NEW CITY COURT

Energy Statement

chapmanbdsp

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0	Planning	01/04/21	HW	PP
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3	Planning addendum	25/06/21	HW	PP
4	Planning addendum	09/07/21	HW	PP

chapmanbdsp
Address: 40 Gracechurch Street, London EC3V 0BT
T: 020 7618 4800
E: info@chapmanbdsp.com

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1 Executive summary

This Energy Statement is to supersede the original document issued for planning in April 2021. This report has been prepared by chapmanbdsp to support the planning application addendum for the redevelopment of New City Court, 4-26 St Thomas Street, London SE1 9RS.

The objective of this energy statement is to present the Applicant's commitment to energy efficiency and carbon dioxide (CO_2) emissions reduction for the Proposed Development. It identifies the applicable planning policies and measures that have been applied to the design of the development in response to these requirements.

Redevelopment is to include demolition of the 1980s office buildings and erection of a 26-storey building (plus mezzanine and two basement levels), restoration and refurbishment of the listed terrace (nos. 4-16 St Thomas Street), and redevelopment of Keats House (nos. 24-26 St Thomas Street) with removal, relocation and reinstatement of the historic façade on a proposed building, to provide office floorspace, flexible office/retail floorspace, restaurant/café floorspace and a public rooftop garden, associated public realm and highways improvements, provision for a new access to the Borough High Street entrance to the Underground Station, cycling parking, car parking, service, refuse and plant areas, and all ancillary or associated works.

Summary of Proposed Amendments

It is proposed to amend the Proposed Development to incorporate a series of improvements to the detailed design and energy strategy.

The Proposed Amendments include the following:

- Improvements to the detailed design of the southern elevation, including provision of integrated photovoltaic panels and balconies, enhancing the operational energy strategy and urban greening factor;
- Reconfiguration of basement levels to facilitate the relocation of the Keats House façade, improve building management facilities and respond to UKPN comments;
- Improvements to Building Management facilities to enhance access and security measures;
- Development of façade to allow for safety egress from the BMU and overall maintenance of the building envelope;
- Introduction of additional security measures, including bollards, along the base of the building at St Thomas Street and King's Head Yard.

Proposed floor areas

Table 1 Proposed floor areas.

Use	Use Class	Proposed GIA (m^2)
Office	E	44,141
Affordable workspace	E	4,908
Flexible office / retail	E	328
Food and drink	E	421
Shared rooftop garden access	-	183
Shared facilities and plant	-	5,480
Total		**55,461**

Applicable regulations and policies

This report has been developed with reference to the following guidance documents:

- National Planning Policy Framework (2019)
- GLA London Plan (2021)
- Southwark Council Core Strategy (April 2011)
- Draft New Southwark Plan – Proposed Changes Version (August 2020)
- Approved Document Part L2A of the Building Regulations 2013 (2016 amendments)
- Approved Document Part L2B of the Building Regulations 2010 (2016 amendments)

Carbon emissions factors

All calculations presented in this document are assessed using the SAP 10.0 carbon factors as listed below:

Table 2 Applied carbon factors.

Use	Fuel carbon factor ($kgCO_2/kWh$)
Natural gas	0.210
Grid supplied electricity	0.233

Key targets

The design approach for the Proposed Development follows the energy hierarchy i.e., being 'lean, clean and green' to achieve the following targets:

- a 15% reduction in regulated CO_2 emissions through energy efficiency measures alone (be lean), below those of a development compliant with Part L 2013 of the Building Regulations.
- a 40% reduction in regulated carbon emissions beyond Part L 2013 for non-residential development through on-site measures (New Southwark Plan).
- BREEAM 'Excellent' Ene 01 minimum standards – refer to sustainability statement produced by chapmanbdsp for details.

Design approach

The design approach targets demand reduction measures first, giving priority to optimisation of building fabric to reduce the need for heating, cooling, and artificial lighting. The objective is to have buildings as energy efficient (i.e. 'lean') as possible before considering any mechanical systems and on-site and off-site measures to deliver low carbon performance.

The following passive design features are proposed:

- High levels of envelope insulation to reduce energy demand.
- Airtight construction to prevent heat loss.
- Optimised glazing-to-solid ratios to mitigate overheating risk and cooling whilst maximising daylight.
- Highly efficient double glazing throughout with low-emissivity coatings to prevent excessive solar gains.
- Openable windows to maximise potential of natural ventilation.

The following energy-efficient plant is proposed:

- High-efficiency mechanical ventilation systems with heat recovery.
- Low energy lighting throughout with occupant detection and photocell diming, where possible.
- Smart meters, system controls and diagnostics systems to operate the building effectively.

A study of the London Heat Map was carried out to identify district energy networks in proximity of the site. The study showed no existing or foreseen network, within 1 km radius of the site, to consider connection at this stage of the project. However, the Proposed Development will be made 'connection ready' for the possibility of connecting to a future district heating network when this becomes available.

Considering the decarbonisation of the grid and the new SAP 10.0 carbon factors, an air source heat pump (ASHP) system has been identified as the most efficient and appropriate technology for the scheme to supply cooling and heating. Cooling will be supplemented by water-cooled chillers to improve overall SEER. Air source heat pumps will also contribute as proposed renewable technology for the Proposed Development.

Summary of results

With this design approach, the proposed whole development shows the potential to achieve:

- 31% carbon emissions improvement over the baseline with passive design measures only; and
- An overall 49% on-site reduction in regulated carbon emissions.

Table 3 Carbon dioxide emissions after each stage of the energy hierarchy.

	Carbon dioxide emissions (tCO_2/year)	
	Regulated	Unregulated
Part L 2013 compliant building	594.5	551.8
Be Lean	410.2	551.8
Be Clean	410.2	551.8
Be Green	305.6	551.8

Table 4 Regulated carbon dioxide savings from each stage of the energy hierarchy.

		Regulated carbon dioxide savings	
		tCO_2/year	%
Be Lean	Savings from demand reduction	184.4	31%
Be Clean	Savings from CHP	0.0	0%
Be Green	Savings from renewable energy	104.6	18%
Total cumulative savings		**288.9**	**49%**

Carbon shortfall	9,168 tCO_2/year
Cash-in-lieu contribution	£870,981

*carbon price assumed as £95 per tonne of carbon dioxide according to Southwark Council and in line with the G

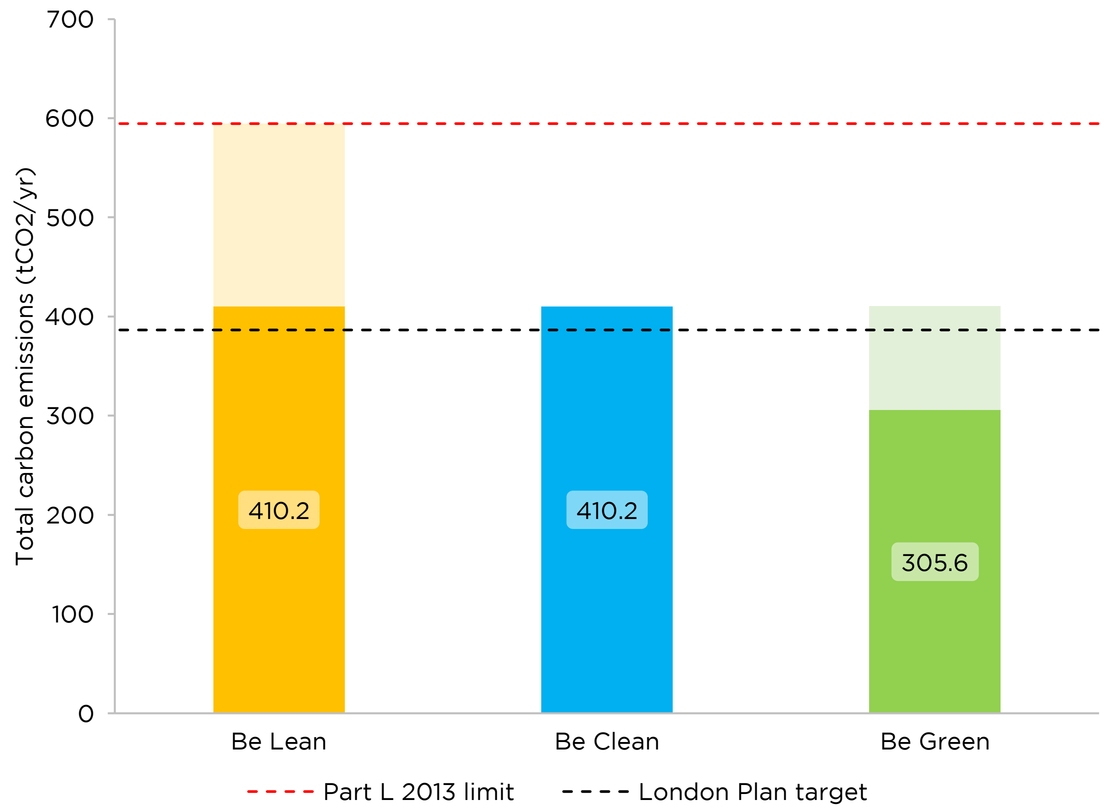

Figure 1 Regulated carbon dioxide emissions at each stage of the energy hierarchy.

2 Introduction

This Energy Statement is to supersede the original document issued for planning in April 2021. This report has been prepared by chapmanbdsp on behalf of GPE (St Thomas Street) Limited ('The Applicant') to support the planning application addendum for New City Court, the Proposed Development at 4-26 St Thomas Street, London, SE1 9RS ('The Site').

The energy strategy approach is illustrated in Figure 2 in line with London Plan Policy SI 2, and includes measures to minimise the energy demand, apply energy efficient measures, assess whether the building can be connected to a heat network or if a CHP can be used, and finally maximise the use of renewable energy sources.

For the purposes of quantifying the CO_2 emissions reduction, the proposed design has been assessed through Part L compliance standard methodologies. The modelling was conducted using approved dynamic thermal modelling software; EDSL Tas v9.5.1.

Figure 2 chapmanbdsp environmental design approach.

2.1 Description of the existing building

The majority of the Site is occupied by the early 1980s offices of New City Court (no. 20 St. Thomas Street), which comprises a part four-storey, part five-storey office building (Class E) with a curved glazed frontage on St Thomas Street. The existing building is dated and is not considered to be of any architectural merit.

Keats House (24-26 St Thomas Street) comprises an unlisted four-storey office building (Class E) with a basement level, originally constructed in the late 19th Century with a retained Venetian-renaissance façade.

The Grade II-listed Georgian terrace buildings (4-16 St Thomas Street) were constructed in the early 19th Century and are currently in Class E office use. Despite their Grade II listing, the terrace buildings are in a poor state of disrepair having been heavily altered both internally and externally, with the listing based on the nature of the St Thomas Street facade only. Each of the existing buildings were connected laterally as part of works undertaken during the 1980s, resulting in the substantial removal of historic fabric from the listed buildings.

Table 5 Existing floor areas.

Use	Use Class	Existing GIA (m^2)
New City Court	E	9,964
Keats House	E	986
Georgian Terrace	E	1,813
Total	-	12,763

2.2 Description of the Proposed Development

Redevelopment include demolition of the 1980s office buildings and erection of a 26-storey building (plus mezzanine and two basement levels), restoration and refurbishment of the listed terrace (nos. 4-16 St Thomas Street), and redevelopment of Keats House (nos. 24-26 St Thomas Street) with removal, relocation and reinstatement of the historic façade on a proposed building, to provide office floorspace, flexible office/retail floorspace, restaurant/café floorspace and a public rooftop garden, associated public realm and highways improvements, provision for a new access to the Borough High Street entrance to the Underground Station, cycling parking, car parking, service, refuse and plant areas, and all ancillary or associated works.

Table 6 Proposed floor areas.

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2.3 Summary of Proposed Amendments

It is proposed to amend the Proposed Development to incorporate a series of improvements to the detailed design and energy strategy.

The Proposed Amendments include the following:

- Improvements to the detailed design of the southern elevation, including provision of integrated photovoltaic panels and balconies, enhancing the operational energy strategy and urban greening factor;
- Reconfiguration of basement levels to facilitate the relocation of the Keats House façade, improve building management facilities and respond to UKPN comments;
- Improvements to Building Management facilities to enhance access and security measures;
- Development of façade to allow for safety egress from the BMU and overall maintenance of the building envelope;
- Introduction of additional security measures, including bollards, along the base of the building at St Thomas Street and King's Head Yard.

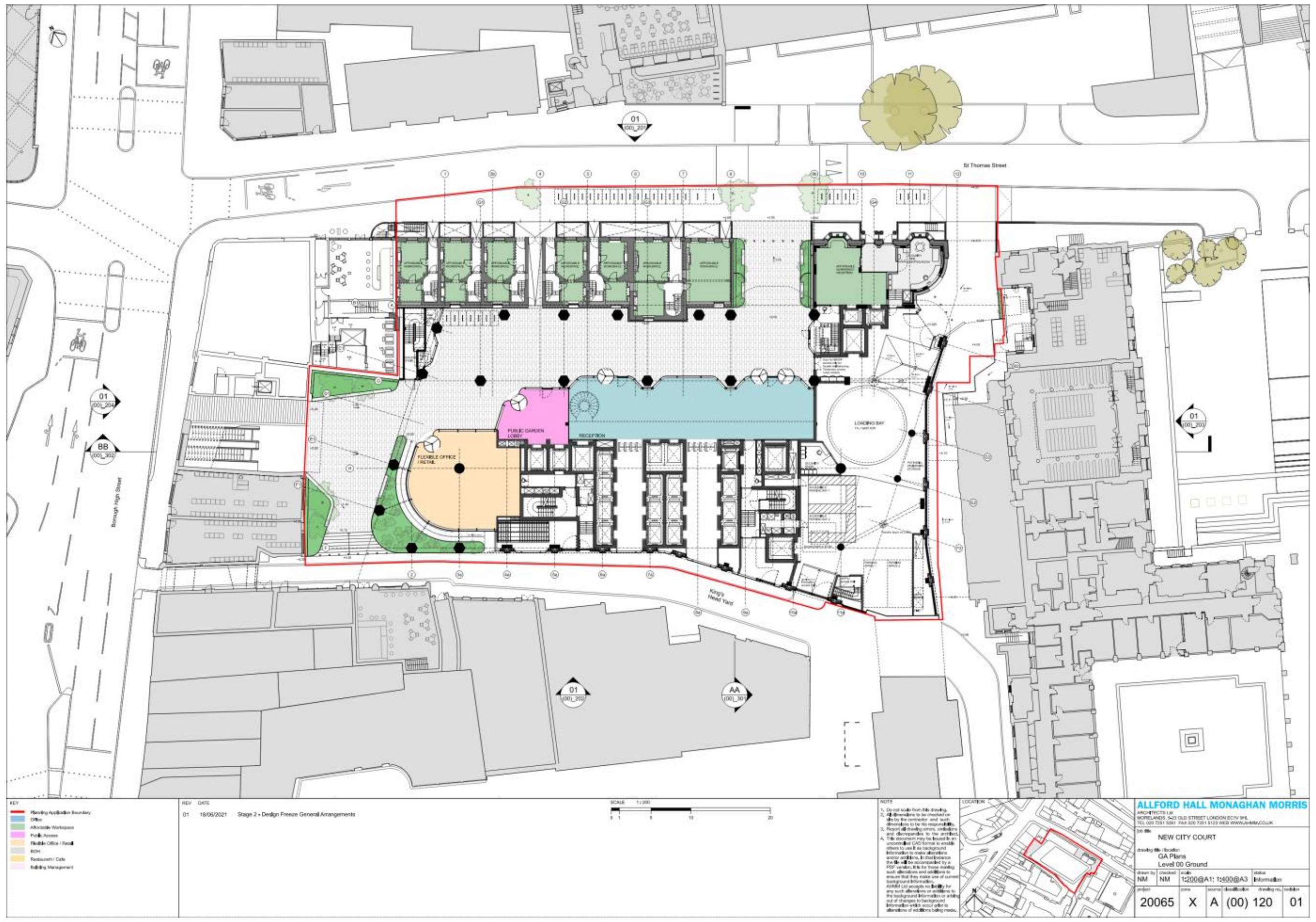


Figure 3 Level 00 Ground floor plan for the Proposed Development, with site boundary shown in red.

2.4 Report objective

The objective of this energy statement is to present the applicant's commitment to energy efficiency and carbon dioxide (CO_2) emissions reduction for the proposed scheme. It identifies the applicable planning policies and measures that have been applied to the design of the scheme in response to these requirements.

2.5 Report structure

The introduction is followed by a review of national and local policies on energy and project requirements. A detailed assessment of the estimated energy consumption and associated carbon dioxide emissions is provided relating to the 'Be Lean', 'Be Clean' and 'Be Green' elements of the energy hierarchy. The Proposed Development has been analysed for the potential risk of overheating, in line with latest industry guidelines. Low and Zero Carbon (LZC) technologies are reviewed in detail for feasibility in the context of the proposed scheme. A summary of the proposed energy strategy is provided at the end of this document.

