HOARE LEA

Former Stag Brewery.
London.
Reselton Properties Limited.

SUSTAINABILITY
ENERGY STRATEGY

REVISION 01 – 14 JULY 2020

Audit sheet.

Rev.	Date	Description	Prepared	Verified
01	14/07/2020	For submission	R. Harper	G. Jones

Document reference: REP-2310513-5A-RH-20190909-Energy Strategy-Rev01.docx

Contents.

Executive summary.

This Energy Strategy has been prepared by Hoare Lea as a revised submission document to the Energy Strategy submitted under Applications A, B and C (refs. 18/0547/FUL, 18/0548/FUL and 18/0549/FUL) ('the Applications'), in respect of the former Stag Brewery Site in Mortlake ('the Site') within the London Borough of Richmond Upon Thames ('LBRuT'). The Applications are for the comprehensive redevelopment of the Site. This document has been prepared on behalf of Reselton Properties Limited ('the Applicant'). A summary of the Applications is set out below:

a. Application A – hybrid planning application for comprehensive mixed use redevelopment of the former Stag Brewery site consisting of:
    i. Land to the east of Ship Lane applied for in detail (referred to as 'Development Area 1' throughout); and
    ii. Land to the west of Ship Lane (excluding the school) applied for in outline (referred to as 'Development Area 2' throughout).
b. Application B – detailed planning application for the school (on land to the west of Ship Lane).
c. Application C – detailed planning application for highways and landscape works at Chalkers Corner.

This document replaces the Energy Strategy and Energy Strategy Addendum.

The Applications were submitted in February 2018 to LBRuT. The Applications are related and were proposed to be linked via a Section 106 Agreement. In May 2019, a package of substitutions was submitted to LBRuT for consideration, which sought to address comments raised by consultees during determination. On 29 January 2020, the Applications were heard at LBRuT's Planning Committee with a recommendation for approval. This scheme is thereafter referred to as "the Original Scheme".

The Committee resolved to grant Applications A and B, and refuse Application C. The granting of Applications A and B was subject to the following:

a. Conditions and informatives as set out in the officer's report, published addendum and agreed verbally at the meeting;
b. Amendments to the Heads of Terms and completion of a Section 106 Legal Agreement which was delegated to the Assistant Director to conclude;
c. No adverse direction from the Greater London Authority ('GLA'); and
d. No call in by the Secretary of State for Housing, Communities and Local Government.

The Applications have been referred to the GLA and the Mayor has given a direction that he will take over the determination of the Applications and act as local planning authority in relation to all three applications.

The Applicant has engaged with the GLA in respect of the proposed amendments to the scheme, referred to throughout this document as the 'Revised Scheme'. As a result of these discussions, a number of changes have been made to the scheme proposals which are summarised as follows:

a. Increase in residential unit provision from up to 813 units (this includes the up to 150 flexible assisted living and / or residential units) to up to 1,250 units;
b. Increase in affordable housing provision from up to 17% to up to 30%;
c. Increase in height for some buildings, of up to three storeys compared to the Original Scheme;
d. Change to the layout of Buildings 18 and 19, conversion of Block 20 from a terrace row of housing to two four storey buildings;
e. Reduction in the size of the western basement, resulting in an overall reduction in car parking spaces of 186 spaces, and introduction of an additional basement storey beneath Building 1 (the cinema);
f. Other amendments to the masterplan including amendments to internal layouts, re-location and change to the quantum and mix of uses across the Site, including the removal of the nursing home and assisted living in Development Area 2;
g. Landscaping amendments, including canopy removal of four trees on the north west corner of the Site; and
h. Associated highways works may be carried out on adopted highways land.

The submission documents have tested an affordable housing provision of 30%. However, it should be noted that the final affordable housing level is subject to further viability testing and discussions with the GLA.

Minor amendments have also been made to the road and pedestrian layouts for the school (Application B). No other amendments are proposed to Application B. No amendments are proposed to the physical works proposed under Application C, although alternative options within the highway boundaries for mitigating the highway impact of the amended proposals have been assessed within the relevant substitution documents for Applications A and B and are the subject of ongoing discussions with the GLA and TfL.

