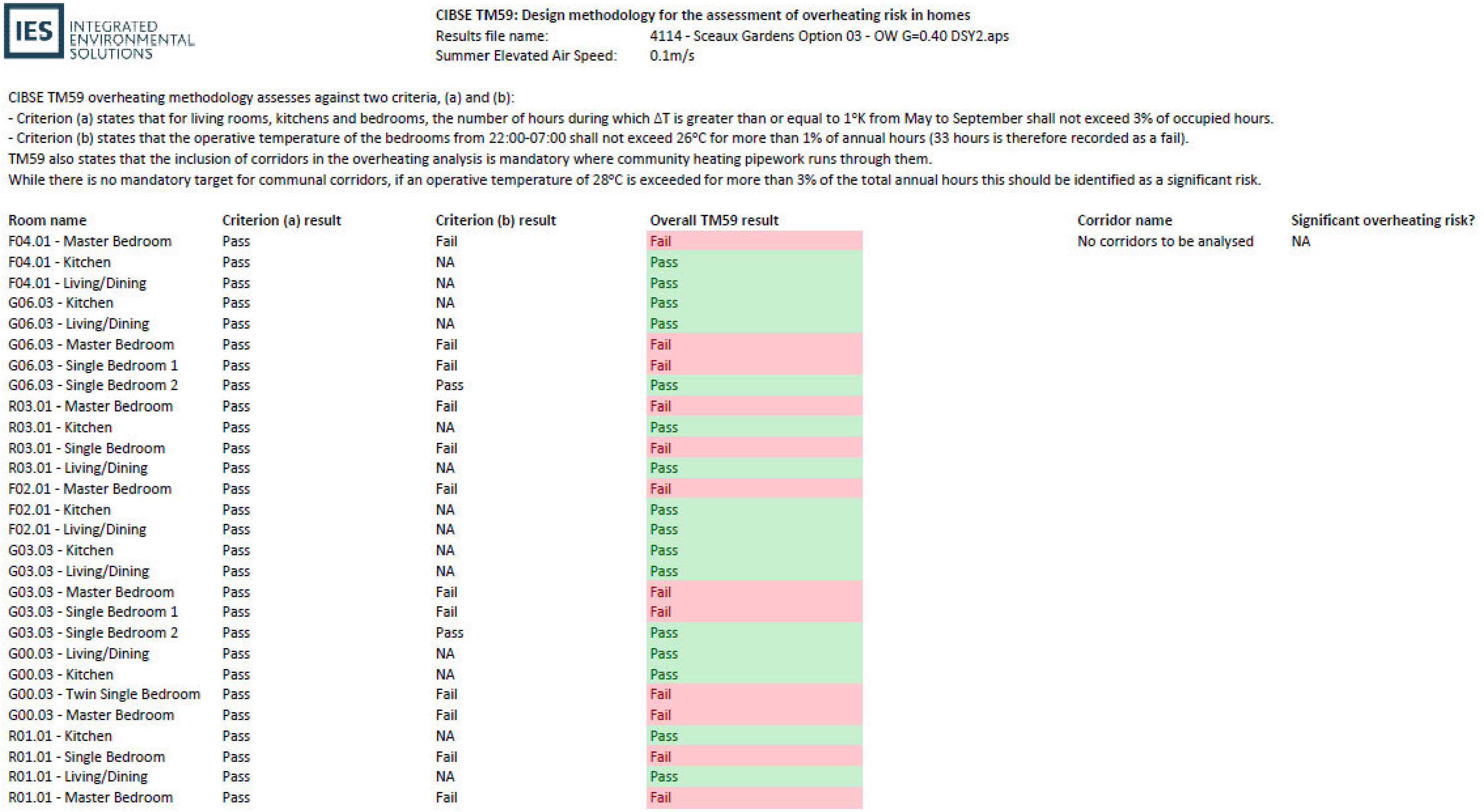
(DSY2) OPTION 03

The software model has been utilised to assess the risk of overheating against CIBSE TM59: 2017 'Design methodology for the assessment of overheating risk in homes'. The following report summaries have been generated against

Option 03 - Baseline + Mitigation Measure 1 + Mitigation Measure 2

Openable external glazing 90% openable area with a solar shading G-value of 0.45

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**



CIBSE TM59: Design methodology for the assessment of overheating risk in homes

Results file name:	4114 - Sceaux Gardens Option 03 - OW G=0.40 DSY2.aps
Summer Elevated Air Speed:	0.1m/s

CIBSE TM59 overheating methodology assesses against two criteria, (a) and (b):