2.6 Carbon emission factors

The GLA has decided that since January 2019 and until central Government updates Part L with the latest carbon emission factors, planning applicants have been encouraged to use the SAP 10.0 emission factors for referable applications when estimating CO_2 emission performance against London Plan policies. This new approach is in accordance to Section 5 of the GLA guidance on preparing energy assessments, and is adopted by the GLA to reflect the decarbonisation of the electricity grid, which is not currently considered by the Part L compliance calculations. This approach will remain in place until the Government adopts a revision to the Building Regulation with updated emission factors.

The *GLA carbon emission reporting spreadsheet* facilitates the use of the SAP 10.0 emission factors and ensures a consistent and transparent process for updating Part L 2013 carbon dioxide emission performance, as shown in Section 11.1.

Table 7 Fuel carbon factor for SAP 2012 and SAP 10.0.

	Fuel carbon factor (kgCO_2/kWh)	
Fuel type	SAP 2012	SAP 10.0
Natural gas	0.216	0.210
Grid electricity	0.519	0.233

3 Planning policy context

The following adopted and emerging sustainability policies and documents have been considered within the context of the proposed scheme, to identify and target compliance with relevant requirements and to inform the viable environmental design opportunities:

- GLA London Plan (March 2021);
- GLA guidance on preparing energy assessments (2020);
- Draft 'Be Seen' energy modelling guidance (October 2020)
- Southwark Council Core Strategy (April 2011)
- Draft New Southwark Plan – Proposed Changes Version (August 2020)

3.1 The London Plan (2021)

The London Plan, a spatial development strategy for Greater London includes objectives to reduce the capital's impact on, and exposure to, the effect of climate change. The most relevant policies for this energy statement are:

Policy SI 2: Minimising greenhouse gas emissions

Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

- Be lean: use less energy and manage demand during operation.
- Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.
- Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.
- Be seen: monitor, verify and report on energy performance.

Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

A minimum on-site reduction of at least 35% beyond Building Regulations is required for major development. Residential development should achieve 10%, and non-residential development should achieve 15% through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

1. Through a cash in lieu contribution to the borough's carbon offset fund, or
2. Off-site provided that an alternative proposal is identified, and delivery is certain.

Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e., unregulated emissions.

Policy SI 3: Energy infrastructure

Development plans should identify the need for, any suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing energy infrastructure.

Development plans should identify heating and cooling networks, identify proposed locations for future heating and cooling networks ad identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.

Policy SI 4: Managing heat risk

Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

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

3.2 GLA guidance on preparing energy assessments (2020)

This GLA guidance note provides further details on how to prepare an energy assessment to accompany strategic planning applications as set out in London Plan Policy SI 2. The guidance note reiterates that the purpose of energy assessments is: 'to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy'. The energy assessment carried out for this scheme follows the principles of this GLA guidance note.

3.3 Draft 'Be Seen' Energy Modelling Guidance (2020)

This guidance note explains the process that needs to be followed to comply with the 'Be Seen' post-construction monitoring requirement as set out in the London Plan Policy SI 2. The guidance sets out what each responsible party needs to do to comply with the policy from the inception stage of a development to full occupancy. It also provides information on the 'be seen' monitoring portal and breaks up the process into three main reporting stages on which information needs to be submitted (i.e. planning stage, as-built stage and in-use stage). The 'Be Seen' section of this report has followed the principles of this GLA guidance note.

3.4 Core Strategy (2011)

Strategic Policy 13: High environmental standards

The Strategic Policy 13 sets out Southwark Council's approach to development that will help us live and work in a way that respects the limits of the planet's natural resources, reduces pollution and damage to the environment and helps us adapt to climate change.

This is achieved by;

1. Requiring development to meet the highest possible environmental standards, including targets based on the Code for Sustainable Homes and BREEAM.
2. Requiring all new development to be designed and built to minimise greenhouse gas emissions across its lifetime. This will be achieved by applying the energy hierarchy;
   a. Designing all developments so that they require as little energy as possible to build and use.
   b. Expecting all major developments to set up and/or connect to local energy generation networks where possible. We will develop local energy networks across Southwark.
   c. Requiring developments to use low and zero carbon sources of energy.
3. Enabling existing buildings to become more energy efficient and make use of low and zero carbon sources of energy.

The Policy targets aim to reduce CO_2 emissions across Southwark by 80% over 2005 levels by 2050, as well as all non-residential development (excluding community facilities and schools) should achieve at least BREEAM 'excellent'.

3.5 Draft New Southwark Plan (2020)

Southwark Council declared a Climate Emergency as of 2019, with the ambition to reach carbon neutrality by 2030. The New Southwark Plan has been developed as a response to this ambition, with the 'Cleaner, Greener, Safer' strategic policy setting out the aim of protecting and enhancing the environment through making new and existing buildings as energy efficient as possible.

Policy 68: Sustainability standards

Development must achieve a BREEAM rating of 'Excellent' for non-residential development and non self-contained residential development over 500sqm; and achieve BREEAM rating of 'Excellent' in non-domestic refurbishment for conversion, extension and change of use of non-residential floorspace over 500sqm

Development must reduce the risk of overheating, taking into account climate change predictions over the life time of the building, in accordance with prioritised measures set out in the GLA London Plan cooling hierarchy.

Policy 69: Energy

Developments must minimise carbon emissions on site in accordance with the energy hierarchy; be lean, be clean, be green.

Major developments must reduce carbon dioxide emissions on site by a minimum of 40% on 2013 Building Regulations Part L and zero-carbon (100%) for non-residential developments. Any shortfall against carbon emissions reduction requirements must be secured off site through planning obligations or as a financial contribution.

Major developments must be designed to incorporate decentralised energy in accordance with the following hierarchy:

1. Connect to an existing decentralised energy network.
2. Be future-proofed to connect to a planned decentralised energy network.
3. Implement a site-wide low carbon communal heating system.
4. Explore and evaluate the potential to oversize the communal heating system for connection and supply to adjacent sites and, where feasible be implemented.

4 Establishing carbon dioxide emissions – baseline

This section presents the baseline carbon dioxide emissions which are used to assess the carbon dioxide savings achieved by the proposed design.

4.1 Software and modelling information

Regulated and unregulated CO_2 emissions were calculated using EDSL Tas v9.5.1. The proposed building was modelled in EDSL Tas and with all proposed uses appropriately zoned with internal conditions in line with the National Calculation Methodology (NCM). Design drawings issued by AHMM Architects in June 2021 were used to model the proposed buildings.

4.2 Methodology

The following methodology was applied to calculate the carbon dioxide emissions reduction baseline:

1. For the floors that are being refurbished (Georgian Terrace), the baseline assumes the notional specification for existing buildings shown in Appendix 4 of the GLA guidance on preparing energy assessments. This is based on Part L1B and Part L2B of the Building Regulations 2013, as well as the Government's Building Services Compliance Guidance.
2. For the new part of the proposed design (tower and Keats House), the baseline is the 'notional building' according to Part L2A 2013 of the Building Regulations.

The baseline for the 'whole building' carbon emissions reduction assessment will be the combination of these two baselines; (1) and (2).

4.3 Fabric assumptions

Table 8 gives a summary of the parameters assumed for the existing building refurbishment baseline. This assumes the notional specification for existing buildings according to the Energy Assessment Guidance 2020. It also summarises the parameters assumed for a notional new build construction according to Part L2A of Building Regulations.

Table 8 Baseline building – Fabric performance assumptions for the existing building elements.

Building element	Thermal performance	
	Existing building baseline	New built notional
External walls	0.55 W/(m^2.K)	0.26 W/(m^2.K)
Roof	0.18 W/(m^2.K)	0.18 W/(m^2.K)
Floor	0.25 W/(m^2.K)	0.22 W/(m^2.K)
Window	1.80 W/(m^2.K)	1.60 W/(m^2.K)
Glazing	0.40 (g-value)	0.40 (g-value)
Air permeability	25 m^3/(m^2.hr) @ 50 Pa	3 m^3/(m^2.hr) @ 50 Pa

4.4 Building services systems assumptions

System types are modelled as per the actual building and heating provided by gas boiler and can be found in the table below:

Table 9 Assumptions for the building systems baseline scenario across the whole development.

System	Refurbishment	New build	Source
Main heating fuel (heating and hot water)	Mains gas	Mains gas	GLA energy assessment guidance (2020)
Boiler efficiency	84%	91%	Appendix 4 of GLA energy assessment guidance (2020) / Table 5 of Part L2A 2013
Ventilation	Mixed-mode	Mixed-mode	Confirmed by MEP engineer
Central ventilation SFP	2.20 W/l/s	1.8 W/l/s	Appendix 4 of GLA energy assessment guidance (2020) / Table 5 of Part L2A 2013
Terminal Unit SFP	0.50 W/l/s	0.3 W/l/s	
Cooling efficiency (SEER)	4.70	2.70	
Heat recovery	70%	70%	
Hot water system efficiency	84%	91%	
Lighting efficacy	51 lm/W	60 lm/W	

4.5 Baseline carbon dioxide emissions

The baseline carbon dioxide emissions are presented in Table 10.

Table 10 Baseline carbon dioxide emissions

	Carbon dioxide emissions (tCO_2/year)	
	Regulated	Unregulated
Part L 2013 compliant building	594.5	551.8

5 Be Lean – Demand reduction

The project team has sought to maximise energy efficiency through considerate measures, set out in this section.

The energy efficiency strategy has been developed following a hierarchical approach. The strategy aims to reduce energy demands by first incorporating suitable design measures, followed by proposed enhancements to provide an efficient building fabric (where possible) and highly efficient heating, ventilation, and air conditioning (HVAC) systems.

The overall energy efficiency of the scheme has been achieved by incorporating the following passive and active measures.

5.1 Passive measures

Passive measures to reduce energy demand incorporated in the project include:

- A window g-value of 0.37 was used for the new windows of the tower to reduce overheating risk and reliance on mechanical cooling.
- The use of exposed concrete slabs provide high thermal mass to moderate the cooling loads.
- Low air permeability reduce leakage through the façade.
- Good level of insulation on the new building fabric and where possible also on the refurbished exposed walls and roofs.
- Openable windows are provided at every office floor as well as the Georgian Terrace to maximise potential of natural ventilation through the year.
- Optimised glazing ratio to reduce solar gains whilst ensuring access to daylight.
- Design of effective shading devices dependent on the solar orientation of the façade.

5.2 Building fabric

The proposed fabric performance of the retained elements is summarised in Table 11 and Table 12.

Table 11 Proposed building fabric performance for the retained elements.

Element	Thermal performance
External walls (new)	0.28 W/(m^2.K)
External walls (retained)	0.35 W/(m^2.K)
Roof (new)	0.16 W/(m^2.K)
Floor (retained)	0.25 W/(m^2.K)
Windows	1.8 W/(m^2.K)
Glazing (g-value)	0.40
High usage entrance doors	1.8 W/(m^2.K)
Air permeability	10 m^3/(m^2.hr) @ 50 Pa

Table 12 Proposed building fabric properties for the newly built elements.

Element		Thermal performance
Curtain wall (Tower)	Average area-weighted	1.20 W/(m^2.K)
	Glass	1.10 W/(m^2.K)
	Glass (g-value)	0.37
	Solid	0.18 W/(m^2.K)
	Frame	3.50 W/(m^2.K)
External wall (Keats House)		0.30 W/(m^2.K)
Roof		0.12 W/(m^2.K)
Floor		0.20 W/(m^2.K)
Revolving doors		5.40 W/(m^2.K)
Air permeability		3 m^3/(m^2.hr) @ 50 Pa

5.3 Active measures

The same system serves both the refurbished Georgian Terrace and new-build Tower, therefore the active measures applied are the same.

Ventilation

Mixed-mode with mechanical ventilation is proposed for the offices; mechanical ventilation for the kitchen and basement stores and plant rooms; VAV for the reception; CAV for the changing areas; fan coil system for the retail spaces; extract only for the toilets; and natural ventilation for all circulation spaces.

Refer to Section 11.3 for further information on the proposed systems for the scheme.

Heating, cooling, and hot water systems

In line with paragraphs 7.7 and 7.8 of GLA guidance the 'Be Lean' case should assume that the heating is provided by gas boilers and active cooling would be provided by electrically powered equipment. The boilers should be assumed to have an efficiency of 91%.

Lighting

All main tenant office areas include auto on / auto off presence detection and photocell dimming. All spaces are modelled with a minimum lighting efficacy of 70 lm/W, with reception and retail spaces modelled at 95 lm/W.

Refer to Section 11.3 for further information on the proposed systems for the scheme.

5.4 Be Lean – Carbon dioxide emissions after demand reduction

The Be Lean stage carbon dioxide emissions and savings are presented in the tables below.

Table 13 Carbon dioxide emissions after each stage of the energy hierarchy.

	Carbon dioxide emissions (tCO_2/year)	
	Regulated	Unregulated
Part L 2013 compliant building	594.5	551.8
Be Lean	410.2	551.8

Table 14 Regulated carbon dioxide savings from each stage of the energy hierarchy.

		Regulated carbon dioxide savings	
		tCO_2/year	%
Be Lean	Savings from demand reduction	184.4	31%

6 Cooling and overheating

6.1 The cooling hierarchy

As part of the drive to reduce energy demand highlighted by the Mayor's cooling hierarchy set out in Policy SI 4 of the London Plan, the Proposed Development has considered several passive and active measures to reduce the need for cooling. The approach is summarised in Table 15.

Table 15 Measures from the London Plan cooling hierarchy implemented in the Proposed Development.

London Plan cooling hierarchy	Proposed measures
Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure.	• Optimised glazing ratio to reduce solar gains whilst ensuring access to daylight. • Design of effective shading devices dependent on the solar orientation of the façade. • The proposed construction aims to achieve low air permeability.
Minimise internal heat generation through energy efficient design	• Energy efficiency lighting specified throughout. • Lighting controls. • Well insulated ductwork with very low losses in the heating/hot water systems distribution will be used.
Manage the heat within the building through exposed internal thermal mass and high ceilings	• The exposed concrete slabs provide high thermal mass to moderate the cooling loads for the tower. Keats House and the Georgian Terrace benefit further from the thermal mass of the building envelope structure.
Provide passive ventilation	• Openable windows are provided at every office floor in the main Tower, as well as in the Georgian Terrace, to maximise potential of natural ventilation throughout the year.
Provide mechanical ventilation	• Adequate ventilation provided by a mixed mode system with mechanical ventilation and heat recovery
Provide active cooling systems	• Highly efficient air source heat pump with chiller across the whole development to provide cooling.

6.2 Overheating risk analysis

An overheating analysis has been carried out using dynamic simulation modelling software, where the proposed building has been modelled with Tas v9.5.1. GLA recommends that *all developments are required to undertake a detailed analysis of the risk of overheating* and the purpose of this study is to support the energy statement.

Scope

This study relates to the office, reception, and restaurant zones of the Proposed Development. The overheating analysis has been conducted separately for each part of the development; the Georgian Terrace refurbishment, and the Tower and Keats House new-build.

The thermal comfort assessment described in this report is based on the drawings issued by AHMM Architects on 13th February 2021.

Criteria

According to the GLA energy assessment guidance (2020), overheating analysis for non-domestic should be demonstrated according CIBSE TM52. The intent of this methodology is to inform designers, developers, and others responsible for defining the indoor environment in buildings and should be considered when carrying out dynamic thermal modelling.

Weather files

Overheating calculations have been carried out using the following weather scenarios as required by the GLA guidance:

- DSY1 for the 2020s, high emissions, 50% percentile.
- DSY2 - 2003: a year with a very intense single warm spell.
- DSY3 - 1976: a year with a prolonged period of sustained warmth.

Internal gains

A combination of project-specific internal conditions and NCM profiles were used for the purpose of this study. The following table shows the internal conditions used for the simulation:

Table 16 Design conditions of the office, retail, and reception areas.

Internal conditions	Office	Retail	Reception
Cooling setpoint / setback	24 / 28 °C	24 / 28 °C	23 / 150 °C
Heating setpoint / setback	22 / 5 °C	20 / 5 °C	20 / 12 °C
Occupancy sensible gain	11.25 W/m^2	13.42 W/m^2	8.61 W/m^2
Lighting gain	6 W/m^2	10 W/m^2	19.4 W/m^2
Equipment gain	15 W/m^2	18.88 W/m^2	6.19 W/m^2

Sensitivity study

A sensitivity study has been carried out to identify the potential of overheating risk in the office spaces without the provision of mechanical cooling (only natural ventilation). The results show that all the assessed zones fail the overheating criteria with the DSY1 weather file, except for the offices within the basement of the new build tower. The results of this study are included in Section 11.4.

Results

The results of the assessment with all the passive and active measures are presented in Section 11.4 and show that all the assessed zones pass the criteria. Additional iterations for DSY2 and DSY 3 were carried out and both pass the overheating criteria. These are also included in Section 11.4.

6.3 Active cooling

Active cooling is proposed for the development. Natural ventilation is not enough to guarantee occupant comfort in line with the CIBSE TM52 criteria, therefore, active cooling has been proposed. The cooling requirements of the development are identified in the table below.

Table 17 Cooling demand for the whole Proposed Development compared to a baseline building.