A more detailed summary is included within the Planning Statement Addendum and Design and Access Statement Addendum submitted with the Revised Scheme documents.

These changes are being brought forward as substitutions to Applications A, B and C (refs. 18/0547/FUL, 18/0548/FUL and 18/0549/FUL), which are related applications (to be linked via a Section 106 Agreement).

It is important to note that no changes are proposed to the physical works proposed under Application C – the only change to this application is that the supporting documents (which include all documents submitted under Applications A and B) have been updated in the context of the proposed changes to the scheme as sought under Applications A and B. Application C was resolved to be refused by LBRuT at Committee on 29 January 2020. As a result, whilst the works proposed in Application C are still an available option, the Applicant has progressed alternative approaches for addressing and mitigating the impacts on surrounding highways, and these have been tested within the relevant substitution documents for Applications A and B. All of these options are subject to ongoing discussions and testing with TfL. They are all within the existing highway boundaries and if agreed would not, in themselves, require planning consent.

Accordingly, Application C remains 'live' within this substitution package.

This report sets out the Energy Strategy for the Proposed Development for the whole site encompassing Applications A and B. For the areas of Application A that will be subject to full planning permission (Development Area 1) and Application B, the School, this strategy represents the targeted approach to energy for the Proposed Development.

The Energy Strategy for Development Area 2 is provided in outline.

Whilst the school was made as a separate application (Application B), for the purposes of this strategy it has been included within all calculations for Development Area 1 and the masterplan for Application A (i.e. the approach remains unchanged).

1.1.1 Policies & drivers

This document summarises the pertinent policies and requirements applicable to the Proposed Development. Of these, the principal target is to achieve a reduction in regulated CO_2 emissions of 35% beyond the requirements of the Building Regulations Part L (2013) for the non-domestic elements of the Proposed Development and 'zero carbon' for the residential aspects, corresponding to a 100% reduction in regulated CO_2 emissions beyond the requirements of the Building Regulations Part L (2013), as set out in the London Plan (2016) and set out in the recently adopted LBRuT Local Plan (2018).

As this is a revision of the original Energy Strategy to a current application, it is considered acceptable for the energy strategy to be based on the guidance document at the time of the original application (March 2016 version) and that has been discussed and agreed with the GLA as an acceptable Energy Strategy.

London Plan Intend to Publish Version (dated December 2019)
Although not currently adopted, the Proposed Development has also considered the proposed policies of the London Plan Intend to Publish Version (dated December 2019).

The most significant changes to the policies, in relation to energy demand and carbon emissions, compared to the adopted Plan are as follows:

- All major development will achieve net zero carbon compared to the Part L baseline, with a minimum of 35% reduction being met on site. Remaining emissions to be offset via carbon offset payment to the Local Authority.
- Non-regulated emissions should be calculated and minimised.
- Residential development should achieve at least a 10% carbon emission reduction at the Be Lean stage of the energy strategy.
- Non-residential development should achieve at least a 15% carbon emission reduction at the Be Lean stage of the energy strategy.
- Whole life-cycle carbon emissions should be calculated and demonstrate actions to reduce.
- Carbon emissions are calculated using proposed SAP10.1 carbon factors.
- Combined Heat and Power (CHP) engines can only be considered where there is a case to enable the delivery of an areas-wide heat network and meet the development's electricity demands and provide demand response to the local electricity network.

It is considered that we have a position agreed with the GLA on the Original Scheme (including conditions) which we have sought to carry over to the Revised Scheme. On this basis Part L 2013 carbon factors have continued to be used. A CHP and heat network are also proposed and the CHP will include suitable NOx abatement technologies to ensure a low impact on local air quality. The development has sought to achieve CO_2 emissions reductions as set out at the Be Lean stages.