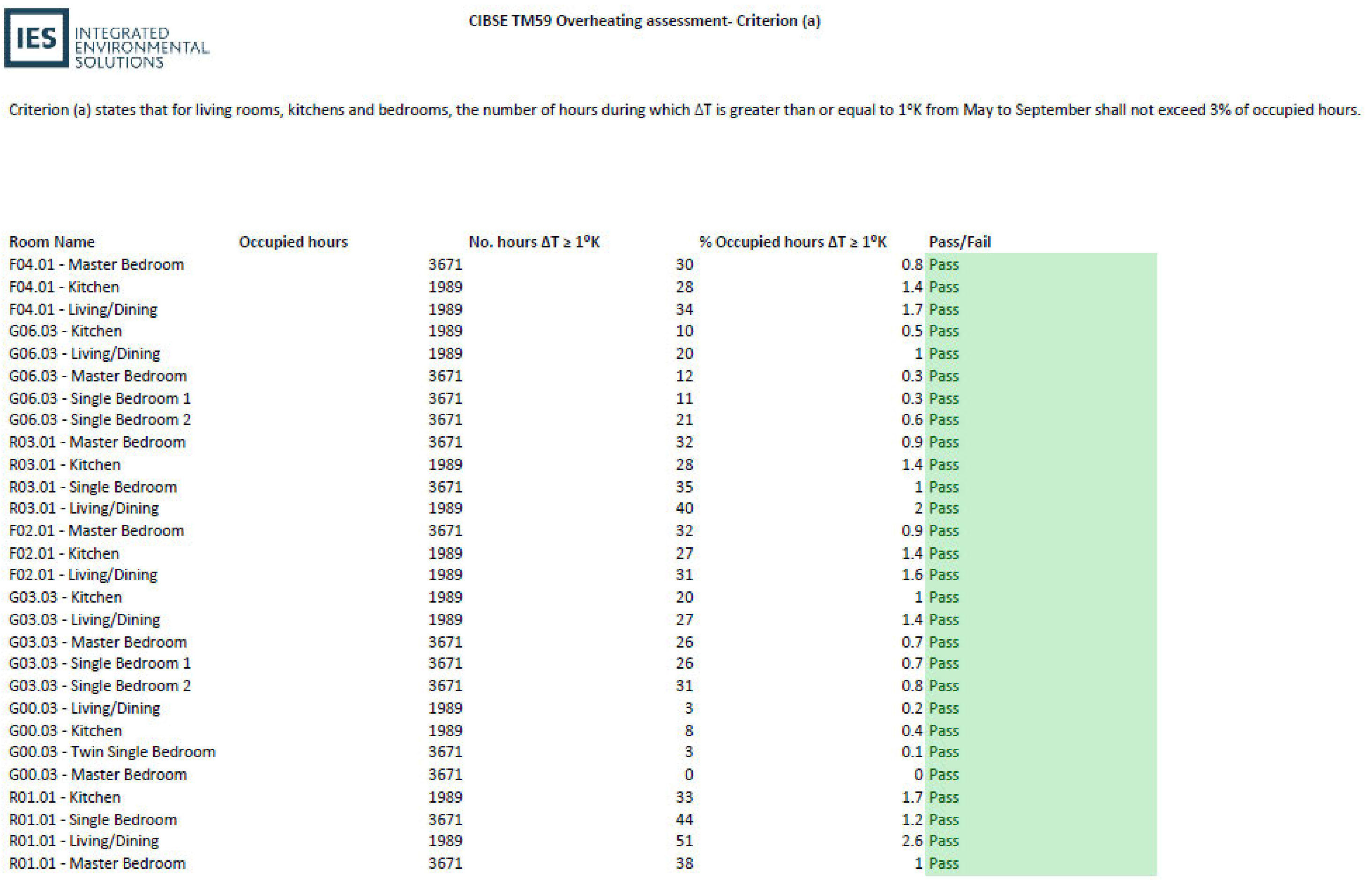
- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).

TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them.

While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Criterion (a) result	Criterion (b) result	Overall TM59 result
F04.01 - Master Bedroom	Pass	Fail	Fail
F04.01 - Kitchen	Pass	NA	Pass
F04.01 - Living/Dining	Pass	NA	Pass
G06.03 - Kitchen	Pass	NA	Pass
G06.03 - Living/Dining	Pass	NA	Pass
G06.03 - Master Bedroom	Pass	Fail	Fail
G06.03 - Single Bedroom 1	Pass	Fail	Fail
G06.03 - Single Bedroom 2	Pass	Pass	Pass
R03.01 - Master Bedroom	Pass	Fail	Fail
R03.01 - Kitchen	Pass	NA	Pass
R03.01 - Single Bedroom	Pass	Fail	Fail
R03.01 - Living/Dining	Pass	NA	Pass
F02.01 - Master Bedroom	Pass	Fail	Fail
F02.01 - Kitchen	Pass	NA	Pass
F02.01 - Living/Dining	Pass	NA	Pass
G03.03 - Kitchen	Pass	NA	Pass
G03.03 - Living/Dining	Pass	NA	Pass
G03.03 - Master Bedroom	Pass	Fail	Fail
G03.03 - Single Bedroom 1	Pass	Fail	Fail
G03.03 - Single Bedroom 2	Pass	Pass	Pass
G00.03 - Living/Dining	Pass	NA	Pass
G00.03 - Kitchen	Pass	NA	Pass
G00.03 - Twin Single Bedroom	Pass	Fail	Fail
G00.03 - Master Bedroom	Pass	Fail	Fail
R01.01 - Kitchen	Pass	NA	Pass
R01.01 - Single Bedroom	Pass	Fail	Fail
R01.01 - Living/Dining	Pass	NA	Pass
R01.01 - Master Bedroom	Pass	Fail	Fail