	Area weighted average cooling demand (MJ/m^2)	Total area weighted cooling demand (MJ/year)
Actual	14.4	703,094
Notional	117.8	5,734,746

7 Be Clean - Heating infrastructure

Due to the relatively low domestic hot water demand related to office and retail uses and the lack of a stable heating demand baseload, the use of a Combined Heat and Power (CHP) system was not deemed as an adequate strategy for this project. Indeed, a CHP needs to usually run for 3,500 – 4,500 hours/year to be considered practically and economically feasible.

According to the London Borough of Southwark's 2019 Energy Mapping and Masterplanning report, the site is in an identified district heating opportunity area. Potential low carbon energy sources include the River Thames, London Bridge Tube Station (possible vent shaft) and existing CHP. However, currently there are no district heating networks in the vicinity of the site area. The London Heat Map Tool indicates that the nearest network is located 1 km from the site (Please refer to Figure 4).

On the London Heat Map there is a reference to an EU ETS site (at postcode SE1 9RS) and a 'Communal Boiler Study' that belong to the Guys & St Thomas' Hospital NHS Trust. We have approached Guy & St Thomas' Hospital NHS Trust to check whether they would consider and have capacity to supply heating/cooling to a nearby third-party project. However, we had no response. Communication with the Guy & St Thomas' Hospital NHS Trust is shown in Section 11.5.

The site is therefore not located within a viable distance to a heating network. However, the scheme will be made 'connection ready', by allowing the necessary space for the required heat exchanger (Figure 5) and pipework, so that connection can be made to the system at an appropriate point in the future, subject to a district heating network being installed adjacent to the site or availability is established by the NHS trust.

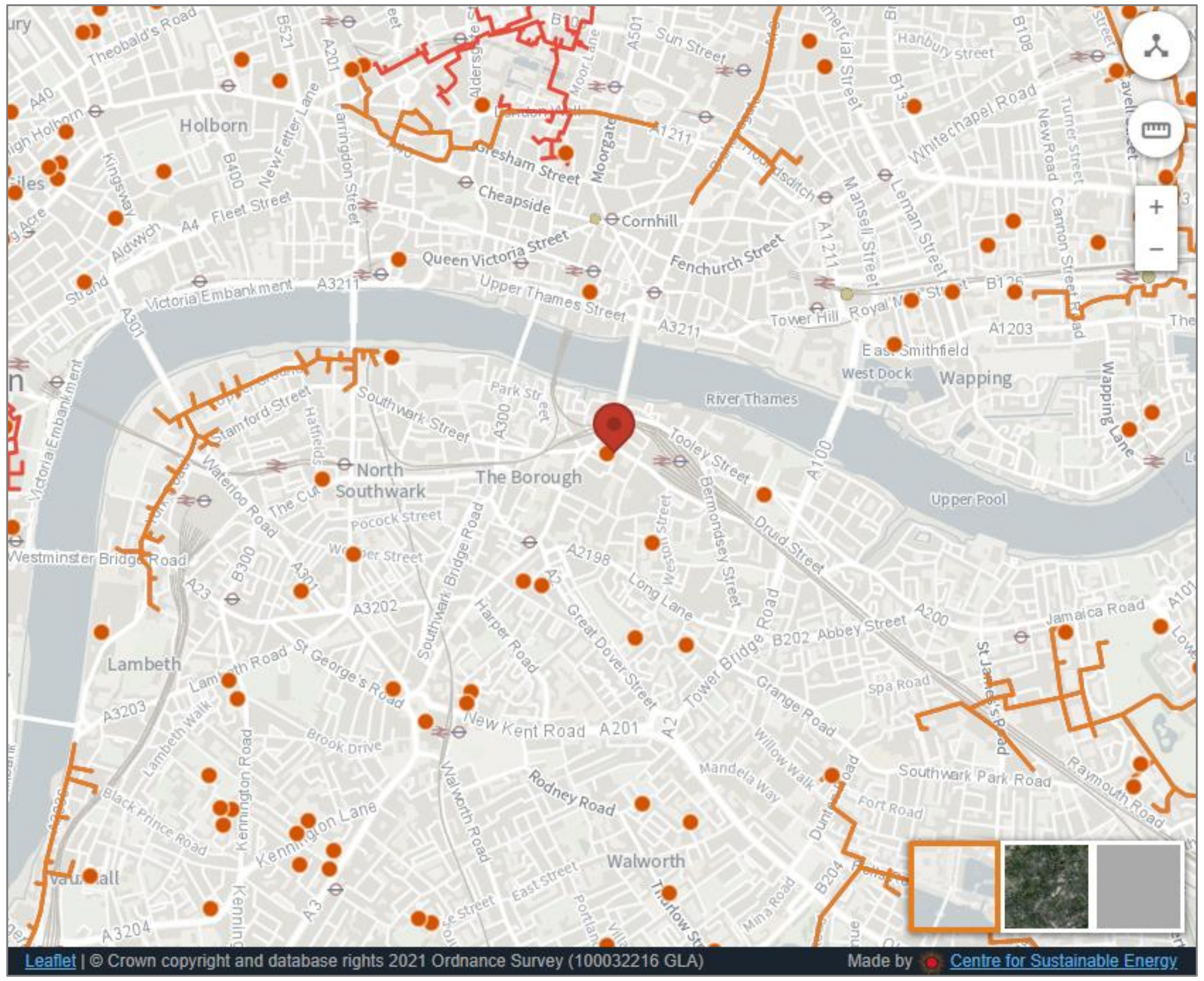


Figure 4 The site highlighted on the London Heat Map.

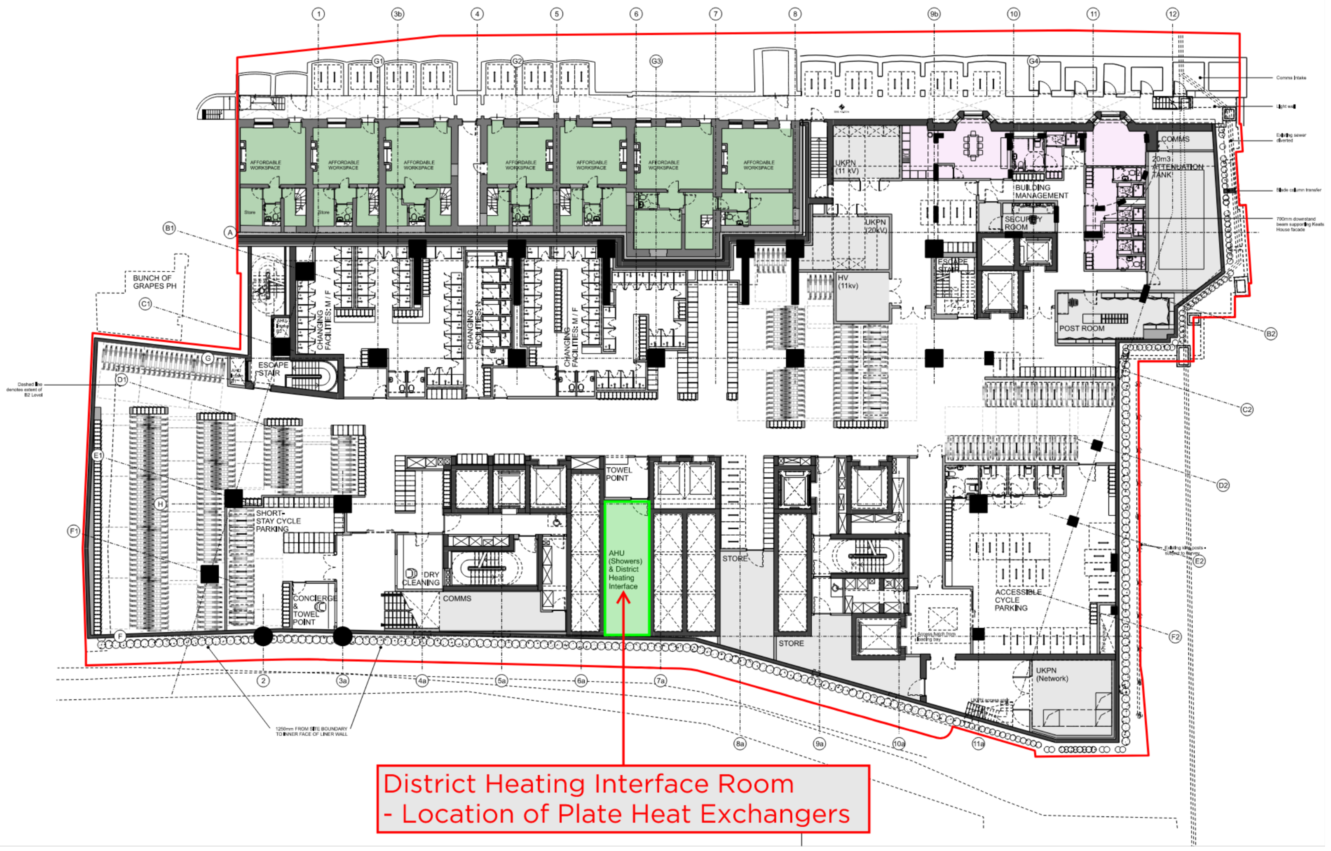


Figure 5 The location for connection with a potential district heating network is shown on Level B01 annotated via a red arrow.

7.1 Be Clean – Carbon dioxide emissions after heating infrastructure

The Be Clean stage carbon dioxide emissions and savings are presented in the tables below.

Table 18 Carbon dioxide emissions after each stage of the energy hierarchy.

	Carbon dioxide emissions (tCO_2/year)	
	Regulated	Unregulated
Part L 2013 compliant building	594.5	551.8
Be Lean	410.2	551.8
Be Clean	410.2	551.8

Table 19 Regulated carbon dioxide savings from each stage of the energy hierarchy.

		Regulated carbon dioxide savings	
		tCO_2/year	%
Be Lean	Savings from demand reduction	184.4	31%
Be Clean	Savings from CHP	0.0	0%

8 Be Green – Renewable energy

The final step in the energy hierarchy requires the generation of energy by renewable energy technologies, to be examined in line with the London Plan Policy SI 2: 'Minimising Carbon Dioxide Emissions', and the New Southwark Plan Policy 69: 'Energy'.

The following technologies have been investigated:

- Photovoltaic panels
- Solar water heating
- Wind turbines
- Heat pumps
- Alternative fuels including biomass and biofuels

Key parameters which have been considered in this feasibility study include:

- Current and future planning policies/aspirations;
- Opportunities of the site and energy demand/profile of the development;
- Practical implementation considerations;
- Installation and maintenance issues;
- Implications for internal arrangement and space allocation, infrastructure and site layout;
- Public acceptability;
- Environmental and visual impact;
- Deliverability;
- Security and availability of fuel supply;
- Capital and life cycle costs, payback and grants;
- Carbon contribution and cost per CO_2 saving; and
- Interactions of the technologies with one another.

The Low and Zero Carbon (LZC) feasibility matrix with detailed information on various renewable energy technologies, their benefits and drawbacks for the Proposed Development can be found in Section 11.7.

8.1 Photovoltaic panels

Photovoltaic (PV) panels directly convert sunlight into electrical current using semiconductors. The output of a cell is directly proportional to the intensity of the light received by the active surface of the cell.

The efficiency of PV panels is relatively low around 6-19% (depending on the technology). Despite this low efficiency, their advantage is low maintenance, and zero-carbon electricity that offsets grid electricity and hence provides considerable CO_2 emissions savings. A well-designed installation in an optimum location can generate around 150 kWh annually per m^2 installed, but this can be significantly lower depending on the efficiency of the modules.

For the Proposed Development, this strategy shows a significant potential particularly due to the high unobstructed rooftop of the main building and the careful design of plant to create an available installation area.

A total of 197.2 m^2 of photovoltaic panels are being proposed at the roof level. This area was selected as it is unobstructed from any neighbouring building or self-shading. The electricity displaced through the use of these photovoltaic panels is expected to be approximately 26 MWh per annum.

The option to select east-west facing roof-level photovoltaic panels has multiple benefits:

- The continuous PV layout reduces the risk of overshadowing from an adjacent PV array.
- The configuration allows for a higher PV density on a given area.
- The configuration will result in a slight improvement over a south-facing PV layout fitted on the same area. Furthermore, the system would allow the PVs to capture more solar energy earlier during the day and later during the afternoon than a conventional south-facing system. Hence the maximum output of the system avoids the energy 'spikes' available via the grid at midday smoothening the energy demand.

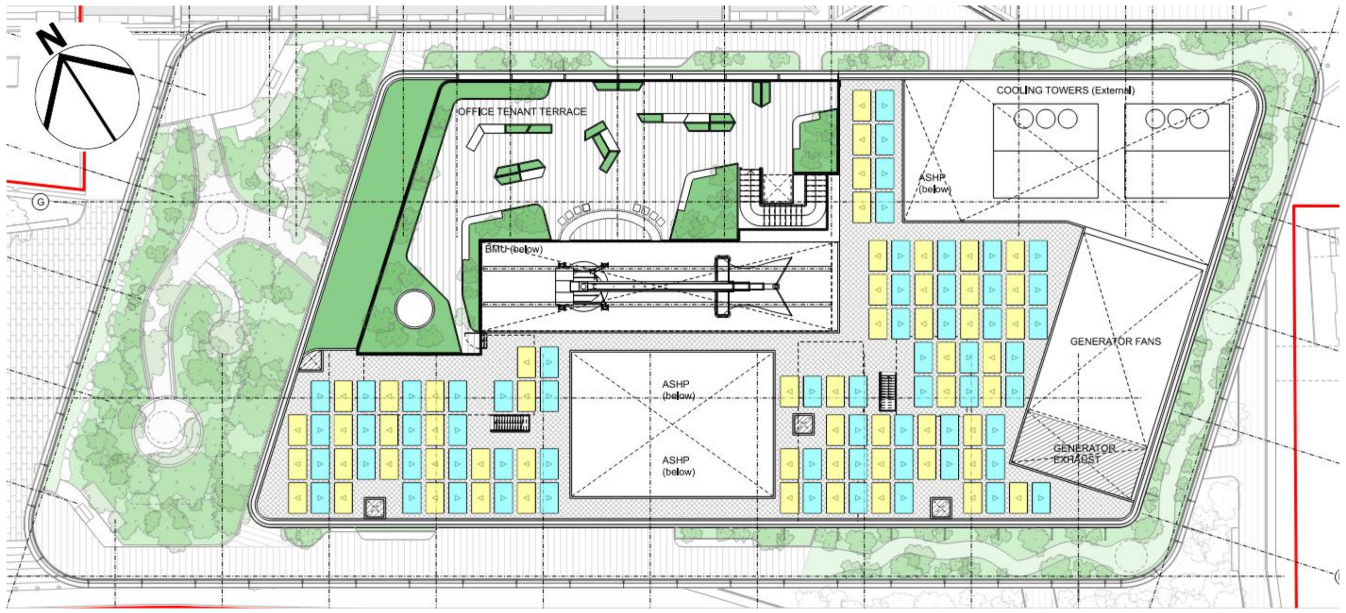


Figure 6 Roof plan showing photovoltaic panels layout in blue (east-facing) and yellow (west-facing).

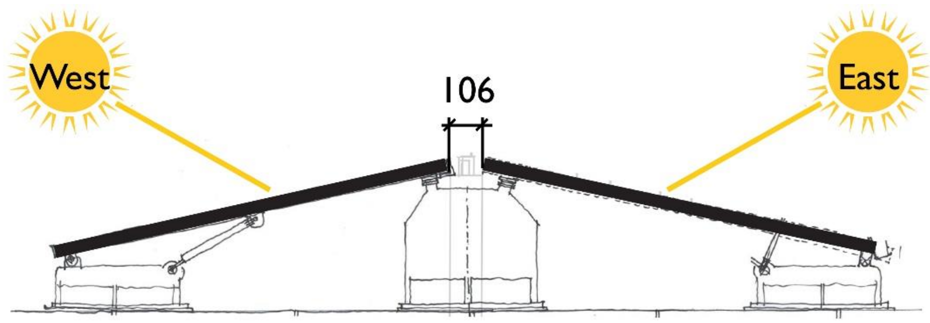


Figure 7 east-west PV layout concept.