1.1.2 Approach
The residential elements of the Proposed Development have been assessed using Part L1A 2013 approved SAP v9.92 (2012) methodology. Non-residential spaces have been modelled using Part L2A compliant software or benchmarked using Part L 2013 compliant results from similar building types. This has provided the basis for the analysis of the designed building and services and the consideration of all applicable passive design, energy efficiency and Low or Zero Carbon (LZC) technologies.

The assessment makes use of the Mayor of London's Energy Hierarchy and the cooling hierarchy from the London Plan (2016).

1.2 Summary of changes in this Energy Strategy
The Proposed Development has met the relevant planning policy targets set by the Greater London Authority (GLA) and London Borough of Richmond upon Thames (LBRuT) through energy efficient design, provision of a site wide heat network powered by Combined Heat and Power (CHP) plant, and consideration of roof top Photovoltaic (PV) panels across the site. Where the carbon emission target is not met on site, the shortfall will be offset by a single carbon offset payment to the local authority.

Previously, the original scheme was accepted by the GLA and LBRuT subject to conditions on the following issues:

- Application A
  - NS12: GLA (Energy) – Site-wide Heat Network
    - No development shall take place in Development Area 2 or any Plot within, with the exception of demolition and excavation, until a scheme has been submitted demonstrating how connection can be made between the heat networks for Development Area 1 and Development Area 2 (as shown in drawing C645_MP_P_00_005 (or any subsequent approved revisions thereafter), thereby creating a single site-wide heat network covering the full site covered by Application A has been submitted to and approved in writing by the Local Planning Authority (in consultation with the GLA). The applicant shall use reasonable endeavours to ensure that the single site wide heat network will be delivered. Development Area 2, and any Plot within, shall not be implemented other than in accordance with the approved details, and thereafter maintained.
  - NS13 GLA (Energy) – Carbon Dioxide Emissions Reduction
    - No development shall take place in Development Area 2 or any Plot within, with the exception of demolition and excavation, until a scheme, containing a review of suitable low and zero carbon technologies that could be incorporated to provide a carbon dioxide emissions reduction at least commensurate with the Energy Strategy submitted for Application A (Development Area 1 and Development Area 2), has been submitted to and approved in writing by the Local Planning Authority, in consultation with the GLA. The review would be undertaken in line with the energy policy in place at the time of submission of the Reserved Matters submission. Development Area 2, and any Plot within, shall not be implemented other than in accordance with the approved details, and thereafter maintained.
  - NS14: GLA (Energy) – Zero Carbon Technology Feasibility Report
    - In the event that the Development Area 2 of Application A (ref. 18/0547/FUL) does not become operational within 5 years of the first occupation of Development Area 1, a low and zero carbon technology feasibility report shall be submitted to and approved in writing by the Local Planning Authority in consultation with the Greater London Authority. The report shall review the options to replace the gas boilers in the Phase 1 energy centre with the connection to the site-wide heat network proposed in Application A, or, if this is not available, an alternative low and zero carbon technology to serve the Phase 1 energy centre. The applicant shall use reasonable endeavours to prioritise connection to the site wide heat network, or to replace the gas boilers with the identified low carbon technology if shown to be feasible. A carbon dioxide emissions reduction at least commensurate with the Energy Strategy submitted for Application A should be demonstrated. The development shall be implemented in accordance with the approved details (and timetable for implementation) and shall be thereafter maintained.
- Application B
  - NS12: Energy Strategy
    - Prior to the commencement of development, an Energy Strategy for the development hereby approved shall be submitted to and approved in writing by the Local Planning Authority. The strategy shall demonstrate:

a. The building achieves compliance with Part L 2013 with passive design and energy efficiency measures
b. The building achieves at least 29.8% reduction in CO_2 emissions
c. The necessary Carbon Offset Fund (in line with adopted standards)
d. How the building and its associated energy requirements will be met in line with the Energy Hierarchy (in particular 10% Lean Energy Requirement)

- The development shall not be constructed other than in accordance with the approved scheme.

The Proposed Development intends to follow the energy strategy as to that submitted under the original application with the changes as agreed with the GLA.