Corridor name	Significant overheating risk?
No corridors to be analysed	NA

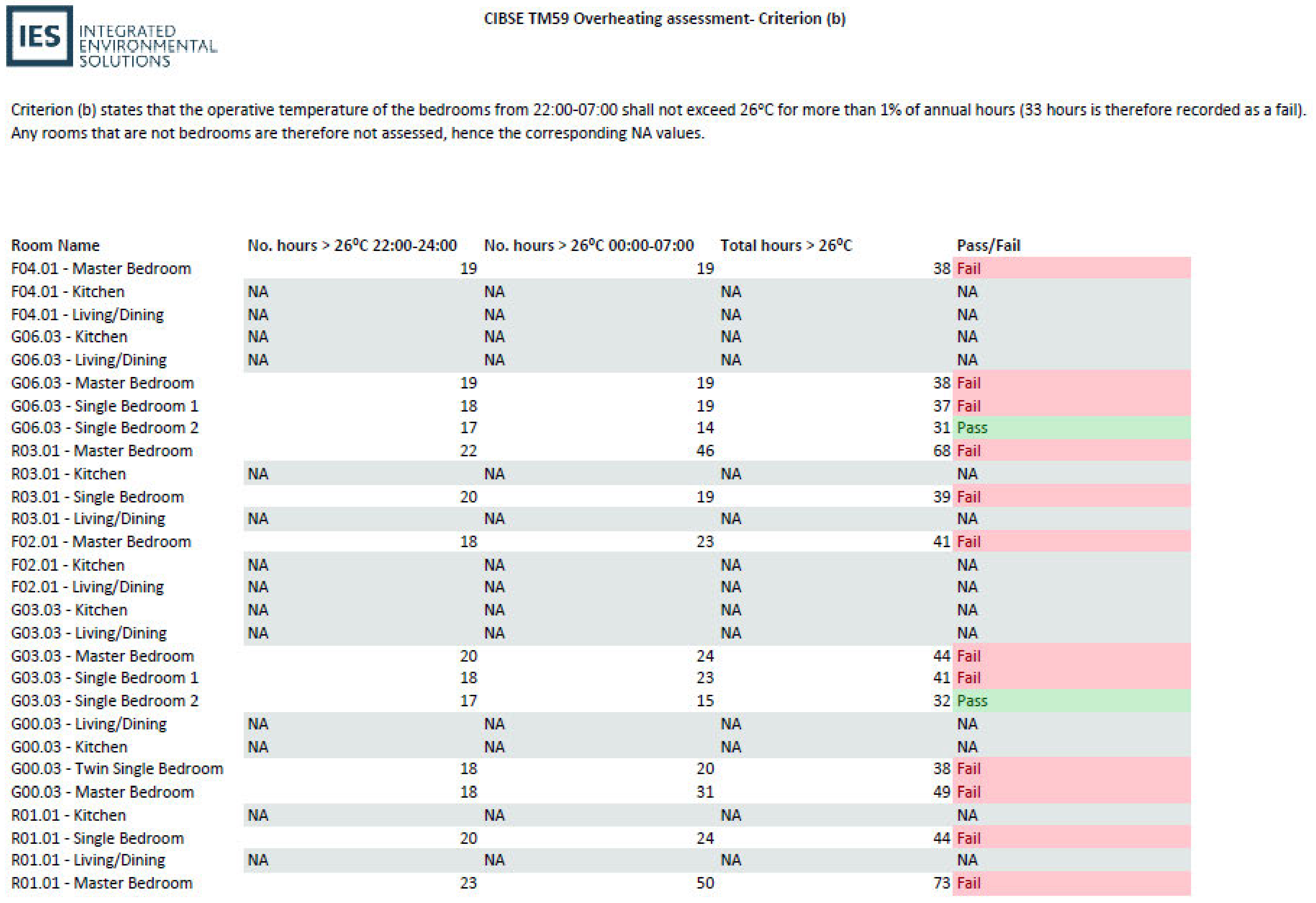


IES INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59 Overheating assessment- Criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.