Building integrated photovoltaic panels (BIPVs) are also proposed for the south façade, totalling 311 m^2. Placing PV panels on the façade allows the Proposed Development to maximise the potential electricity displaced. The electricity displaced through BIPVs is expected to be approximately 16.5 MWh per annum. South-facing BIPVs were selected over other orientations for the following reasons:

- The building core is situated along the south façade, meaning there is a reduced glazed area and increased opaque area to place the PV panels.
- South-facing orientation receives the greatest solar radiation resulting in increased PV efficiency.
- The surrounding buildings to the south are low-level, having little impact on overshadowing the PV panels

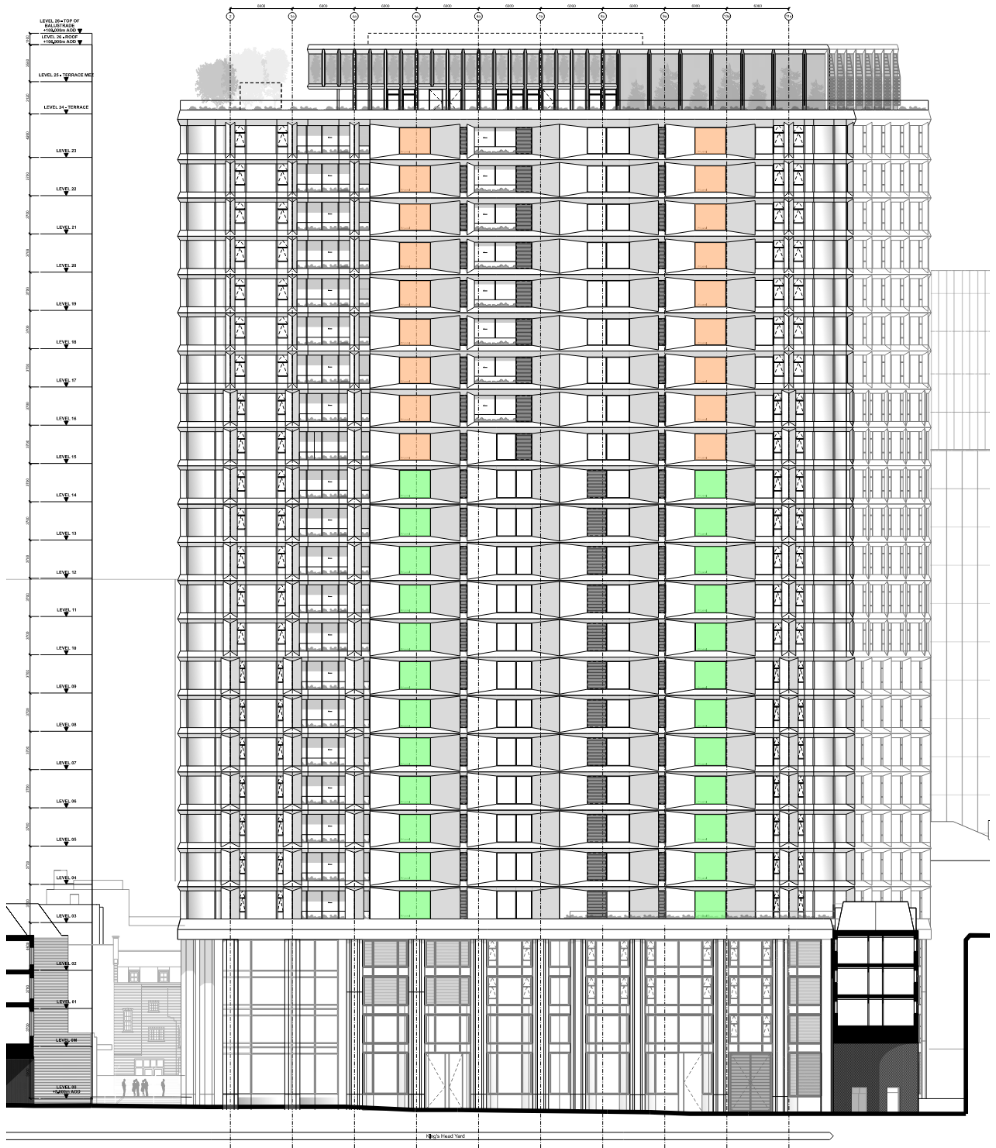


Figure 8 South elevation showing PV panels layout in orange (7.2 m² per panel) and green (7.6 m² per panel).

Figure 6 indicates the proposed roof-level PV layout and Figure 8 indicates the BIPV layout for the south façade. Based on the assumptions given below, the total PV system capacity is 77.9 kWp. When modelled and simulated using a CIBSE TRY weather file, the predicted maximum daily energy output of the system is calculated as 33.6 kW. The approximate heights of the surroundings and roof levels are given in Figure 9. The surrounding heights are approximate.

Table 20 Photovoltaic panel system properties.

	West-facing roof PV panels	East-facing roof PV panels	South-facing BIPV panels
Panels	56	60	42
Orientation	302°	122°	229°
Efficiency	19%		13%
Inclination	10°		90°
Displaced electricity	42.5 MWh per annum		
Carbon emissions savings	9.9 tonnes CO_2 per annum		

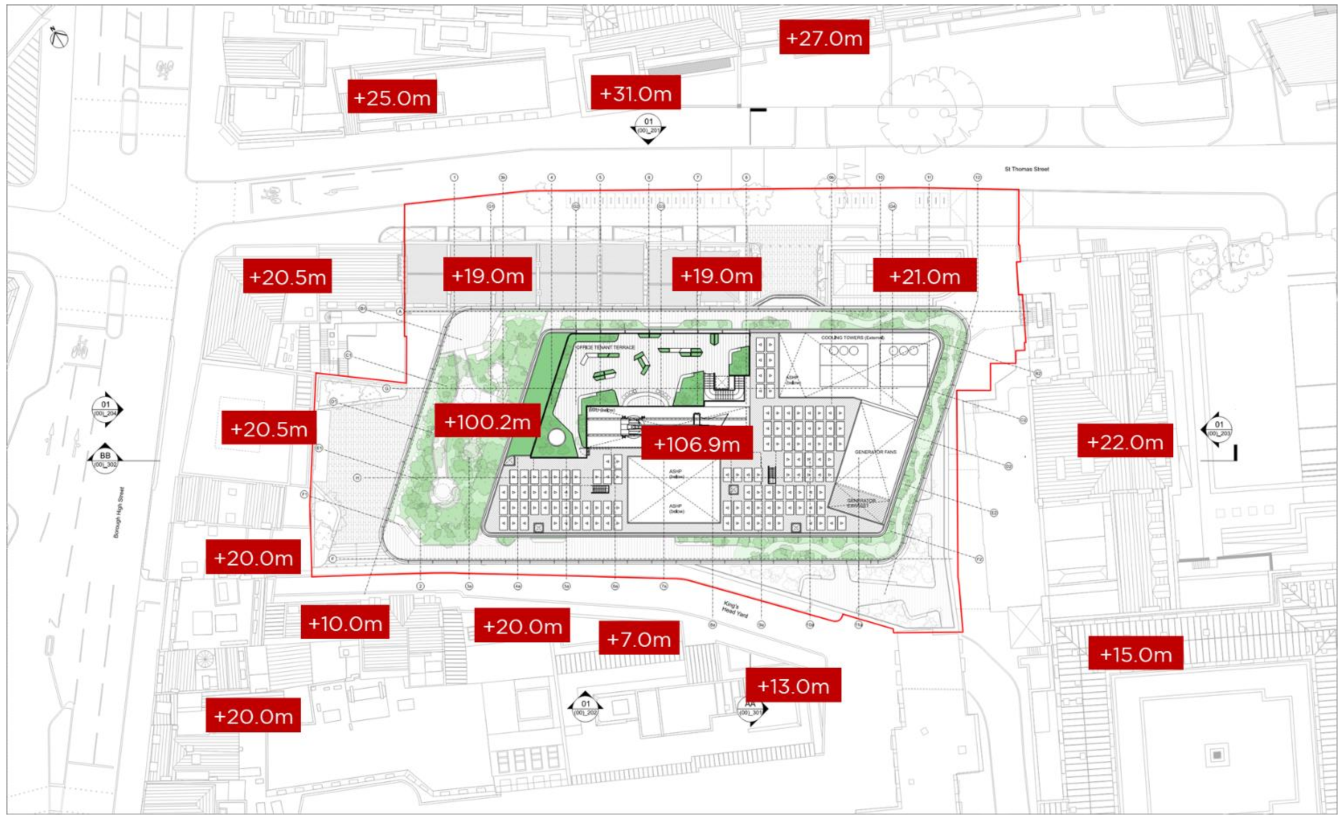


Figure 9 Approximate building heights above AOD.

8.2 Solar thermal

Solar hot water systems, usually placed upon the roof of a building, harness solar radiation in order to generate a heated water supply. The location and positioning of solar thermal array is very important in achieving acceptable performance.

Solar water heating is currently one of the most cost effective and affordable renewable technologies. Renewable solar energy is converted to heat via panels that absorb the high frequency heat radiation emitted from the sun. Evacuated tube technology maximises useful heat extraction even on a cold, cloudy day.

This technology has not been recommended for the scheme due to the very low domestic hot water demand for the non-domestic uses proposed.

8.3 Wind turbines

Wind turbines come in vertical and horizontal axis forms and generate electrical energy using the wind. They have in the past received a poor reputation due to their carbon intensive construction and issues associated with noise and visual impact of wind farms. However, systems are becoming more and more common as well as more accepted even in some low-density urban areas or for exceptionally tall buildings. Small scale turbines suitable for domestic type environments are also now more available and affordable.

Wind energy is a cost-effective method of renewable power generation. Wind turbines can produce electricity, ranging from watts to megawatt outputs, without CO2 emissions. Turbines must reliably generate sufficient energy to be useful, but still be small enough to mount on the building. They must also be sufficiently quiet to be acceptable to both building users and the occupants of surrounding buildings. Vibration must also be limited so that damage is not caused to the building or turbine.

For wind turbines to operate effectively, the average wind speed for the site needs to be above a threshold level of 6.3 m/s. Wind speeds in built up urban areas are not reliable and therefore this technology is not considered suitable for the scheme.

8.4 Ground source heat pumps

Ground source heat pumps are an established technology which operate like a refrigerator, consisting of a vapour compression cycle heat pump, linked to a heat exchanger buried in the ground.

Ground source heat pumps are not considered viable due to insufficient space.

8.5 Air source heat pumps

Air source heat pump systems can efficiently elevate low-grade environmental heat from the air to the level required for space heating and even domestic hot water system (albeit at low efficiency). Heat pumps work much more efficiently at lower temperatures (28-35°C) than standard boiler systems and are hence more suitable to "low-energy" underfloor heating systems or larger low-temperature radiator and fan-coil systems that are also considered low-response systems as they give out heat at lower temperatures over longer periods of time.

Air source heat pumps are an established technology which operates like a refrigerator by extracting heat from the outside air and are operable even at low temperatures. Although run on electricity, the heat extracted from the air is constantly being renewed naturally.

Air source heat pumps were chosen over ground source heat pumps for this scheme due to lack of space for ground source systems.

Details of the Seasonal Coefficient of Performance (SCOP) and Seasonal Energy Efficiency ratio (SEER) of the proposed heat pump under test conditions are as follows: given below:

- SCOP (heating): 2.9 / 3.0 (restaurant DHW only) / 5.0 (showers only)
- SEER (cooling): 4.0

The ASHP will run beside water-cooled chillers in cooling mode, but will contribute to 100% of the site's heat load. This demonstrates how the heat fraction from the ASHP has been fully maximised. No additional technology will be used to meet peak load requirements. For the approach to generating domestic hot water, the showers within the basement will have calorifiers fed from the water-to-water heat pump within the basement. A schematic of the proposed heat pump system is given in Section 11.8.

It is estimated the ASHP will provide the Proposed Development with 184.9 MWh of cooling energy and 98.6 MWh of heating energy annually (see Table 21).

Table 21 Carbon dioxide savings – Air source heat pump system.

		Cooling	Heating
Energy provided by ASHP	MWh/annum	184.9	98.6

The resulting carbon dioxide reduction due to the use of the heat pump technology is 94.7 tCO_2/annum, i.e., indicating a reduction of 15.9% in carbon dioxide emissions of the whole development.

Table 22 Carbon dioxide savings – Air source heat pump system.

		tCO_2/year	%
Be Green	Savings from ASHP only	94.7	15.9

The heat pump will comply with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) product criteria for the relevant ASHP technology. The heat pump also complies with the other relevant issues as outlined in the Microgeneration Certification Scheme Heat Pump Product Certification Requirements document at: http://www.microgenerationcertification.org

The end user will be supplied with regular information to control and operate the system.

The performance of the heat pump system will be monitored post-construction to ensure it is achieving the expected performance approved during planning, in line with the 'be seen' policy.

8.6 Alternative fuels (biomass and biofuels)

Biofuels have the potential to contribute to the reduction of carbon dioxide emissions if used as a replacement fuel for a boiler or CHP plant. Biofuels are considered to have low or zero carbon intensities as the only carbon dioxide emissions attributed to biofuels are those associated with their collection, processing and distribution.

Alternative fuels such as solid biomass or liquid biofuels are used to achieve very high net CO_2 emissions savings under building regulations, albeit often with local increase in pollutant emissions and raising some concerns about sustainable management of natural resources related to over-exploitation of biomass fuel.

The rationale for using biomass fuels is that carbon dioxide is released when energy is generated using biofuels is balanced by that absorbed during the fuels production though sustainable management practices (i.e. deforestation).

In order to ensure efficient operation, biomass boilers are typically sized to meet a constant rather than highly variable base load. Moreover, in an urban location such as that of New City Court, transport and delivery of biomass would be extremely problematic and would increase the carbon intensity of the fuel. Certain biomass sources are also claimed to threaten food production and as such considered unsustainable. From an air quality perspective, biofuels commonly produce higher NOx emissions when burnt than conventional natural gas combustion and often do not meet requirements of the Clean Air Act and Local Air Quality Management Plans.

Therefore, both biomass and biofuels are not considered appropriate for this site which is located in central London and have been discounted in favour of more reliable fit and forget equipment due to the intensive nature of biofuel use on site relating to deliveries, maintenance, dust and equipment responsiveness.

8.7 Be Green – Carbon dioxide emissions after renewable energy

The Be Green stage carbon dioxide emissions and savings are presented in the tables below.

Table 23 Carbon dioxide emissions after each stage of the energy hierarchy.

	Carbon dioxide emissions (tCO_2/year)	
	Regulated	Unregulated
Part L 2013 compliant building	594.5	551.8
Be Lean	410.2	551.8
Be Clean	410.2	551.8
Be Green	305.6	551.8

Table 24 Regulated carbon dioxide savings from each stage of the energy hierarchy.

		Regulated carbon dioxide savings	
		tCO_2/year	%
Be Lean	Savings from demand reduction	184.4	31%
Be Clean	Savings from CHP	0.0	0%
Be Green	Savings from renewable energy	104.6	18%
Total cumulative savings		**288.9**	**49%**

9 Be Seen

The Mayor of London has declared a climate emergency and has set an ambition for London to be net zero-carbon. To truly achieve net zero-carbon buildings, a better understanding of their actual operational energy performance is required. Although Part L calculations give an indication of the theoretical performance of buildings, it is well established that there is a 'performance gap' between design theory and measured reality. The London Plan has introduced the 'Be Seen' framework as an attempt to bridge this gap.

For the purposes of complying with the 'Be Seen' policy, a development is split into a number of 'reportable units' (RUs) which applicants will need to report against individually. These are illustrated in the figure below.

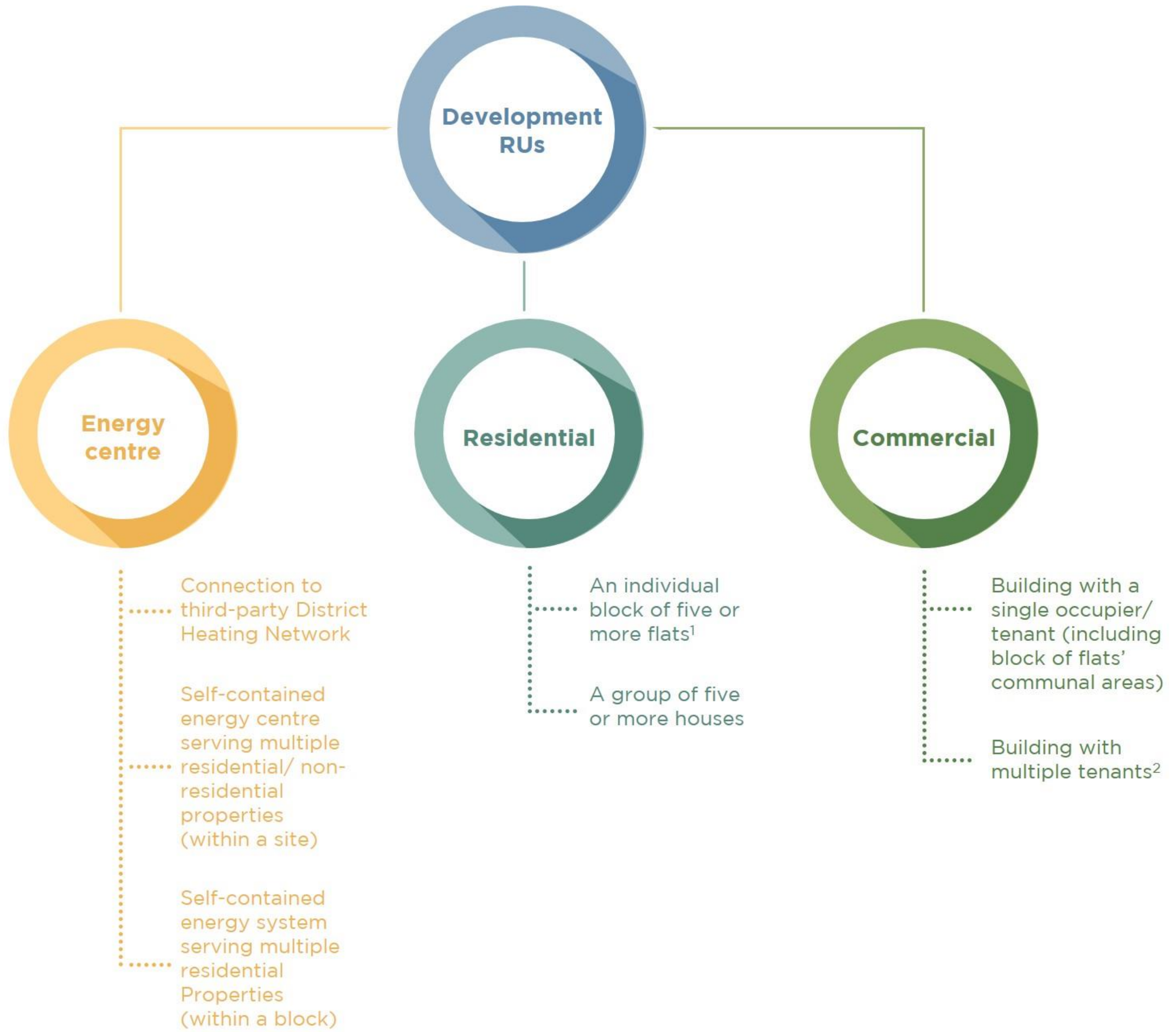


Figure 10 Visual representation of a development's Reportable Units (RUs).