The changes to the agreed Energy Strategy as a result of the amendments to the scheme have not been significant. The areas of dwellings provided in the scheme have increased. As the dwellings tend to have a greater thermal demand than the non-dwelling areas that they have replaced the CHP connected to the heat

network will produce more energy resulting in greater CO_2 emissions reductions in this Energy Strategy. Other changes to the scheme include a reduction in the area of basement in Development Area 2.

1.3 Be Lean - Passive design & energy efficiency measures.

Passive design measures to be implemented at the Proposed Development include:

2. Suitable glazing ratio and glass g-value (0.29) to balance heat losses, heat gains and daylight ingress.
3. Fabric insulation levels achieving improvements over Building Regulations Part L (2013) requirements of 25% - 100%.
4. Fabric air permeability achieving improvements over Building Regulations Part L (2013) requirements of 75% and 70% for dwellings and commercial spaces respectively.

Energy efficiency measures to be implemented at the Proposed Development include:

1. Efficient space heating systems with zonal, programmable and thermostatic controls, with separate programmer for hot water.
2. Efficient low-energy lighting throughout all dwellings. External and communal lighting will be coupled to daylight and presence detection sensors to minimise unnecessary use.
3. Efficient mechanical ventilation with heat recovery which will limit the need for space heating in winter months, aid the mitigation of high internal temperatures in summer months (where openable windows cannot be used due to ambient acoustic conditions), and maintain good indoor air quality.
4. Appropriately insulated pipework and ductwork (and air sealing to ductwork) to minimise losses and gains.
5. Variable speed pumps and fans to minimise energy consumption for distribution of services

The above measures would also be considered for the areas within the outline application of the Proposed Development.

1.3.1 **Whole Site – Application A**

It is anticipated that the areas within the of the Application A site will perform to a comparable level to the Part L calculations undertaken for Development Area 1.

Based on this level of performance the areas of the Proposed Development would be expected to achieve **~5.1%** reduction in CO_2 emissions beyond the requirements of the Part L gas boiler 'baseline' on a site wide basis.

1.3.2 **Application A – Development area 1**

These measures are anticipated to achieve **~5.3%** reduction in regulated CO_2 emissions beyond the requirements of the Building Regulations Part L (2013) 'baseline' for the areas within the application. When considering the residential elements alone, it is anticipated that a **~7.9%** reduction in CO_2 emissions beyond the requirements of the Building Regulations Part L (2013) 'baseline' will be achieved.

Furthermore, it has been calculated based on the parameters outlined within this report and the SAP calculations undertaken that the dwellings will improve upon the requirements of Target Fabric Energy Efficiency (TFEE) included in Part L1A 2013.

As a result, the Proposed Development will achieve compliance with the requirements of the Building Regulations Part L 2013 through passive design and energy efficiency measures alone.

1.3.3 **Application A – Development area 2**

The passive design measures are anticipated to achieve a **4.6%** reduction in regulated CO_2 emissions to demonstrate compliance with the Building Regulations Part L (2013) 'baseline' for the areas within the application at the Be Lean stage. Opportunities to implement passive design measures to achieve a reduction in CO_2 emissions at the Be Lean stage would be considered in detailed design.

As a result, the Proposed Development will achieve compliance with the requirements of the Building Regulations Part L 2013 through passive design and energy efficiency measures.

1.3.4 **Application B - School**

These measures are anticipated to achieve **~5.7%** reduction in regulated CO_2 emissions beyond the requirements of the Part L gas boiler 'baseline' for the school.

As a result, the Proposed Development will achieve compliance with the requirements of the Building Regulations Part L 2013 through passive design and energy efficiency measures.

1.4 Be Clean - Infrastructure and low-carbon supply of energy.

The Proposed Development is proposing a staggered approach across the two Development Areas of Application A. The overall emissions are calculated using the SAP 2012 carbon factors (as per March 2016 GLA guidance). These are the carbon factors used in the submitted energy strategy.

An energy centre is proposed to be provided within the basement of each development area as per discussions with the GLA. This will provide flexibility for the areas that will be subject to a reserved matters application (Development Area 2) to maximise the availability of CO_2 emissions reductions when this area is brought forward for development. The energy centre in Development Area 1 will include gas fired boilers to serve Development Area 1 prior to the construction of Development Area 2, therefore this represents a temporary solution for serving the thermal demands within Development Area 1.