Room Name	Occupied hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Pass/Fail
F04.01 - Master Bedroom	3671	30	0.8	Pass
F04.01 - Kitchen	1989	28	1.4	Pass
F04.01 - Living/Dining	1989	34	1.7	Pass
G06.03 - Kitchen	1989	10	0.5	Pass
G06.03 - Living/Dining	1989	20	1	Pass
G06.03 - Master Bedroom	3671	12	0.3	Pass
G06.03 - Single Bedroom 1	3671	11	0.3	Pass
G06.03 - Single Bedroom 2	3671	21	0.6	Pass
R03.01 - Master Bedroom	3671	32	0.9	Pass
R03.01 - Kitchen	1989	28	1.4	Pass
R03.01 - Single Bedroom	3671	35	1	Pass
R03.01 - Living/Dining	1989	40	2	Pass
F02.01 - Master Bedroom	3671	32	0.9	Pass
F02.01 - Kitchen	1989	27	1.4	Pass
F02.01 - Living/Dining	1989	31	1.6	Pass
G03.03 - Kitchen	1989	20	1	Pass
G03.03 - Living/Dining	1989	27	1.4	Pass
G03.03 - Master Bedroom	3671	26	0.7	Pass
G03.03 - Single Bedroom 1	3671	26	0.7	Pass
G03.03 - Single Bedroom 2	3671	31	0.8	Pass
G00.03 - Living/Dining	1989	3	0.2	Pass
G00.03 - Kitchen	1989	8	0.4	Pass
G00.03 - Twin Single Bedroom	3671	3	0.1	Pass
G00.03 - Master Bedroom	3671	0	0	Pass
R01.01 - Kitchen	1989	33	1.7	Pass
R01.01 - Single Bedroom	3671	44	1.2	Pass
R01.01 - Living/Dining	1989	51	2.6	Pass
R01.01 - Master Bedroom	3671	38	1	Pass



CIBSE TM59 Overheating assessment- Criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).
Any rooms that are not bedrooms are therefore not assessed, hence the corresponding NA values.

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
F04.01 - Master Bedroom	19	19	38	Fail
F04.01 - Kitchen	NA	NA	NA	NA
F04.01 - Living/Dining	NA	NA	NA	NA
G06.03 - Kitchen	NA	NA	NA	NA
G06.03 - Living/Dining	NA	NA	NA	NA
G06.03 - Master Bedroom	19	19	38	Fail
G06.03 - Single Bedroom 1	18	19	37	Fail
G06.03 - Single Bedroom 2	17	14	31	Pass
R03.01 - Master Bedroom	22	46	68	Fail
R03.01 - Kitchen	NA	NA	NA	NA
R03.01 - Single Bedroom	20	19	39	Fail
R03.01 - Living/Dining	NA	NA	NA	NA
F02.01 - Master Bedroom	18	23	41	Fail
F02.01 - Kitchen	NA	NA	NA	NA
F02.01 - Living/Dining	NA	NA	NA	NA
G03.03 - Kitchen	NA	NA	NA	NA
G03.03 - Living/Dining	NA	NA	NA	NA
G03.03 - Master Bedroom	20	24	44	Fail
G03.03 - Single Bedroom 1	18	23	41	Fail
G03.03 - Single Bedroom 2	17	15	32	Pass
G00.03 - Living/Dining	NA	NA	NA	NA
G00.03 - Kitchen	NA	NA	NA	NA
G00.03 - Twin Single Bedroom	18	20	38	Fail
G00.03 - Master Bedroom	18	31	49	Fail
R01.01 - Kitchen	NA	NA	NA	NA
R01.01 - Single Bedroom	20	24	44	Fail
R01.01 - Living/Dining	NA	NA	NA	NA
R01.01 - Master Bedroom	23	50	73	Fail