Note that a de minimis threshold applies, where the gross internal floor area of a RU is less than 250 m^2 and/or the expected emissions for the unit are less than 5% of the development's total emissions. De minimis buildings are only required to report energy generation from renewable energy technologies.

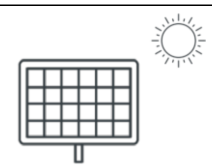
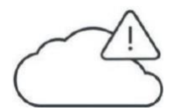
9.1 Be Seen commitment

In accordance with the Draft 'be seen' energy monitoring guidance note, the development will be designed to enable post construction monitoring, and that the information set out in Table 25 will be submitted to the GLA's portal at the appropriate reporting stages.

The evidence being requested at the planning stage should be generated via the analysis conducted as part of the energy assessment submission. For non-residential uses, energy consumption (kWh/m^2) and carbon emissions (tCO_2/m^2) estimates should be informed and reported using two separate methodologies.

Once planning approval has been granted, the Applicant commits to provide estimates of each of the performance indicators listed in the table below within 8 weeks, using the GLA 'be seen' reporting spreadsheet. The Applicant also commits to provide the upcoming reporting stages' target dates for the submission of updated information against the performance indicators at the 'as-built' and 'in-use' stages

Table 25 Planning stage performance indicators.

Performance indicator group	Description
 **Contextual data**	• Location Unique Property Reference Number (UPRN) or Address (if no UPRN available) • Site plan • Typology / Planning Use Class (all included) • GIA (m^2) for each Typology / Use Class • Anticipated target dates for each 'be seen' reporting stage (i.e. 'as-built' and 'in-use')
 **Building energy use**	• Grid electricity consumption (kWh) • Gas consumption (kWh) • Other fuels consumption (kWh) • District heating/cooling consumption (kWh) (if applicable)
 **Renewable energy**	• Energy generation (kWh)
 **Carbon emissions**	• Carbon emissions estimates (tonnes CO_2/m^2) for residential and non-residential uses separately as well as the whole development • Carbon shortfall for the entire development (tonnes CO_2) • Estimated carbon offset amount (£)

10 Conclusion

The design proposal for New City Court is supported by a robust energy strategy which demonstrates a firm commitment to the London Plan and Southwark Council policies whilst refurbishing existing building stock and contributing to lowering the borough's carbon emissions from existing buildings.

The energy strategy has followed the energy hierarchy and has set out the CO_2 emissions savings for both the refurbished Georgian terrace and new build Tower and Keats House. Across the whole site, CO_2 emissions reductions at each stage of the energy hierarchy are:

- Be Lean: 31%
- Be Clean: 0%
- Be Green: 49%

The Proposed Development has targeted demand reduction measures, giving priority to the optimisation of the building fabric to reduce the need for heating and cooling. The design is focused on achieving a low-energy building rather than relying on carbon offsetting mechanisms, committing to the priorities set in the London Plan as well as the New Southwark Plan.

Other demand reduction measures include the specification of mixed mode with mechanical ventilation with heat recovery.

In line with paragraph 9.16 of the GLA guidance, potential connection to existing heat network system was investigated, but it was not deemed viable as the Proposed Development does not lie within the vicinity of an existing or potential energy network.

The renewable obligation for the project will be met by utilising highly efficient air source heat pump technology alongside photovoltaic panels. This is estimated to contribute to 18% CO_2 emission reduction (Be Green stage of the energy hierarchy). In the context of the site setting, other opportunities for on-site renewable energy generation were explored but not deemed appropriate due to site constraints.

The design approach for the scheme follows the GLA's energy hierarchy i.e., being 'lean, clean and green' and exceedingly achieves the following targets:

- a 15% reduction in regulated CO_2 emissions through energy efficiency measures alone (be lean), below those of a development compliant with Part L 2013 of the Building Regulations
- a 35% reduction in regulated carbon emissions beyond Part L 2013 for non-residential development through on-site measures
- BREEAM 'Excellent' Ene 01 minimum standards – refer to sustainability statement produced by chapmanbdsp for details.

This Proposed Development clearly demonstrates a major commitment to reducing CO_2 emissions resulting in a 49% reduction in regulated CO_2 emissions.

As with all projects, the predicted level of CO_2 emission reductions for the Proposed Development will potentially vary as the project moves forwards since the current predictions are based on concept design information. However, the key design aspirations as set out in this and other documents submitted as part of the planning application will remain in place.

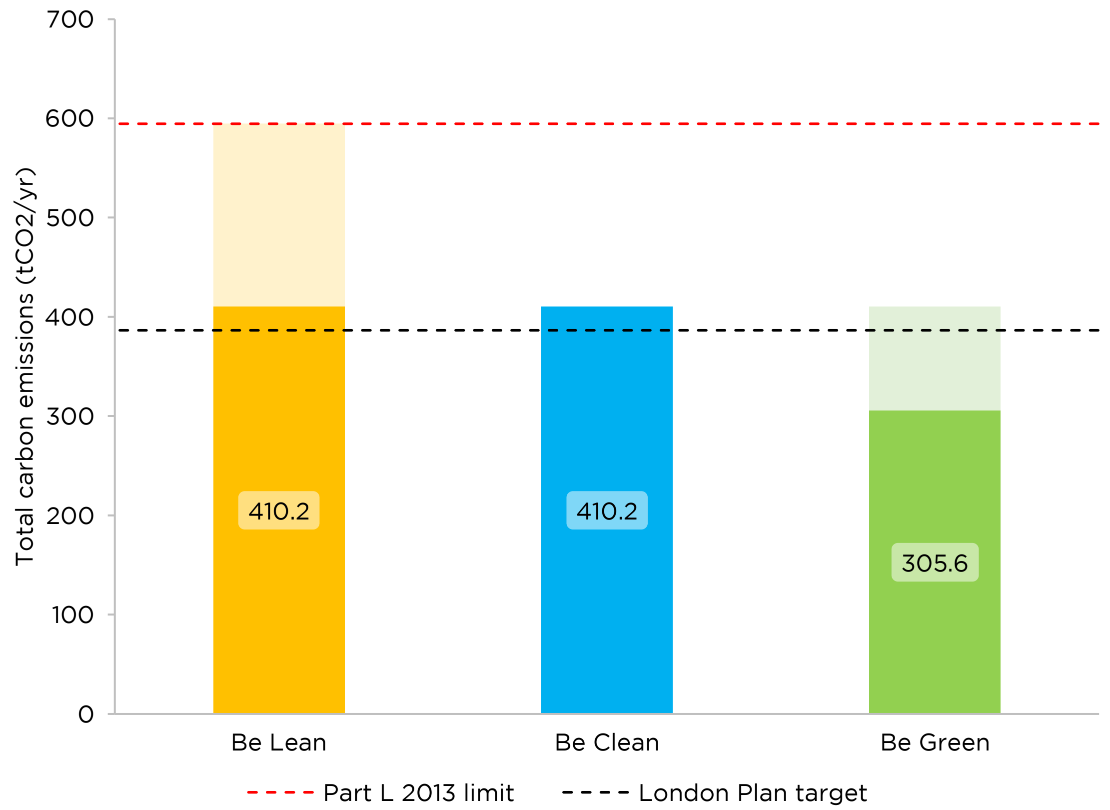


Figure 11 Regulated carbon dioxide emissions at each stage of the energy hierarchy for the whole Proposed Development using SAP 10.0 carbon factor.

11 Appendices

11.1 GLA spreadsheet

SAP 2012 Performance

SAP 10.0 Performance

Non-domestic

SAP 2012 Performance

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	1,138.6	1,228.6
After energy demand reduction (be lean)	719.6	1,228.6
After heat network connection (be clean)	719.6	1,228.6
After renewable energy (be green)	680.7	1,228.6

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	419.0	37%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	38.8	3%
Total Cumulative Savings	**457.9**	**40%**
Annual savings from off-set payment	680.7	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**20,422**	-
Cash in-lieu contribution (£)	**1,940,081**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SAP 10.0 Performance

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	594.5	551.8
After energy demand reduction (be lean)	410.2	551.8
After heat network connection (be clean)	410.2	551.8
After renewable energy (be green)	305.6	551.8

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	184.4	31%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	104.6	18%
Total Cumulative Savings	**288.9**	**49%**
Annual savings from off-set payment	305.6	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**9,168**	-
Cash in-lieu contribution (£)*	**870,981**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SITE-WIDE

SAP 2012 Performance

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2013 baseline	1,138.6		
Be lean	719.6	419.0	37%
Be clean	719.6	0.0	0%
Be green	680.7	38.8	3%
Total Savings	-	457.9	40%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**20,421.9**	-

SAP 10.0 Performance

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2013 baseline	594.5		
Be lean	410.2	184.4	31%
Be clean	410.2	0.0	0%
Be green	305.6	104.6	18%
Total Savings	-	288.9	49%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**9,168.2**	-

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

55287 - New City Court

As designed

Date: Mon Mar 22 17:38:57 2021

Administrative information

Building Details

Address: New City Court, 20 St Thomas St, London, SE1 9RS

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: HW

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	21.2
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	21.2
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	24.8
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.55	0.55	External Wall South
Floor	0.25	0.25	0.25	Basement Floor
Roof	0.25	0.18	0.18	Internal Ceiling 650
Windows***, roof windows, and rooflights	2.2	1.84	1.84	Win_GeorgianT_Varied_Sash 1/2open
Personnel doors	2.2	1.89	1.89	Door_GeorgianT_Varied_Opaque
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	25

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1488	1488
External area [m²]	2138	2138
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	1335	1164
Average U-value [W/m²K]	0.62	0.54
Alpha value* [%]	30.21	30.21

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	27.88	6.96
Cooling	0.14	7.37
Auxiliary	12.18	10.24
Lighting	23.53	20.27
Hot water	2.68	2.48
Equipment*	34.28	34.28
TOTAL**	**66.42**	**47.31**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	82.26	96.98
Primary energy* [kWh/m²]	144.61	124.89
Total emissions [kg/m²]	24.8	21.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

Figure 12 Georgian Terrace Refurbishment BRUKL; existing

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

55287 - New City Court

As designed

Date: Mon Mar 22 21:15:39 2021

Administrative information

Building Details

Address: New City Court, 20 St Thomas St, London, SE1 9RS

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: HW

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	21.2
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	21.2
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	14.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.31	0.35	External Wall North
Floor	0.25	0.25	0.25	Basement Floor
Roof	0.25	0.16	0.16	Internal Ceiling 650
Windows***, roof windows, and rooflights	2.2	1.84	1.84	Win_GeorgianT_Varied_Sash 1/2open
Personnel doors	2.2	1.89	1.89	Door_GeorgianT_Varied_Opaque
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	10

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1488	1488
External area [m²]	2138	2138
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	10	3
Average conductance [W/K]	1057	1164
Average U-value [W/m²K]	0.49	0.54
Alpha value* [%]	30.21	30.21

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	14.83	6.96
Cooling	0.14	7.37
Auxiliary	9.18	10.24
Lighting	12.28	20.27
Hot water	2.48	2.48
Equipment*	34.28	34.28
TOTAL**	**38.92**	**47.31**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	47.95	96.98
Primary energy* [kWh/m²]	85.78	124.89
Total emissions [kg/m²]	14.7	21.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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Figure 13 Georgian Terrace Refurbishment BRUKL; lean

BRUKL Output Document

Compliance with England Building Regulations Part L 2013

HM Government

Project name

55287 - New City Court

As designed

Date: Mon Mar 22 21:20:43 2021

Administrative information

Building Details

Address: New City Court, 20 St Thomas St, London, SE1 9RS

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: HW

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	21.6
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	21.6
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	16
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.31	0.35	External Wall North
Floor	0.25	0.25	0.25	Basement Floor
Roof	0.25	0.16	0.16	Internal Ceiling 650
Windows***, roof windows, and rooflights	2.2	1.84	1.84	Win_GeorgianT_Varied_Sash 1/2open
Personnel doors	2.2	1.89	1.89	Door_GeorgianT_Varied_Opaque
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	10

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1488	1488
External area [m²]	2138	2138
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	10	3
Average conductance [W/K]	1057	1164
Average U-value [W/m²K]	0.49	0.54
Alpha value* [%]	30.21	30.21

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	8.11	4.97
Cooling	0.14	7.37
Auxiliary	8.96	10.02
Lighting	12.28	20.27
Hot water	2.14	2.48
Equipment*	34.28	34.28
TOTAL**	**31.63**	**45.11**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	47.95	96.98
Primary energy* [kWh/m²]	94.69	122.83
Total emissions [kg/m²]	16	21.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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Figure 14 Georgian Terrace Refurbishment BRUKL; green

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

55287 - New City Court

As designed

Date: Thu Jun 24 12:04:28 2021

Administrative information

Building Details

Address: New City Court, 20 St Thomas St, London, SE1 9RS

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: HW

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	23.3
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	23.3
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	14.8
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.3	0.3	Party Wall
Floor	0.25	0.18	0.18	Internal Floor
Roof	0.25	0.12	0.2	Internal Ceiling 350
Windows***, roof windows, and rooflights	2.2	0.82	1.82	Win_Fixed_Fit_Keats_00M_01
Personnel doors	2.2	1.7	1.9	Door_Fixed_Keats
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	3.75	5.38	Door-L00_Revolving

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	3

Page 1 of 21

Figure 15 Main tower BRUKL; lean

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	47212	47212
External area [m²]	27793	27793
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	16904	13382
Average U-value [W/m²K]	0.61	0.48
Alpha value* [%]	22.06	22.06

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
1	**A1/A2 Retail/Financial and Professional services**
1	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
98	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.42	1.3
Cooling	1.03	11.67
Auxiliary	10.35	9.39
Lighting	11.09	18.8
Hot water	13.36	13.36
Equipment*	49.08	49.08
TOTAL**	**38.26**	**54.52**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	22.36	125.42
Primary energy* [kWh/m²]	86.52	137.2
Total emissions [kg/m²]	14.8	23.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

55287 - New City Court

As designed

Date: Thu Jun 24 11:22:25 2021

Administrative information

Building Details

Address: New City Court, 20 St Thomas St, London, SE1 9RS

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: HW

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	23.2
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	23.2
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	13.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.3	0.3	Party Wall
Floor	0.25	0.18	0.18	Internal Floor
Roof	0.25	0.12	0.2	Internal Ceiling 350
Windows***, roof windows, and rooflights	2.2	0.82	1.82	Win_Fixed_Fit_Keats_00M_01
Personnel doors	2.2	1.7	1.9	Door_Fixed_Keats
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	3.75	5.38	Door-L00_Revolving

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	3

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Figure 16 Main tower BRUKL; green

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	47212	47212
External area [m²]	27793	27793
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	16904	13382
Average U-value [W/m²K]	0.61	0.48
Alpha value* [%]	22.06	22.06

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
1	**A1/A2 Retail/Financial and Professional services**
1	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
98	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.18	0.96
Cooling	1.03	11.67
Auxiliary	10.23	9.26
Lighting	11.09	18.8
Hot water	4.89	6.77
Equipment*	49.08	49.08
TOTAL**	**28.42**	**47.46**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0.9	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	22.36	125.42
Primary energy* [kWh/m²]	85.07	134.12
Total emissions [kg/m²]	13.9	23.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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11.3 Building services system assumptions