At the time of the submission of the reserved matters submission it is expected that a gas-fired CHP will be specified to be connected to Development Area 1 and Development Area 2, however, as per the agreed planning conditions for the original Application A there will be a review at the time of reserved matters to determine the Energy Strategy that provides suitable CO2 emissions reductions in line with this strategy.

For the Outline proposals (Development Area 2) of Application A the reserved matters submission will include a review of suitable low and zero carbon technologies that could be incorporated to provide a carbon dioxide emissions reduction at least commensurate with this Energy Strategy. The review would be undertaken where feasible to do so in line with the energy policy in place at the time of submission of the Reserved Matters submission. The review shall be submitted to GLA for review and comment.

The school will be serviced by its own energy centre independently from the heat networks associated with Application A. The programme for construction of the school is anticipated to be brought forward at the same time as Development Area 1. The development of the school site is not under the applicant's control and therefore the energy strategy allows for Application B to be brought forward independently.

The townhouses within Development Area 2 are also to be serviced separately with individual boilers located within each townhouse.

1.4.1 **Whole Site – Application A**

On the basis that the CHP engine within the energy centre would supply 90% of the hot water requirements and up to 50% of the space heating requirements of the areas within the whole Application A site, it is expected that a reduction in regulated CO_2 emissions of **860tonnes** per annum can be achieved using Part L 2013 carbon factors. This is equivalent to a further **35.7%** reduction in CO_2 emissions beyond the requirements of the Part L gas boiler 'baseline'.

When considering the dwellings in Application A separately, the contribution of the CHP engine is equivalent to **~40.2%** reduction beyond the Part L gas boiler 'baseline' and **748 tonnes** of CO_2.

1.4.2 **Application A – Development area 1**

When considering all of the areas within the Development Area 1 of Application A the contribution of the CHP engine is equivalent to **~34.1%** reduction beyond the Part L gas boiler 'baseline', equivalent to **511 tonnes** of CO_2 emissions.

When considering the dwellings within Development Area 1 separately and on the basis that the CHP engine will supply the hot water requirements and up to 50% of the space heating requirements of the Proposed Development, it is expected that a reduction in regulated CO_2 emissions of 399 tonnes per annum can be achieved. This is equivalent to a further 42.1% reduction in CO_2 emissions beyond the requirements of the Part L gas boiler 'baseline' after the Be Lean improvements.

1.4.3 Application A – Development area 2

On the basis that the heat network with CHP would provide for the domestic hot water demand in Development Area 2 and up to 50% of the space heating demand. It is anticipated that this would reduce regulated CO_2 emissions by approximately 349 tonnes per annum. This is equivalent to a reduction of ~38.2% beyond the Part L gas boiler 'baseline'.

At reserved matters submission an energy strategy that provides beneficial CO_2 emissions reductions in accordance with policy and building regulations at the time of the reserved matters submission would be submitted for consideration with the application at that time.

1.4.4 Application B - School

For the school a CHP engine has been assessed to supply 100% of the hot water and 50% of the space heating demands. It is expected that if a CHP is feasible for the school a reduction in regulated CO_2 emissions of 42tonnes per annum can be achieved. This is equivalent to a further 23.9% reduction in CO_2 emissions beyond the requirements of the Part L gas boiler 'baseline'.

1.5 Be Green - On-site renewable energy generation.

The inclusion of on-site renewable energy generation has been assessed.

1.5.1 Whole site – Application A

It is anticipated that a PV array with a total area of 360m^2 would be provided on the roof area of the Proposed Development. Based on the solar irradiance data for London, an array of this size would generate approximately 62,400kWh of electricity per annum, reducing CO_2 emissions by 32 tonnes per annum. This is equivalent to a reduction in regulated CO_2 emissions of 1.3% beyond the Part L gas boiler 'baseline' for the anticipated emissions of the Proposed Development (Application A). Further opportunities to increase the area of the PV array will be provided in the reserved matters submission(s).