ADAPTIVE OVERHEATING REPORTS – FUTURE WEATHER FILES DATA SETS

London_LWC_DSY3_2020High50

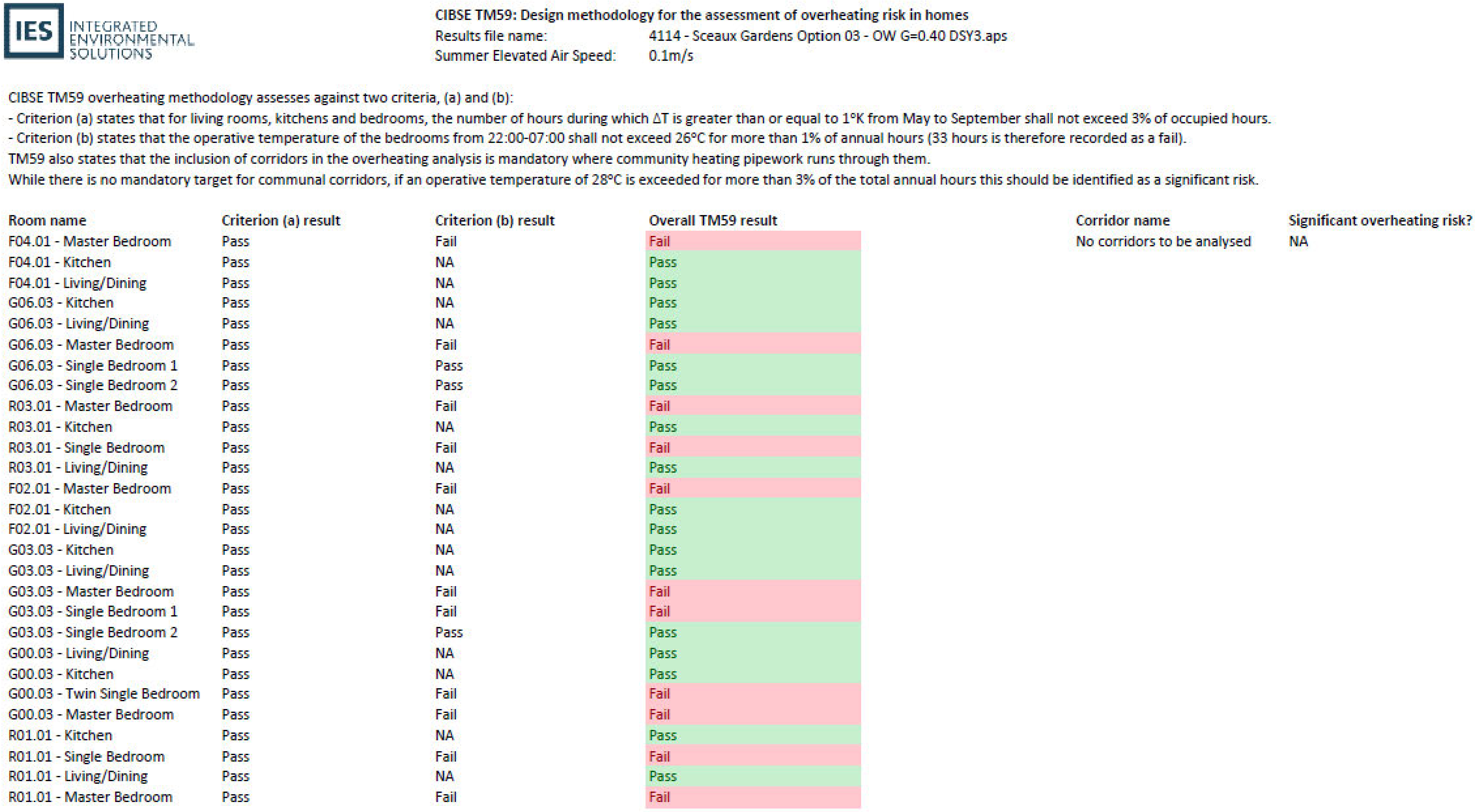
(DSY3) OPTION 03

The software model has been utilised to assess the risk of overheating against CIBSE TM59: 2017 'Design methodology for the assessment of overheating risk in homes'. The following report summaries have been generated against

Option 03 - Baseline + Mitigation Measure 1 + Mitigation Measure 2

Openable external glazing 90% openable area with a solar shading G-value of 0.45

***Open when internal temperature exceeds 21 °C and only when the external air temperature is less than the internal air temperature during the hours 9am to 22pm.**



CIBSE TM59: Design methodology for the assessment of overheating risk in homes

Results file name:	4114 - Sceaux Gardens Option 03 - OW G=0.40 DSY3.aps
Summer Elevated Air Speed:	0.1m/s