55287 - New City Court
RIBA Stage 2
Modelled by HW
Reviewed by PP
Date 25/06/2021

chapmanbdsp

Parameters		Green									Clean	Lean
		Office	Sales	Kitchen	Toilet	Circulation / above-ground plant	Plant (sub-level) / Store / Laund	Changing	Reception	Restaurant	Main spaces	Main spaces
Lighting	Units											
Lighting efficacy	lm/W	70	95	70	70	70	70	70	70	95	→	→
Lighting gain	W/m^2	-	-	-	-	-	-	-	-	-	→	→
Auto presence detection		Auto On/Auto Off	-	-	Auto On/Auto Off	Auto On/Auto Off	Auto On/Auto Off	Auto On/Auto Off	Auto On/Auto Off	-	→	→
Daylight control		Photocell dimming	-	-	-	-	-	-	-	-	→	→
Daylight control - Back space sensor		Yes	-	-	-	-	-	-	-	-	→	→
Daylight control - Photocell on Timer Clock		Yes	-	-	-	-	-	-	-	-	→	→
Constant illuminance control		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	→	→
Display lighting efficacy	lm/W	-	80	-	-	-	-	-	30	80	→	→
Auto time switching control for display lighting		-	No	-	-	-	-	-	Yes	No	→	→
Ventilation	Units											
System type		Mixed Mode	Fancoil	Mechanical Ventilation	Extract Only (fan remote from zone)	Natural Ventilation	Mechanical Ventilation	CAV	VAV	Fancoil	←	←
Demand control sensor		Gas	Gas	Gas	-	-	-	Gas	Gas	Gas	←	←
Demand control method		Speed control	Speed control	Speed control	-	-	-	Speed control	Speed control	Speed control	←	←
SFP - Supply	W/l/s	1.1	1.0	1.1	-	-	1.1	1.1	1.1	1.0	←	←
SFP - Extract	W/l/s	0.8	0.6	0.8	0.5	-	0.8	0.8	0.8	0.6	←	←
SFP - Terminal	W/l/s	0.3	0.2	-	-	-	-	-	-	-	←	←
Heat recovery		Thermal wheel	Thermal wheel	Thermal wheel	-	-	Thermal wheel	Thermal wheel	Thermal wheel	Thermal wheel	←	←
Efficiency	%	70%	70%	70%	-	-	70%	70%	70%	70%	←	←
Mixing behaviour		-	-	-	-	-	-	Fresh air only	Fresh air only	-	←	←
Design flow rate	ach		-	-	10	-	-	-		-	←	←
HVAC Guide Cooling		Vapour compression cycle chillers - water cooled > 750kW	Vapour compression cycle chillers - water cooled > 750kW	-	-	-	-	Vapour compression cycle chillers - water cooled > 750kW	Vapour compression cycle chillers - water cooled > 750kW	Vapour compression cycle chillers - water cooled > 750kW	←	←
HVAC Guide Heating		Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump	Heat Pump	←	Boilers in new build - Nat gas
HVAC Guide SFP		New buildings - central balanced mechanical ventilation with heating/cooling	New buildings - central balanced mechanical ventilation with heating/cooling	New buildings - central balanced mechanical ventilation with heating only	No central mech vent. Associated with this system	-	New buildings - central balanced mechanical ventilation with heating only	New buildings - central balanced mechanical ventilation with heating/cooling	New buildings - central balanced mechanical ventilation with heating/cooling	New buildings - central balanced mechanical ventilation with heating/cooling	←	←
HVAC type		chilled ceilings / passive chilled beams & disp. Vent.	Fan coil systems	other local room heater - unfanned	other local room heater - unfanned	other local room heater - unfanned	other local room heater - unfanned	constant volume system	Single-duct VAV	Fan coil systems	←	←
HVAC Guide Zone SFP (supply/extract)		new buildings - zonal supply and extract ventilation units serving a single zone	new buildings - zonal supply and extract ventilation units serving a single zone	No zonal air distribution	new buildings - zonal extract system where fan is remote from zone	-	No zonal air distribution	No zonal air distribution	new buildings - zonal supply and extract ventilation units serving a single zone	new buildings - zonal supply and extract ventilation units serving a single zone	←	←
HVAC Guide Zone SFP (terminal)		New building - other local ventilation units	New buildings - fan coil units	-	-	-	-	-	-	New buildings - fan coil units	←	←
DHW type		Electric DHW heaters	Electric DHW heaters	Electric DHW heaters	Electric DHW heaters	Electric DHW heaters	Electric DHW heaters	Heat Pump	Electric DHW heaters	Heat Pump	←	Direct fired - Nat gas
Miscellaneous - space related	Units											
Out of value monitoring		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		←	←
Pump configuration		Variable speed with multiple pressure sensor in the system	Variable speed with multiple pressure sensor in the system	Variable speed with multiple pressure sensor in the system	Variable speed with multiple pressure sensor in the system	Variable speed with multiple pressure sensor in the system	Variable speed with multiple pressure sensor in the system	Constant speed pumping	Variable speed with multiple pressure sensor in the system		←	←
Heating circuit	Units											
System type		ASHP	ASHP	ASHP	ASHP	ASHP	ASHP	ASHP	ASHP	ASHP	←	Boiler
Efficiency	COP / %	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	←	91%
Distribution efficiency	%	95%	95%	95%	95%	95%	95%	95%	95%	95%	←	90%
Fuel source		Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	←	Gas
CHP present		No	No	No	No	No	No	No	No	No	←	No
Efficiency / H:P	%	-	-	-	-	-	-	-	-	-	-	-
Fuel source		-	-	-	-	-	-	-	-	-	-	-
Priority / size basis		-	-	-	-	-	-	-	-	-	-	-
Size fraction		-	-	-	-	-	-	-	-	-	-	-
Cooling circuit	Units											
System type		ASHP/Chiller	ASHP/Chiller	-	-	-	-	ASHP/Chiller	ASHP/Chiller	ASHP/Chiller	→	→
Efficiency	EER	4.54/9.23	4.54/9.23	-	-	-	-	4.54/9.23	4.54/9.23	4.54/9.23	→	→
Distribution efficiency	%	95%	95%	-	-	-	-	95%	95%	95%	→	→
Fuel source		Electricity	Electricity	-	-	-	-	Electricity	Electricity	Electricity	→	→
Hot water circuit	Units											
System type		Direct Electric	Direct Electric	Direct Electric	Direct Electric	Direct Electric	Direct Electric	ASHP	Direct Electric	ASHP	←	Direct Fired: Gas
Efficiency	%	100%	100%	100%	100%	100%	100%	5.00	100%	3.00	←	91%
Distribution efficiency	%	100%	100%	100%	100%	100%	100%	95%	100%	95%	←	95%
Fuel source		Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	Electricity	←	Nat Gas
Renewables	Units	East-facing roof PV panels	West-facing roof PV panels	South-facing BIPV panels							Whole scheme	Whole scheme
Photovoltaics present		Yes	Yes	Yes							←	-
Efficiency	%	19%	19%	13%							←	-
Inclination	°	10	10	90							←	-
No. of panels		60	56	42							←	-
Miscellaneous	Units	Whole scheme									Whole scheme	Whole scheme
Light metering		Yes									→	→
Power factor correction		>0.95									→	→

11.4 Overheating analysis

Overheating calculations have been carried out using the following weather scenarios as required by the GLA guidance:

Refurbishment – Georgian Terrace

Table 26 Georgian Terrace Proposed design – DSY1 – 2020s, high emissions, 50% percentile scenario

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office GB01 1	1272	38	0	0.0	0	Pass
Office GB01 2	1272	38	0	0.0	0	Pass
Office GB01 3	1272	38	0	0.0	0	Pass
Office GB01 4	1272	38	0	0.0	0	Pass
Office GB01 5	1272	38	0	0.0	0	Pass
Office GB01 6	1272	38	0	0.0	0	Pass
Office GB01 7	1272	38	0	0.0	0	Pass
Office G00 1	1272	38	0	0.0	0	Pass
Office G00 2	1272	38	0	0.0	0	Pass
Office G00 3	1272	38	0	0.0	0	Pass
Office G00 4	1272	38	0	0.0	0	Pass
Office G00 5	1272	38	0	0.0	0	Pass
Office G00 6	1272	38	0	0.0	0	Pass
Office G00 7	1272	38	0	0.0	0	Pass
Office G01 1	1272	38	0	0.0	0	Pass
Office G01 2	1272	38	0	0.0	0	Pass
Office G01 3	1272	38	0	0.0	0	Pass
Office G01 4	1272	38	0	0.0	0	Pass
Office G01 5	1272	38	0	0.0	0	Pass
Office G01 6	1272	38	0	0.0	0	Pass
Office G01 7	1272	38	0	0.0	0	Pass
Office G02 1	1272	38	0	0.0	0	Pass
Office G02 2	1272	38	0	0.0	0	Pass
Office G02 3	1272	38	0	0.0	0	Pass
Office G02 4	1272	38	0	0.0	0	Pass
Office G02 5	1272	38	0	0.0	0	Pass
Office G02 6	1272	38	0	0.0	0	Pass
Office G02 7	1272	38	0	0.0	0	Pass
Office G03 1	1272	38	0	0.0	0	Pass
Office G03 2	1272	38	0	0.0	0	Pass
Office G03 3	1272	38	0	0.0	0	Pass
Office G03 4	1272	38	0	0.0	0	Pass
Office G03 5	1272	38	0	0.0	0	Pass
Office G03 6	1272	38	0	0.0	0	Pass
Office G03 7	1272	38	0	0.0	0	Pass

Table 27 Georgian Terrace Proposed design – DSY2 – 2003: a year with a very intense single warm spell

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office GB01 1	1272	38	0	0.0	0	Pass
Office GB01 2	1272	38	0	0.0	0	Pass
Office GB01 3	1272	38	0	0.0	0	Pass
Office GB01 4	1272	38	0	0.0	0	Pass
Office GB01 5	1272	38	0	0.0	0	Pass
Office GB01 6	1272	38	0	0.0	0	Pass
Office GB01 7	1272	38	0	0.0	0	Pass
Office G00 1	1272	38	0	0.0	0	Pass
Office G00 2	1272	38	0	0.0	0	Pass
Office G00 3	1272	38	0	0.0	0	Pass
Office G00 4	1272	38	0	0.0	0	Pass
Office G00 5	1272	38	0	0.0	0	Pass
Office G00 6	1272	38	0	0.0	0	Pass
Office G00 7	1272	38	0	0.0	0	Pass
Office G01 1	1272	38	0	0.0	0	Pass
Office G01 2	1272	38	0	0.0	0	Pass
Office G01 3	1272	38	0	0.0	0	Pass
Office G01 4	1272	38	0	0.0	0	Pass
Office G01 5	1272	38	0	0.0	0	Pass
Office G01 6	1272	38	0	0.0	0	Pass
Office G01 7	1272	38	0	0.0	0	Pass
Office G02 1	1272	38	0	0.0	0	Pass
Office G02 2	1272	38	0	0.0	0	Pass
Office G02 3	1272	38	0	0.0	0	Pass
Office G02 4	1272	38	0	0.0	0	Pass
Office G02 5	1272	38	0	0.0	0	Pass
Office G02 6	1272	38	0	0.0	0	Pass
Office G02 7	1272	38	0	0.0	0	Pass
Office G03 1	1272	38	0	0.0	0	Pass
Office G03 2	1272	38	0	0.0	0	Pass
Office G03 3	1272	38	0	0.0	0	Pass
Office G03 4	1272	38	0	0.0	0	Pass
Office G03 5	1272	38	0	0.0	0	Pass
Office G03 6	1272	38	0	0.0	0	Pass
Office G03 7	1272	38	0	0.0	0	Pass

Table 28 Georgian Terrace Proposed design - DSY3 – 1976: a year with a prolonged period of sustained warmth

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office GB01 1	1272	38	0	0.0	0	Pass
Office GB01 2	1272	38	0	0.0	0	Pass
Office GB01 3	1272	38	0	0.0	0	Pass
Office GB01 4	1272	38	0	0.0	0	Pass
Office GB01 5	1272	38	0	0.0	0	Pass
Office GB01 6	1272	38	0	0.0	0	Pass
Office GB01 7	1272	38	0	0.0	0	Pass
Office G00 1	1272	38	0	0.0	0	Pass
Office G00 2	1272	38	0	0.0	0	Pass
Office G00 3	1272	38	0	0.0	0	Pass
Office G00 4	1272	38	0	0.0	0	Pass
Office G00 5	1272	38	0	0.0	0	Pass
Office G00 6	1272	38	0	0.0	0	Pass
Office G00 7	1272	38	0	0.0	0	Pass
Office G01 1	1272	38	0	0.0	0	Pass
Office G01 2	1272	38	0	0.0	0	Pass
Office G01 3	1272	38	0	0.0	0	Pass
Office G01 4	1272	38	0	0.0	0	Pass
Office G01 5	1272	38	0	0.0	0	Pass
Office G01 6	1272	38	0	0.0	0	Pass
Office G01 7	1272	38	0	0.0	0	Pass
Office G02 1	1272	38	0	0.0	0	Pass
Office G02 2	1272	38	0	0.0	0	Pass
Office G02 3	1272	38	0	0.0	0	Pass
Office G02 4	1272	38	0	0.0	0	Pass
Office G02 5	1272	38	0	0.0	0	Pass
Office G02 6	1272	38	0	0.0	0	Pass
Office G02 7	1272	38	0	0.0	0	Pass
Office G03 1	1272	38	0	0.0	0	Pass
Office G03 2	1272	38	0	0.0	0	Pass
Office G03 3	1272	38	0	0.0	0	Pass
Office G03 4	1272	38	0	0.0	0	Pass
Office G03 5	1272	38	0	0.0	0	Pass
Office G03 6	1272	38	0	0.0	0	Pass
Office G03 7	1272	38	0	0.0	0	Pass

Table 29 Georgian Terrace No cooling scenario - DSY1 – 2020s, high emissions, 50% percentile scenario

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office GB01 1	1272	38	231	22.0	0	Fail
Office GB01 2	1272	38	326	22.0	1	Fail
Office GB01 3	1272	38	343	22.0	2	Fail
Office GB01 4	1272	38	332	22.0	1	Fail
Office GB01 5	1272	38	349	21.0	8	Fail
Office GB01 6	1272	38	406	16.0	130	Fail
Office GB01 7	1272	38	377	20.0	69	Fail
Office G00 1	1272	38	325	22.0	14	Fail
Office G00 2	1272	38	258	17.0	41	Fail
Office G00 3	1272	38	241	18.0	30	Fail
Office G00 4	1272	38	231	20.0	16	Fail
Office G00 5	1272	38	336	21.0	22	Fail
Office G00 6	1272	38	285	19.0	73	Fail
Office G00 7	1272	38	311	20.0	80	Fail
Office G01 1	1272	38	272	18.0	89	Fail
Office G01 2	1272	38	273	15.0	103	Fail
Office G01 3	1272	38	274	15.0	100	Fail
Office G01 4	1272	38	289	15.0	166	Fail
Office G01 5	1272	38	301	18.0	119	Fail
Office G01 6	1272	38	314	15.0	183	Fail
Office G01 7	1272	38	356	18.0	129	Fail
Office G02 1	1272	38	342	18.0	151	Fail
Office G02 2	1272	38	337	19.0	152	Fail
Office G02 3	1272	38	343	18.0	157	Fail
Office G02 4	1272	38	339	15.0	228	Fail
Office G02 5	1272	38	383	20.0	208	Fail
Office G02 6	1272	38	377	19.0	217	Fail
Office G02 7	1272	38	407	17.0	191	Fail
Office G03 1	1272	38	360	16.0	133	Fail
Office G03 2	1272	38	368	16.0	162	Fail
Office G03 3	1272	38	378	17.0	179	Fail
Office G03 4	1272	38	384	18.0	224	Fail
Office G03 5	1272	38	381	17.0	208	Fail
Office G03 6	1272	38	517	20.0	259	Fail
Office G03 7	1272	38	387	18.0	175	Fail

New build – Tower and Keats House

Table 30 Tower and Keats House Proposed design – DSY1 – 2020s, high emissions, 50% percentile scenario