When considering the non-domestic use areas separately if this array was to be connected to the supply to the office or landlords supplies in each building the contribution is equivalent to a 5.9% reduction in CO_2 emissions beyond the Part L gas boiler 'baseline'.

PV is therefore anticipated to be a suitable addition to the Proposed Development in pursuit of further reductions in regulated CO_2 emissions.

1.5.2 Application A – Development area 1

Considering the available roof space of Development Area 1, and allowing for access and maintenance requirements, a total solar PV system size in the region of 360m^2 array area will be included in the Proposed Development as shown in Appendix H.

Based on the solar irradiance data for London, an array of this size would reduce CO_2 emissions by 32tonnes per annum. This is equivalent to a reduction in regulated CO_2 emissions of 2.2% beyond the Building Regulations Part L (2013) 'baseline' on the CO_2 emissions of Development Area 1. When considering the non-residential elements separately, the contribution is equivalent to a 5.9% reduction in CO_2 emissions beyond the Part L gas boiler 'baseline'.

PV is therefore deemed to be a suitable addition to the Proposed Development in pursuit of further reductions in regulated CO_2 emissions.

1.5.3 Application A – Development area 2

At the reserved matters submission, the available roof space of Development Area 2, for the installation of a solar PV system size would be considered. It is anticipated that this array would contribute to a reduction in CO_2 emissions of at least 1% beyond Part L 2013. This has been agreed in a draft condition as agreed by LBRuT and the GLA on the Original Scheme, prior to the scheme's resolution at the LBRuT Planning Committee on 29 January 2020. The draft condition reads: "The Reserved Matters submission for the Outline proposals (Development Area 2) of Application A (ref. 18/0547/FULL) will include a review of suitable low and zero carbon technologies that could be incorporated to provide a carbon dioxide emissions reduction at least commensurate with the Energy Strategy submitted for Application A (Development Area 1 and Development Area 2). The review would be undertaken where feasible to do so in line with the energy policy in place at the time of submission of the Reserved Matters submission. The review shall be submitted to GLA for review and comment"

1.5.4 .Application B – School

PV is not proposed to be located on the school building as the roof area is being used to provide a play area and is also allocated for plant.

1.6 Overall carbon dioxide emissions reduction.

A summary of the anticipated CO_2 emissions and reduction at each step of the energy hierarchy is given in Table 1 below. This captures the CO_2 emissions that would be used to calculate a potential offset payment for the whole site including the areas associated with Application A and B. The calculation of the Carbon Offset payment needs to be dealt with on a bespoke basis for a mixed-use scheme of this scale.

1.6.1 Application A

Table 1: Summary of CO_2 emissions reductions.

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	2,411	455
Reduction from Be Lean	2,288	455
Reduction from Be Clean	1,428	455
Reduction from Be Green	1,396	455
	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	122	5.1%
Reduction from Be Clean	860	35.7%
Reduction from Be Green	32	1.3%
Total Reduction	1015	42.1%
Dwelling Reduction	864	35.8%
Non-Dwelling Reduction	150	6.2%

1.6.2 **Dwelling only summary**

Dwellings	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	1,859	58
Reduction from Be Lean	1,743	58
Reduction from Be Clean	995	58
Reduction from Be Green	995	58

Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	117	6.3%
Reduction from Be Clean	748	40.2%
Reduction from Be Green	0	0.0%
Total Reduction	864	46.5%
Total Target Reduction	1,859	100%
Annual Surplus / Shortfall	-995	-53.5%

1.6.3 **Non-Dwellings**

Non-Dwellings	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	551	396
Reduction from Be Lean	546	396
Reduction from Be Clean	433	396
Reduction from Be Green	401	396

Non-Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	5	1.0%
Reduction from Be Clean	113	20.4%
Reduction from Be Green	32	5.9%
Total Reduction	150	27.3%
Total Target Reduction	193	35.00%
Annual Surplus / Shortfall	43	7.72%

1.6.4 **Application A – Development area 1**

A summary of the anticipated CO_2 emissions and reductions at each step of the energy hierarchy is given in Table 2 below. The Proposed Development achieves an overall **41.6%** reduction in regulated CO_2 emissions when considering the Development Area 1 of Application A.