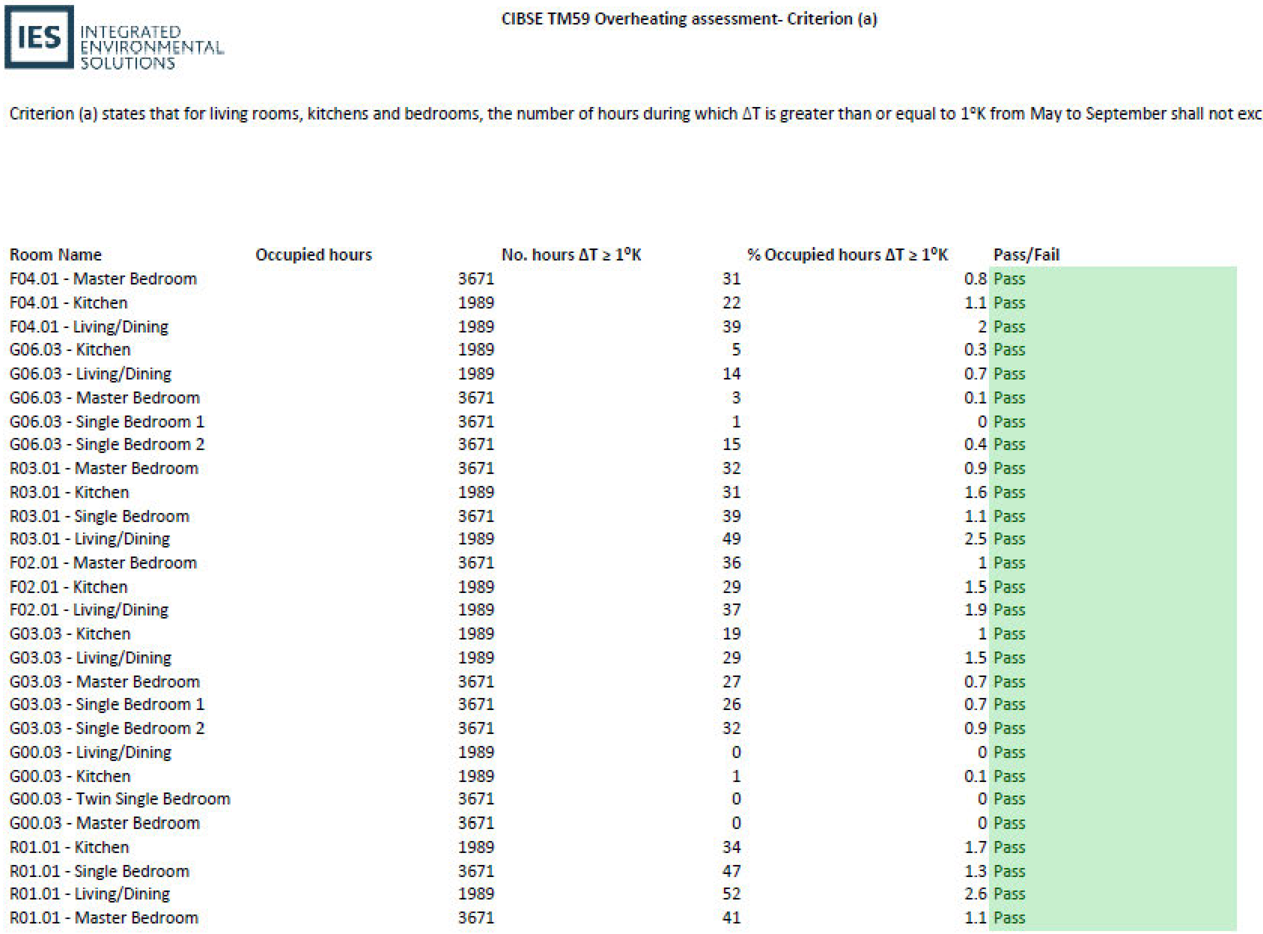
CIBSE TM59 overheating methodology assesses against two criteria, (a) and (b):
- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).

TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them.

While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Criterion (a) result	Criterion (b) result	Overall TM59 result
F04.01 - Master Bedroom	Pass	Fail	Fail
F04.01 - Kitchen	Pass	NA	Pass
F04.01 - Living/Dining	Pass	NA	Pass
G06.03 - Kitchen	Pass	NA	Pass
G06.03 - Living/Dining	Pass	NA	Pass
G06.03 - Master Bedroom	Pass	Fail	Fail
G06.03 - Single Bedroom 1	Pass	Pass	Pass
G06.03 - Single Bedroom 2	Pass	Pass	Pass
R03.01 - Master Bedroom	Pass	Fail	Fail
R03.01 - Kitchen	Pass	NA	Pass
R03.01 - Single Bedroom	Pass	Fail	Fail
R03.01 - Living/Dining	Pass	NA	Pass
F02.01 - Master Bedroom	Pass	Fail	Fail
F02.01 - Kitchen	Pass	NA	Pass
F02.01 - Living/Dining	Pass	NA	Pass
G03.03 - Kitchen	Pass	NA	Pass
G03.03 - Living/Dining	Pass	NA	Pass
G03.03 - Master Bedroom	Pass	Fail	Fail
G03.03 - Single Bedroom 1	Pass	Fail	Fail
G03.03 - Single Bedroom 2	Pass	Pass	Pass
G00.03 - Living/Dining	Pass	NA	Pass
G00.03 - Kitchen	Pass	NA	Pass
G00.03 - Twin Single Bedroom	Pass	Fail	Fail
G00.03 - Master Bedroom	Pass	Fail	Fail
R01.01 - Kitchen	Pass	NA	Pass
R01.01 - Single Bedroom	Pass	Fail	Fail
R01.01 - Living/Dining	Pass	NA	Pass
R01.01 - Master Bedroom	Pass	Fail	Fail