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office 07 1	1272	38	1	1.0	0	Pass
Office 07 2	1272	38	0	0.0	0	Pass
Office 07 3	1272	38	0	0.0	0	Pass
Office 07 4	1272	38	0	0.0	0	Pass
Office 07 5	1272	38	5	3.0	0	Pass
Office 07 6	1272	38	0	0.0	0	Pass
Office 03 1	1272	38	0	0.0	0	Pass
Office 03 2	1272	38	0	0.0	0	Pass
Office 03 3	1272	38	0	0.0	0	Pass
Office 03 4	1272	38	0	0.0	0	Pass
Office 03 5	1272	38	0	0.0	0	Pass
Office 03 6	1272	38	0	0.0	0	Pass
Office 02 1	1272	38	6	3.0	0	Pass
Office 02 2	1272	38	0	0.0	0	Pass
Office 02 3	1272	38	0	0.0	0	Pass
Office 02 4	1272	38	0	0.0	0	Pass
Office 02 5	1272	38	0	0.0	0	Pass
Office 02 6	1272	38	0	0.0	0	Pass
Office 15 1	1272	38	6	3.0	0	Pass
Office 15 2	1272	38	0	0.0	0	Pass
Office 15 3	1272	38	0	0.0	0	Pass
Office 15 4	1272	38	0	0.0	0	Pass
Office 15 5	1272	38	11	5.0	0	Pass
Office 15 6	1272	38	0	0.0	0	Pass
Office 18 1	1272	38	13	5.0	0	Pass
Office 18 2	1272	38	0	0.0	0	Pass
Office 18 3	1272	38	0	0.0	0	Pass
Office 18 4	1272	38	2	2.0	0	Pass
Office 18 5	1272	38	16	6.0	0	Pass
Office 18 6	1272	38	0	0.0	0	Pass
Office 18 7	1272	38	0	0.0	0	Pass
Office 23 1	1272	38	13	5.0	0	Pass
Office 23 2	1272	38	0	0.0	0	Pass
Office 23 3	1272	38	0	0.0	0	Pass
Office 23 4	1272	38	9	4.0	0	Pass
Office 23 5	1272	38	16	6.0	0	Pass
Office 23 6	1272	38	0	0.0	0	Pass
Office 23 7	1272	38	0	0.0	0	Pass
Office 11 1	1272	38	6	3.0	0	Pass
Office 11 2	1272	38	0	0.0	0	Pass
Office 11 3	1272	38	0	0.0	0	Pass
Office 11 4	1272	38	0	0.0	0	Pass
Office 11 5	1272	38	11	5.0	0	Pass
Office 11 6	1272	38	0	0.0	0	Pass
Office 16 1	1272	38	6	3.0	0	Pass
Office 16 2	1272	38	0	0.0	0	Pass
Office 16 3	1272	38	0	0.0	0	Pass
Office 16 4	1272	38	0	0.0	0	Pass
Office 16 5	1272	38	11	5.0	0	Pass
Office 16 6	1272	38	0	0.0	0	Pass
Office 16 7	1272	38	0	0.0	0	Pass
Office K02 1	1272	38	0	0.0	0	Pass
Office K01 1	1272	38	0	0.0	0	Pass
Office K00M 1	1272	38	0	0.0	0	Pass
Reception K00 1	1272	38	0	0.0	0	Pass
Office K00 1	1272	38	0	0.0	0	Pass
A3A4_EatDrink 24 1	2448	73	2	2.0	0	Pass
A3A4_EatDrink 24 2	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 3	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 4	2448	73	6	4.0	0	Pass
A3A4_EatDrink 25 1	2448	73	0	0.0	0	Pass
Office 01 1	1272	38	14	5.0	0	Pass
Office 01 2	1272	38	0	0.0	0	Pass
Office 01 3	1272	38	0	0.0	0	Pass
Office 01 4	1272	38	0	0.0	0	Pass
Office 01 5	1272	38	0	0.0	0	Pass
Office 01 6	1272	38	0	0.0	0	Pass
Office 00M 1	1272	38	0	0.0	0	Pass
Office 00M 2	1272	38	0	0.0	0	Pass
Office 00M 3	1272	38	0	0.0	0	Pass
Office 00M 4	1272	38	0	0.0	0	Pass
Reception 00 1	1272	38	0	0.0	0	Pass
Reception 00 2	1272	38	0	0.0	0	Pass
A1A2_Office KB01 1	1530	45	0	0.0	0	Pass
Office B01 1	1272	38	0	0.0	0	Pass
Office 14 1	1272	38	7	3.0	0	Pass
Office 14 2	1272	38	0	0.0	0	Pass
Office 14 3	1272	38	0	0.0	0	Pass
Office 14 4	1272	38	0	0.0	0	Pass
Office 14 5	1272	38	11	5.0	0	Pass
Office 14 6	1272	38	0	0.0	0	Pass
Office 04 1	1272	38	0	0.0	0	Pass
Office 04 2	1272	38	0	0.0	0	Pass

Office 04 3	1272	38	0	0.0	0	Pass
Office 04 4	1272	38	0	0.0	0	Pass
Office 04 5	1272	38	4	3.0	0	Pass
Office 04 6	1272	38	0	0.0	0	Pass
Office 05 1	1272	38	1	1.0	0	Pass
Office 05 2	1272	38	0	0.0	0	Pass
Office 05 3	1272	38	0	0.0	0	Pass
Office 05 4	1272	38	0	0.0	0	Pass
Office 05 5	1272	38	2	2.0	0	Pass
Office 05 6	1272	38	0	0.0	0	Pass

Table 31 Tower and Keats House Proposed design – DSY2 – 2003: a year with a very intense single warm spell

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office 07 1	1272	38	0	0.0	0	Pass
Office 07 2	1272	38	0	0.0	0	Pass
Office 07 3	1272	38	0	0.0	0	Pass
Office 07 4	1272	38	0	0.0	0	Pass
Office 07 5	1272	38	0	0.0	0	Pass
Office 07 6	1272	38	0	0.0	0	Pass
Office 03 1	1272	38	0	0.0	0	Pass
Office 03 2	1272	38	0	0.0	0	Pass
Office 03 3	1272	38	0	0.0	0	Pass
Office 03 4	1272	38	0	0.0	0	Pass
Office 03 5	1272	38	0	0.0	0	Pass
Office 03 6	1272	38	0	0.0	0	Pass
Office 02 1	1272	38	0	0.0	0	Pass
Office 02 2	1272	38	0	0.0	0	Pass
Office 02 3	1272	38	0	0.0	0	Pass
Office 02 4	1272	38	0	0.0	0	Pass
Office 02 5	1272	38	0	0.0	0	Pass
Office 02 6	1272	38	0	0.0	0	Pass
Office 15 1	1272	38	0	0.0	0	Pass
Office 15 2	1272	38	0	0.0	0	Pass
Office 15 3	1272	38	0	0.0	0	Pass
Office 15 4	1272	38	0	0.0	0	Pass
Office 15 5	1272	38	0	0.0	0	Pass
Office 15 6	1272	38	0	0.0	0	Pass
Office 18 1	1272	38	0	0.0	0	Pass
Office 18 2	1272	38	0	0.0	0	Pass
Office 18 3	1272	38	0	0.0	0	Pass
Office 18 4	1272	38	0	0.0	0	Pass
Office 18 5	1272	38	0	0.0	0	Pass
Office 18 6	1272	38	0	0.0	0	Pass
Office 18 7	1272	38	0	0.0	0	Pass
Office 23 1	1272	38	0	0.0	0	Pass
Office 23 2	1272	38	0	0.0	0	Pass
Office 23 3	1272	38	0	0.0	0	Pass
Office 23 4	1272	38	0	0.0	0	Pass
Office 23 5	1272	38	0	0.0	0	Pass
Office 23 6	1272	38	0	0.0	0	Pass
Office 23 7	1272	38	0	0.0	0	Pass
Office 11 1	1272	38	0	0.0	0	Pass
Office 11 2	1272	38	0	0.0	0	Pass
Office 11 3	1272	38	0	0.0	0	Pass
Office 11 4	1272	38	0	0.0	0	Pass
Office 11 5	1272	38	0	0.0	0	Pass
Office 11 6	1272	38	0	0.0	0	Pass
Office 16 1	1272	38	0	0.0	0	Pass
Office 16 2	1272	38	0	0.0	0	Pass
Office 16 3	1272	38	0	0.0	0	Pass
Office 16 4	1272	38	0	0.0	0	Pass
Office 16 5	1272	38	0	0.0	0	Pass
Office 16 6	1272	38	0	0.0	0	Pass
Office 16 7	1272	38	0	0.0	0	Pass
Office K02 1	1272	38	0	0.0	0	Pass
Office K01 1	1272	38	0	0.0	0	Pass
Office K00M 1	1272	38	0	0.0	0	Pass
Reception K00 1	1272	38	0	0.0	0	Pass
Office K00 1	1272	38	0	0.0	0	Pass
A3A4_EatDrink 24 1	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 2	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 3	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 4	2448	73	0	0.0	0	Pass
A3A4_EatDrink 25 1	2448	73	0	0.0	0	Pass
Office 01 1	1272	38	0	0.0	0	Pass
Office 01 2	1272	38	0	0.0	0	Pass
Office 01 3	1272	38	0	0.0	0	Pass
Office 01 4	1272	38	0	0.0	0	Pass
Office 01 5	1272	38	0	0.0	0	Pass
Office 01 6	1272	38	0	0.0	0	Pass
A1A2_Sales 00M 1	1377	41	0	0.0	0	Pass
A1A2_Sales 00M 2	1377	41	0	0.0	0	Pass
A1A2_Sales 00M 3	1377	41	0	0.0	0	Pass
Office 00M 1	1272	38	0	0.0	0	Pass
Office 00M 2	1272	38	0	0.0	0	Pass

Office 00M 3	1272	38	0	0.0	0	Pass
Office 00M 4	1272	38	0	0.0	0	Pass
Reception 00 1	1272	38	0	0.0	0	Pass
Reception 00 2	1272	38	0	0.0	0	Pass
A1A2_Sales 00 1	1377	41	0	0.0	0	Pass
A1A2_Sales 00 2	1377	41	0	0.0	0	Pass
A1A2_Office KB01 1	1530	45	0	0.0	0	Pass
Office B01 1	1272	38	0	0.0	0	Pass
Office 14 1	1272	38	0	0.0	0	Pass
Office 14 2	1272	38	0	0.0	0	Pass
Office 14 3	1272	38	0	0.0	0	Pass
Office 14 4	1272	38	0	0.0	0	Pass
Office 14 5	1272	38	0	0.0	0	Pass
Office 14 6	1272	38	0	0.0	0	Pass
Office 04 1	1272	38	0	0.0	0	Pass
Office 04 2	1272	38	0	0.0	0	Pass
Office 04 3	1272	38	0	0.0	0	Pass
Office 04 4	1272	38	0	0.0	0	Pass
Office 04 5	1272	38	0	0.0	0	Pass
Office 04 6	1272	38	0	0.0	0	Pass
Office 05 1	1272	38	0	0.0	0	Pass
Office 05 2	1272	38	0	0.0	0	Pass
Office 05 3	1272	38	0	0.0	0	Pass
Office 05 4	1272	38	0	0.0	0	Pass
Office 05 5	1272	38	0	0.0	0	Pass
Office 05 6	1272	38	0	0.0	0	Pass

Table 32 Tower and Keats House Proposed design - DSY3 – 1976: a year with a prolonged period of sustained warmth

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office 07 1	1272	38	0	0.0	0	Pass
Office 07 2	1272	38	0	0.0	0	Pass
Office 07 3	1272	38	0	0.0	0	Pass
Office 07 4	1272	38	0	0.0	0	Pass
Office 07 5	1272	38	0	0.0	0	Pass
Office 07 6	1272	38	0	0.0	0	Pass
Office 03 1	1272	38	0	0.0	0	Pass
Office 03 2	1272	38	0	0.0	0	Pass
Office 03 3	1272	38	0	0.0	0	Pass
Office 03 4	1272	38	0	0.0	0	Pass
Office 03 5	1272	38	0	0.0	0	Pass
Office 03 6	1272	38	0	0.0	0	Pass
Office 02 1	1272	38	0	0.0	0	Pass
Office 02 2	1272	38	0	0.0	0	Pass
Office 02 3	1272	38	0	0.0	0	Pass
Office 02 4	1272	38	0	0.0	0	Pass
Office 02 5	1272	38	0	0.0	0	Pass
Office 02 6	1272	38	0	0.0	0	Pass
Office 15 1	1272	38	0	0.0	0	Pass
Office 15 2	1272	38	0	0.0	0	Pass
Office 15 3	1272	38	0	0.0	0	Pass
Office 15 4	1272	38	0	0.0	0	Pass
Office 15 5	1272	38	0	0.0	0	Pass
Office 15 6	1272	38	0	0.0	0	Pass
Office 18 1	1272	38	0	0.0	0	Pass
Office 18 2	1272	38	0	0.0	0	Pass
Office 18 3	1272	38	0	0.0	0	Pass
Office 18 4	1272	38	0	0.0	0	Pass
Office 18 5	1272	38	0	0.0	0	Pass
Office 18 6	1272	38	0	0.0	0	Pass
Office 18 7	1272	38	0	0.0	0	Pass
Office 23 1	1272	38	0	0.0	0	Pass
Office 23 2	1272	38	0	0.0	0	Pass
Office 23 3	1272	38	0	0.0	0	Pass
Office 23 4	1272	38	0	0.0	0	Pass
Office 23 5	1272	38	0	0.0	0	Pass
Office 23 6	1272	38	0	0.0	0	Pass
Office 23 7	1272	38	0	0.0	0	Pass
Office 11 1	1272	38	0	0.0	0	Pass
Office 11 2	1272	38	0	0.0	0	Pass
Office 11 3	1272	38	0	0.0	0	Pass
Office 11 4	1272	38	0	0.0	0	Pass
Office 11 5	1272	38	0	0.0	0	Pass
Office 11 6	1272	38	0	0.0	0	Pass
Office 16 1	1272	38	0	0.0	0	Pass
Office 16 2	1272	38	0	0.0	0	Pass
Office 16 3	1272	38	0	0.0	0	Pass
Office 16 4	1272	38	0	0.0	0	Pass
Office 16 5	1272	38	0	0.0	0	Pass
Office 16 6	1272	38	0	0.0	0	Pass
Office 16 7	1272	38	0	0.0	0	Pass
Office K02 1	1272	38	0	0.0	0	Pass
Office K01 1	1272	38	0	0.0	0	Pass
Office K00M 1	1272	38	0	0.0	0	Pass
Reception K00 1	1272	38	0	0.0	0	Pass
Office K00 1	1272	38	0	0.0	0	Pass

A3A4_EatDrink 24 1	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 2	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 3	2448	73	0	0.0	0	Pass
A3A4_EatDrink 24 4	2448	73	1	1.0	0	Pass
A3A4_EatDrink 25 1	2448	73	0	0.0	0	Pass
Office 01 1	1272	38	0	0.0	0	Pass
Office 01 2	1272	38	0	0.0	0	Pass
Office 01 3	1272	38	0	0.0	0	Pass
Office 01 4	1272	38	0	0.0	0	Pass
Office 01 5	1272	38	0	0.0	0	Pass
Office 01 6	1272	38	0	0.0	0	Pass
A1A2_Sales 00M 1	1377	41	0	0.0	0	Pass
A1A2_Sales 00M 2	1377	41	4	3.0	0	Pass
A1A2_Sales 00M 3	1377	41	0	0.0	0	Pass
Office 00M 1	1272	38	0	0.0	0	Pass
Office 00M 2	1272	38	0	0.0	0	Pass
Office 00M 3	1272	38	0	0.0	0	Pass
Office 00M 4	1272	38	0	0.0	0	Pass
Reception 00 1	1272	38	0	0.0	0	Pass
Reception 00 2	1272	38	0	0.0	0	Pass
A1A2_Sales 00 1	1377	41	0	0.0	0	Pass
A1A2_Sales 00 2	1377	41	4	3.0	0	Pass
A1A2_Office KB01 1	1530	45	0	0.0	0	Pass
Office B01 1	1272	38	0	0.0	0	Pass
Office 14 1	1272	38	0	0.0	0	Pass
Office 14 2	1272	38	0	0.0	0	Pass
Office 14 3	1272	38	0	0.0	0	Pass
Office 14 4	1272	38	0	0.0	0	Pass
Office 14 5	1272	38	0	0.0	0	Pass
Office 14 6	1272	38	0	0.0	0	Pass
Office 04 1	1272	38	0	0.0	0	Pass
Office 04 2	1272	38	0	0.0	0	Pass
Office 04 3	1272	38	0	0.0	0	Pass
Office 04 4	1272	38	0	0.0	0	Pass
Office 04 5	1272	38	0	0.0	0	Pass
Office 04 6	1272	38	0	0.0	0	Pass
Office 05 1	1272	38	0	0.0	0	Pass
Office 05 2	1272	38	0	0.0	0	Pass
Office 05 3	1272	38	0	0.0	0	Pass
Office 05 4	1272	38	0	0.0	0	Pass
Office 05 5	1272	38	0	0.0	0	Pass
Office 05 6	1272	38	0	0.0	0	Pass

Table 33 Tower and Keats House No cooling scenario - DSY1 – 2020s, high emissions, 50% percentile scenario

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
Office 07 1	1272	38	1272	0.0	1272	Fail
Office 07 2	1272	38	1272	0.0	1272	Fail
Office 07 3	1272	38	1272	0.0	1272	Fail
Office 07 4	1272	38	1272	0.0	1272	Fail
Office 07 5	1272	38	1272	0.0	1272	Fail
Office 07 6	1272	38	1272	0.0	1272	Fail
Office 03 1	1272	38	1272	5.0	1269	Fail
Office 03 2	1272	38	1272	5.0	1269	Fail
Office 03 3	1272	38	1272	5.0	1269	Fail
Office 03 4	1272	38	1272	5.0	1269	Fail
Office 03 5	1272	38	1272	5.0	1269	Fail
Office 03 6	1272	38	1272	5.0	1269	Fail
Office 02 1	1272	38	1252	30.0	917	Fail
Office 02 2	1272	38	1247	32.0	840	Fail
Office 02 3	1272	38	1054	33.0	195	Fail
Office 02 4	1272	38	941	30.0	668	Fail
Office 02 5	1272	38	949	31.0	766	Fail
Office 02 6	1272	38	916	30.0	728	Fail
Office 15 1	1272	38	1272	0.0	1272	Fail
Office 15 2	1272	38	1272	0.0	1272	Fail
Office 15 3	1272	38	1272	0.0	1272	Fail
Office 15 4	1272	38	1272	0.0	1272	Fail
Office 15 5	1272	38	1272	0.0	1272	Fail
Office 15 6	1272	38	1272	0.0	1272	Fail
Office 18 1	1272	38	1272	0.0	1272	Fail
Office 18 2	1272	38	1272	0.0	1272	Fail
Office 18 3	1272	38	1272	0.0	1272	Fail
Office 18 4	1272	38	1272	0.0	1272	Fail
Office 18 5	1272	38	1272	0.0	1272	Fail
Office 18 6	1272	38	1272	0.0	1272	Fail
Office 18 7	1272	38	1272	0.0	1272	Fail
Office 23 1	1272	38	1272	4.0	1269	Fail
Office 23 2	1272	38	1272	4.0	1269	Fail
Office 23 3	1272	38	1272	5.0	1269	Fail
Office 23 4	1272	38	1272	5.0	1269	Fail
Office 23 5	1272	38	1272	4.0	1269	Fail
Office 23 6	1272	38	1272	4.0	1268	Fail
Office 23 7	1272	38	1272	5.0	1269	Fail
Office 11 1	1272	38	1272	0.0	1272	Fail