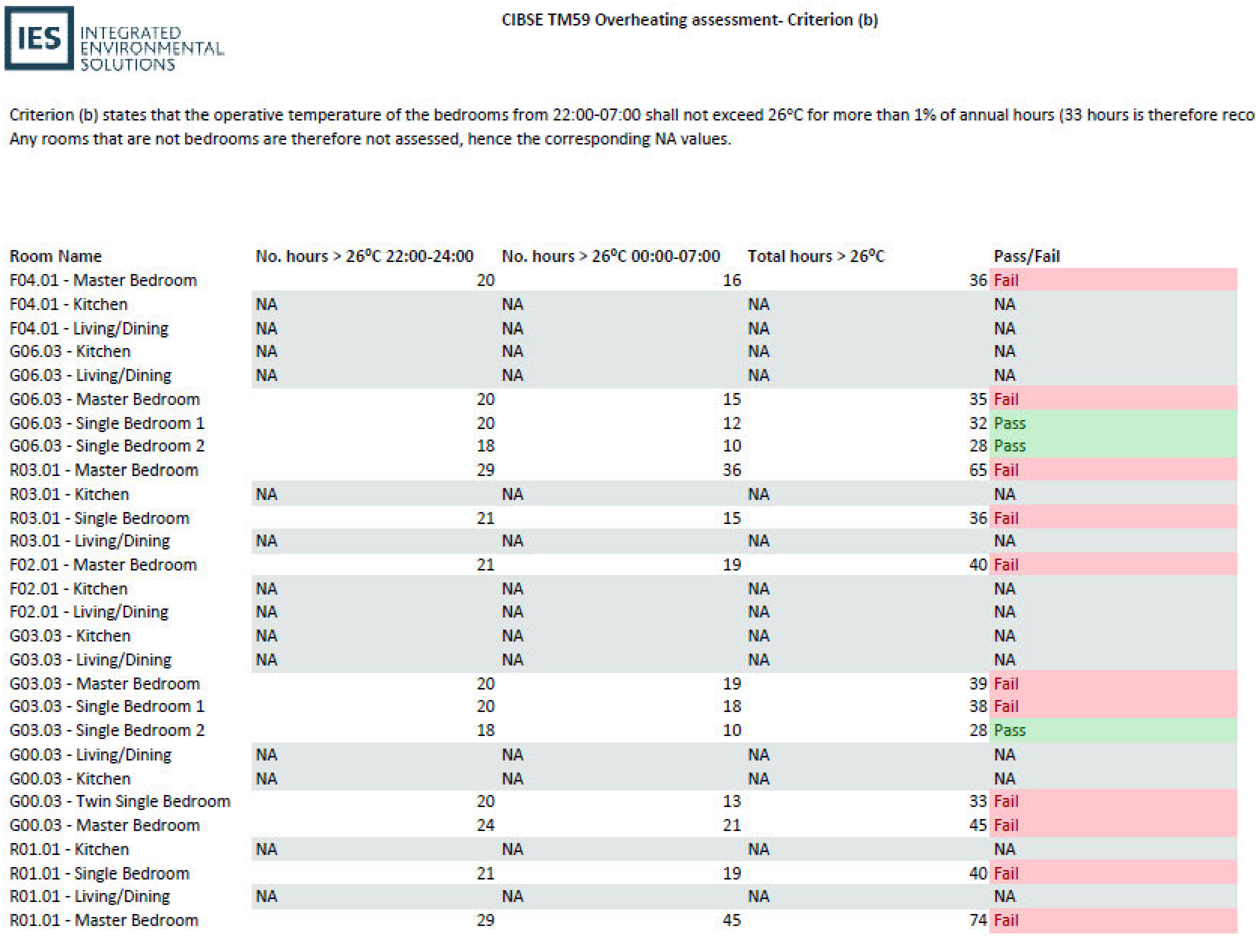
Corridor name	Significant overheating risk?
No corridors to be analysed	NA



CIBSE TM59 Overheating assessment- Criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.

Room Name	Occupied hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Pass/Fail
F04.01 - Master Bedroom	3671	31	0.8	Pass
F04.01 - Kitchen	1989	22	1.1	Pass
F04.01 - Living/Dining	1989	39	2	Pass
G06.03 - Kitchen	1989	5	0.3	Pass
G06.03 - Living/Dining	1989	14	0.7	Pass
G06.03 - Master Bedroom	3671	3	0.1	Pass
G06.03 - Single Bedroom 1	3671	1	0	Pass
G06.03 - Single Bedroom 2	3671	15	0.4	Pass
R03.01 - Master Bedroom	3671	32	0.9	Pass
R03.01 - Kitchen	1989	31	1.6	Pass
R03.01 - Single Bedroom	3671	39	1.1	Pass
R03.01 - Living/Dining	1989	49	2.5	Pass
F02.01 - Master Bedroom	3671	36	1	Pass
F02.01 - Kitchen	1989	29	1.5	Pass
F02.01 - Living/Dining	1989	37	1.9	Pass
G03.03 - Kitchen	1989	19	1	Pass
G03.03 - Living/Dining	1989	29	1.5	Pass
G03.03 - Master Bedroom	3671	27	0.7	Pass
G03.03 - Single Bedroom 1	3671	26	0.7	Pass
G03.03 - Single Bedroom 2	3671	32	0.9	Pass
G00.03 - Living/Dining	1989	0	0	Pass
G00.03 - Kitchen	1989	1	0.1	Pass
G00.03 - Twin Single Bedroom	3671	0	0	Pass
G00.03 - Master Bedroom	3671	0	0	Pass
R01.01 - Kitchen	1989	34	1.7	Pass
R01.01 - Single Bedroom	3671	47	1.3	Pass
R01.01 - Living/Dining	1989	52	2.6	Pass
R01.01 - Master Bedroom	3671	41	1.1	Pass



IES INTEGRATED ENVIRONMENTAL SOLUTIONS

CIBSE TM59 Overheating assessment- Criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail).
Any rooms that are not bedrooms are therefore not assessed, hence the corresponding NA values.

Room Name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Pass/Fail
F04.01 - Master Bedroom	20	16	36	Fail
F04.01 - Kitchen	NA	NA	NA	NA
F04.01 - Living/Dining	NA	NA	NA	NA
G06.03 - Kitchen	NA	NA	NA	NA
G06.03 - Living/Dining	NA	NA	NA	NA
G06.03 - Master Bedroom	20	15	35	Fail
G06.03 - Single Bedroom 1	20	12	32	Pass
G06.03 - Single Bedroom 2	18	10	28	Pass
R03.01 - Master Bedroom	29	36	65	Fail
R03.01 - Kitchen	NA	NA	NA	NA
R03.01 - Single Bedroom	21	15	36	Fail
R03.01 - Living/Dining	NA	NA	NA	NA
F02.01 - Master Bedroom	21	19	40	Fail
F02.01 - Kitchen	NA	NA	NA	NA
F02.01 - Living/Dining	NA	NA	NA	NA
G03.03 - Kitchen	NA	NA	NA	NA
G03.03 - Living/Dining	NA	NA	NA	NA
G03.03 - Master Bedroom	20	19	39	Fail
G03.03 - Single Bedroom 1	20	18	38	Fail
G03.03 - Single Bedroom 2	18	10	28	Pass
G00.03 - Living/Dining	NA	NA	NA	NA
G00.03 - Kitchen	NA	NA	NA	NA
G00.03 - Twin Single Bedroom	20	13	33	Fail
G00.03 - Master Bedroom	24	21	45	Fail
R01.01 - Kitchen	NA	NA	NA	NA
R01.01 - Single Bedroom	21	19	40	Fail
R01.01 - Living/Dining	NA	NA	NA	NA
R01.01 - Master Bedroom	29	45	74	Fail

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.

Good Homes Alliance

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING	KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	4	
	Northern England, Scotland & NI	0	
	Rest of England and Wales	2	

#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3	
	Grtr London, Manchester, B'ham	2	
	Other cities, towns & dense sub-urban areas	1	

#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	1	

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	8	
	Day - barriers some of the time, or for some windows e.g. on quiet side	4	
	Night - reasons to keep all windows closed	8	
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1	
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1	

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3	
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3	

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance	1	

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	2	
	> 2.8m	1	

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	12	
	>50%	7	
	>35%	4	

#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	3	
	Dual aspect	0	

#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per **#6**		Full	Part	
	>65%	6	3	
	>50%	4	2	
	>35%	2	1	

#14 Do windows & openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance		Openings compared to Part F purge rates			
		= Part F	+50%	+100%	
	Single-aspect	minimum required	3	4	
	Dual aspect		2	3	

TOTAL SCORE ☐ = Sum of contributing factors: ☐ *minus* Sum of mitigating factors: ☐

High — 12 — Medium — 8 — Low

score >12:
Incorporate design changes to reduce risk factors and increase mitigation factors
AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score between 8 and 12:
Seek design changes to reduce risk factors and/or increase mitigation factors
AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score <8:
Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

Good Homes Alliance

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	4	
	Northern England, Scotland & NI	0	
	Rest of England and Wales	2	

#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3	
	Grtr London, Manchester, B'ham	2	
	Other cities, towns & dense sub-urban areas	1	

#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	1	

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	8	
	Day - barriers some of the time, or for some windows e.g. on quiet side	4	
	Night - reasons to keep all windows closed	8	
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1	
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1	

Scheme characteristics and dwelling design

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		Full	Part	
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TOTAL SCORE ☐ = Sum of contributing factors: ☐ *minus* Sum of mitigating factors: ☐

High 12 Medium 8 Low

score >12: Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score between 8 and 12:** Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score <8:** Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)