Office 11 2	1272	38	1272	0.0	1272	Fail
Office 11 3	1272	38	1272	0.0	1272	Fail
Office 11 4	1272	38	1272	0.0	1272	Fail
Office 11 5	1272	38	1272	0.0	1272	Fail
Office 11 6	1272	38	1272	0.0	1272	Fail
Office 16 1	1272	38	1272	0.0	1272	Fail
Office 16 2	1272	38	1272	0.0	1272	Fail
Office 16 3	1272	38	1272	0.0	1272	Fail
Office 16 4	1272	38	1272	0.0	1272	Fail
Office 16 5	1272	38	1272	0.0	1272	Fail
Office 16 6	1272	38	1272	0.0	1272	Fail
Office 16 7	1272	38	1272	0.0	1272	Fail
Office K02 1	1272	38	1236	26.0	992	Fail
Office K01 1	1272	38	1254	29.0	1073	Fail
Office K00M 1	1272	38	1245	29.0	963	Fail
Reception K00 1	1272	38	965	28.0	208	Fail
Office K00 1	1272	38	1149	29.0	517	Fail
A3A4_EatDrink 24 1	2448	73	2448	3.0	2447	Fail
A3A4_EatDrink 24 2	2448	73	2448	0.0	2448	Fail
A3A4_EatDrink 24 3	2448	73	2448	0.0	2448	Fail
A3A4_EatDrink 24 4	2448	73	2448	0.0	2448	Fail
A3A4_EatDrink 25 1	2448	73	2448	0.0	2448	Fail
Office 01 1	1272	38	1201	29.0	671	Fail
Office 01 2	1272	38	1176	30.0	584	Fail
Office 01 3	1272	38	777	34.0	7	Fail
Office 01 4	1272	38	748	28.0	347	Fail
Office 01 5	1272	38	753	25.0	507	Fail
Office 01 6	1272	38	752	22.0	489	Fail
Office 00M 1	1272	38	1234	28.0	1001	Fail
Office 00M 2	1272	38	657	19.0	505	Fail
Office 00M 3	1272	38	657	19.0	536	Fail
Office 00M 4	1272	38	661	19.0	526	Fail
Reception 00 1	1272	38	1212	27.0	916	Fail
Reception 00 2	1272	38	1161	24.0	695	Fail
A1A2_Office KB01 1	1530	45	0	0.0	0	Pass
Office B01 1	1272	38	0	0.0	0	Pass
Office 14 1	1272	38	1272	0.0	1272	Fail
Office 14 2	1272	38	1272	0.0	1272	Fail
Office 14 3	1272	38	1272	0.0	1272	Fail
Office 14 4	1272	38	1272	0.0	1272	Fail
Office 14 5	1272	38	1272	0.0	1272	Fail
Office 14 6	1272	38	1272	0.0	1272	Fail
Office 04 1	1272	38	1272	3.0	1271	Fail
Office 04 2	1272	38	1272	3.0	1271	Fail
Office 04 3	1272	38	1272	3.0	1271	Fail
Office 04 4	1272	38	1272	3.0	1271	Fail
Office 04 5	1272	38	1272	3.0	1271	Fail
Office 04 6	1272	38	1272	3.0	1271	Fail
Office 05 1	1272	38	1272	0.0	1272	Fail
Office 05 2	1272	38	1272	0.0	1272	Fail
Office 05 3	1272	38	1272	0.0	1272	Fail
Office 05 4	1272	38	1272	0.0	1272	Fail
Office 05 5	1272	38	1272	0.0	1272	Fail
Office 05 6	1272	38	1272	0.0	1272	Fail

11.5 Communication with Guy's and St. Thomas' Hospital NHS Trust

This appendix includes a copy of the communication with Guy's and St. Thomas' Hospital NHS trust and their subsidiary Essentia in August 2017 and in October 2018, with regards to investigating whether a connection to the NHS Trust heating and/or cooling system close to the site may be feasible.

Herman Calleja

From:	Herman Calleja
Sent:	24 October 2018 08:56
To:	'enquiries@essentia.uk.com'
Cc:	Lucy Vereenooghe; Matthew Thurston; Nitharshan Natarajan
Subject:	RE: Provision of heating/cooling to a nearby project

Dear sir/madam,

Good morning. On the 'London Heat Map' we found a reference to an EU ETS site (at postcode SE1 9RT) and a 'Communal Boiler Study' that belong to the Guys & St Thomas' Hospital NHS Trust.

Currently we are working on a project close to the site. Would you consider (and have capacity) of supplying heating/cooling from your network to a nearby third party project, or are your facilities dedicated exclusively for the use of the Guys & St Thomas' Hospital NHS Trust?

If you would be interested in sharing the facilities with a building nearby please let us know. In case that we do not receive any feedback we will be assuming that such connection and sharing of facilities is not available.

Kind regards,
Herman

From: Herman Calleja
Sent: 14 August 2017 12:54
To: steve.mcguire@gstt.nhs.uk
Cc: Lucy Vereenooghe <lucy.vereenooghe@chapmanbdsp.com>; Matthew Thurston <matthew.thurston@chapmanbdsp.com>; Shikha Bhardwaj <Shikha.Bhardwaj@chapmanbdsp.com>
Subject: Provision of heating/cooling to a nearby project

Dear Steve McGuire

Good afternoon. On the 'London Heat Map' there is a reference to an EU ETS site (at postcode SE1 9RT) and a 'Communal Boiler Study' that belong to the Guys & St Thomas' Hospital NHS Trust.

Currently we are working on a potential project close to this EU ETS site. Would you consider (and have capacity) of supplying heating/cooling from your network to a nearby third party project, or are your facilities dedicated exclusively for the use of the Guys & St Thomas' Hospital NHS Trust?

If you would be interested in sharing the facilities with a building nearby please let us know. In case that we do not receive any feedback we will be assuming that such connection and sharing of facilities is not available.

Kind regards,
Herman

11.6 Air Quality Impacts

Table 34 Air quality impact for the whole development

Energy source	Total fuel consumption (residential) (MWh/year)	Total fuel consumption (non-residential) (MWh/year)
Grid electricity	0	1,354
Gas boilers (communal/individual)	0	0
Gas CHP	0	0
Connection to existing DH network	0	0
Other as use (e.g. cookers)	0	0

11.7 LZC feasibility matrix

	Low or zero carbon technology	Lifespan (yrs)	Lifecycle carbon savings* (tCO_2/yr)	Applicable grants	Tariff (p/kWh)	CapEx (k£/kW)	Payback*	Simple Payback** (yrs)	Life cycle cost*	Space use	Local planning criteria	Noise	Feasibility of export	Technology appropriate for the site	Reasons for inclusion / exclusion
Solar	Solar thermal	20	Low	Renewable Heat Incentive (RHI)	Non-domestic RHI closes to new applicants from 31 March 2021	£500-800/kWh	Medium	-	Low	Suitable (roof space available)	Suitable	Suitable	Possible export of heat to future district heat network	No	Solar Thermal – Solar water heating is traditionally one of the most simplistic and affordable renewable technologies. Solar energy is converted to heat via panels that absorb the high frequency heat radiation emitted from the sun. Advancing technology and the use of 'heat pipes' (tubes utilising refrigerant technology) maximise useful heat extraction even on cold cloudy days. However, the carbon saving of solar hot water depends on the fuel being displaced. This technology has been discounted due to the very low domestic hot water demand with non-domestic uses provided.
	Photovoltaics	25	Low (325 $kgCO_2$/yr per 1 kWp_{el})	Feed-in tariffs (FiT)	FIT scheme closed to new applicants from 1 April 2019	£2,000-5,000/kWel	High	-	Medium	Suitable (roof space available)	Suitable	Suitable	Possible (export of power to local grid)	Yes	Solar photovoltaic cells (PV) – PV cells convert sunlight into usable electricity. Due to the relatively low efficiencies of this system, a large area is often required in order to provide a reasonable quantity of power. PV cells also provide their peak power (referred to as kWp) during the summer months and therefore larger installations need to be carefully considered. For this project, this strategy shows a significant potential particularly due to the high unobstructed rooftop of the main building and the careful design of plant to create an available installation area.
Wind	Wind turbines	20	Low (0.5 t/kWe per yr)	FiT	-	£750/kWel	Medium	-	High	Not suitable (suitable space for stand-alone of roof mounted wind turbine cannot be found for the scheme)	Not Suitable due to height restriction, significant visual impact, flicker.	Potentially not suitable due to noise from turbine's generator.	Possible (export of power to local grid)	No	Wind turbines – Wind turbines produce electrical energy by absorbing wind energy. They are typically available in vertical or horizontal axis. The quantity of energy generated is directly related to the 'swept area' of the blades and as such size is of great importance. However, smaller systems are becoming increasingly more common as well as more accepted and have been used to power schools, sports centres and business parks. For wind turbines to operate effectively, the average wind speed for the site needs to be above a threshold level of 6.3 m/s. The site is in the city centre therefore this technology has been discounted due to the urban location.
Water	Small scale hydro power	-	-	-					-	-	-	-	-	-	No suitable rivers near the development.
	Tidal power	-	-	-					-	-	-	-	-	-	
	Wave power	-	-	-					-	-	-	-	-	-	
Biofuels	Biomass boilers	20	Medium	RHI	-	Medium - High	Medium	5-10 yrs	Low-Medium	Not suitable (large space required for fuel storage)	Suitable	Vehicle noise during regular fuel deliveries and also removal of ash from combustion	Possible export of heat to future district heat network	No	Biomass/Biofuels – Biomass is organic matter of recent origin which can be replenished at the rate at which it is used. It does not include fossil fuels, which have formed over millions of years and thus of finite supply. The CO_2 released when energy is generated from biomass is balanced by that absorbed during the fuel's production. This is termed a carbon neutral process, but only when the source of the fuels is renewable, like a sustainable rotation coppice woodland. Such fuels include logs, compressed sawdust pellets, vegetable oil and ethanol. Biofuels are not considered appropriate for this site which is located in central London and have been discounted in favour of more reliable fit and forget equipment due to the
	Biomass co-generation (CHP)	20	Medium-High	RHI	-	£600 – 1,500/kWel	Medium	5-10 yrs	Medium	Not suitable (large space required for fuel storage)	Suitable	Vehicle noise during regular fuel deliveries and also removal of ash from combustion	Possible export of heat to future district heat network	No	

	Low or zero carbon technology	Lifespan (yrs)	Lifecycle carbon savings* (tCO_2/yr)	Applicable grants	Tariff (p/kWh)	CapEx (k£/kW)	Payback*	Simple Payback** (yrs)	Life cycle cost*	Space use	Local planning criteria	Noise	Feasibility of export	Technology appropriate for the site	Reasons for inclusion / exclusion
															intensive nature of biofuel use on site relating to deliveries, maintenance, dust and equipment responsiveness.
District	District heating and cooling	25+	Medium-high	RHI + FiT	-	-	Medium	-	Medium	Not suitable (no district heating network in the vicinity of the scheme)	Suitable	Suitable	N/A	No	District heating (also known as heat networks or teleheating) is a system for distributing heat generated in a centralized location for residential and commercial heating requirements such as space heating and water heating. The heat is often obtained from cogeneration plant burning fossil fuels but increasingly also biomass, although heat-only boiler stations, geothermal heating, heat pumps and central solar heating are also used, as well as nuclear power. District heating plants can provide high efficiencies and better pollution control than localized boilers. The site of the proposed scheme does not lie within the vicinity of an existing or a potential heat network. A review of the London heat map has shown that the nearest potential heat network is located 1km away from the proposed development. Therefore, connecting to any of the potential networks was not considered feasible for the project as it will incur significant cost implications due to the pipework routing through/under existing buildings. On the 'London Heat Map' there is a reference to an EU ETS site (at postcode SE1 9RT) and a 'Communal Boiler Study' that belong to the Guys & St Thomas' Hospital NHS Trust. We have approached Guy & St Thomas' Hospital NHS Trust to check whether they would consider and have capacity to supply heating/cooling to a nearby third party project. However, we had no response.
Heat pumps	Ground Source Heat Pumps (Closed Loop System)	25 (50+ earth heat exchangers)	Medium (30-50% compared to gas heating system)	RHI	8.7	£800-1,000/kWth	Medium-High	9-10 yrs	Medium-High	Not suitable (space not sufficient for horizontal or vertical system)	Suitable	Suitable	Possible but unlikely	No	Heat Pump Technology – Heat pumps take heat from the air (air source) or the ground (ground source) using liquid circulating in horizontal pipes or vertical boreholes. The heat extracted is raised in temperature by use of a heat pump and the heat is generally used to warm water for space heating, often in the form of under floor heating. If cooling is also needed in a building, the use of the Ground Source Heat Pump (GSHP) earth loop can help replenish the heat extracted in the winter as well as making the cooling more efficient and provides the possibility of free cooling. Air source heat pumps were chosen over ground source heat pumps due to lack of space for ground source systems.
	Ground Source Heat Pumps (Open Loop System)	25 (50+ boreholes)	Medium (40-60% compared to gas heating system)	RHI	-	-	-	-	Medium	Not suitable (space not sufficient to allow for required distance between boreholes)	Suitable	Suitable	Possible but unlikely	No	
	Air Source Heat Pumps	20	Low-Medium (20-40% compared to gas heating system)	N/A	2.5	£800-1,000/kWth	Medium	9-10 yrs	Low	Suitable	Suitable	Suitable (Acoustically insulated engine)	Possible but unlikely	Yes	
Co-Generation	Gas-fired Co-generation (CHP)	15	Medium (30% CO_2 reduction compared to condensing boilers)	N/A	-	£1,000/kWe	Medium (£150-200 per kWe per yr)	4-7 yrs	Low - Medium	Not suitable	Suitable	Suitable (Acoustically insulated engine)	Possible export of heat to future district heat network	No	Combined heat & power (CHP) – This is the production of both heating and electrical power for a building. The benefit of generating the electricity on site is that the waste heat that is usually rejected at power stations can be used to serve heating and power requirements of a building or wider community. Smaller single site systems generally utilise fossil fuels such as gas to operate a spark ignition engine or turbine to turn a generator. Biodiesels can be used which includes correctly processed waste vegetable oil. The main vital pre-requisite of a CHP system is that a demand for both power and heat is requires at the

	Low or zero carbon technology	Lifespan (yrs)	Lifecycle carbon savings* (tCO_2/yr)	Applicable grants	Tariff (p/kWh)	CapEx (k£/kW)	Payback*	Simple Payback** (yrs)	Life cycle cost*	Space use	Local planning criteria	Noise	Feasibility of export	Technology appropriate for the site	Reasons for inclusion / exclusion
															same time and a base load exists for CHP plant to operate efficiently and cost effectively. CHP wasn't considered viable to the proposed development due to the low baseload, as well as the requirement of frequent fuel deliveries to the site.
	Gas-fired Tri-generation (CCHP)	15	Low (compared to high efficiency chillers) – highly dependent on cooling profile of the scheme	N/A	-	-	-	-	Low - Medium	Not suitable	Suitable	Suitable (Acoustically insulated engine)	Possible export of cooling to future district heat network	No	Tri generation systems have been rejected as there is no residual cooling load left by the heat pumps. Inadequate plant space for these systems. Fuel cell systems rejected due to prohibitively high cost.
	Fuel Cells Gas-fired Co/Tri-generation (CHP)	20	Medium (40% CO2 reduction compared to condensing boilers)	N/A	-	£7,000/ kWel	Very high	20+	(Very) High	Not suitable	Suitable	Suitable (Very low noise)	Possible (export of power to the grid and heat to district heating network)	No	
	Waste Heat Recovery	15	Low - Medium	N/A	-	-	-	-	Low	Not suitable	Suitable	Suitable	N/A	No	Insufficient waste heat available.
	Energy Storage	15 (50+ for seasonal storage)	Low – Medium (technology dependant)	N/A	-	-	-	-	Medium – High (technology dependant)	Not suitable	Suitable	Suitable	Possible (integration within district network)	No	Large space required, therefore it is not applicable.

Considered
Implemented
Discarded

Payback period
Low: 1-7 years
Medium: 7-15 years
High: 15+ years

** Compared to Part L Compliant Building with gas boiler and packaged electrical chiller
*From industry standards and case studies (e.g. CIBSE, EST, Carbon Trust etc.)

11.8 Air source heat pump concept schematic