Table 2: Summary of CO_2 emissions reductions for Development Area 1.

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	1,499	444
Reduction from Be Lean	1,419	444
Reduction from Be Clean	907	444
Reduction from Be Green	875	444

	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	80	5.3%
Reduction from Be Clean	511	34.1%
Reduction from Be Green	32	2.2%
Total Reduction	623	41.6%
Dwelling Reduction	473	31.6%
Non-Dwelling Reduction	150	10.0%
Total Target Reduction	1140	76.1%
Annual Surplus / Shortfall	-517	34.5%

1.6.5 **Application A – Development area 2**

A summary of the anticipated CO_2 emissions and reductions at each step of the energy hierarchy is given in Table 2 below. The Proposed Development achieves an overall **42.9%** reduction in regulated CO_2 emissions when considering the Development Area 2 of Application A.

Table 3: Summary of CO_2 emissions reductions for Development Area 1.

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	912	10
Reduction from Be Lean	870	10
Reduction from Be Clean	521	10
Reduction from Be Green	521	10

	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	42	4.6%
Reduction from Be Clean	349	38.2%
Reduction from Be Green	0	0.0%
Total Reduction	391	42.9%
Dwelling Reduction	391	42.9%
Non-Dwelling Reduction	0	0.0%
Total Target Reduction	912	100%
Annual Surplus / Shortfall	521	57.1%

1.6.6 **Application B – The School**

A summary of the anticipated CO_2 emissions and reduction at each step of the energy hierarchy is given in Table 4 below. The application for the School achieves an overall **29.9%** reduction in regulated CO_2 emissions when considering the School.

Table 4: Summary of CO_2 emissions reductions for the School (Application B).

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	177	99
Reduction from Be Lean	167	99
Reduction from Be Clean	124	99
Reduction from Be Green	124	99

Non-Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	10	5.65%
Reduction from Be Clean	42	23.9%
Reduction from Be Green	0	0.0%
Total Reduction	**53**	**29.9%**
Total Target Reduction	**62**	**35.0%**
Annual Surplus / Shortfall	**-9**	**-5.10%**

1.6.7 **Carbon offset**

Table 5 shows the anticipated CO_2 emissions that will be subject to a carbon offset charge to be agreed with LBRuT.

Table 5: Carbon Offset

Whole Site (Application A and B) Total		Carbon Offset (tonnes)	Cost (£)
Development Area 1	Annual Offset (Residential Areas)	474 tCO_2	£853,200
	Annual Offset (Non-residential Areas)	43 tCO_2	£77,400
Development Area 2	Annual Offset (Residential Areas)	521 tCO_2	£937,800
	Annual Offset (Non-residential Areas)	n/a	
School	Annual Offset (School)	9 tCO_2	£16,200
Total carbon offset		1,047	£ 1,884,600

The School (application B) carbon offset charge is £16,200 which is included in the table above, but set out separately for clarity.

1.7 Minimising cooling demand and limiting the effects of heat gains in summer months.

The Proposed Development has been designed in accordance with the cooling hierarchy to minimise cooling demand and limit the likelihood of high internal temperatures. Mitigation measures such as suitable glazing ratio and g-value, appropriate ventilation levels and minimisation of internal heat gains will be implemented. Through these measures, relevant areas of the Proposed Development will achieve compliance with Criterion 3 of the Building Regulations Part L (2013).

An overheating risk assessment has been carried out on the proposals for Development Area 1, in accordance with recent GLA policy 5.9 – Overheating and cooling, using the CIBSE TM59 methodology. A completed overheating checklist has also been provided in this report. Active cooling will not be provided for the residential areas of Development Area 1.

The following mitigation measures have been implemented in the design of the Proposed Development:

a. Energy efficient lighting (such as LED or compact fluorescent) with low heat output
b. Insulation to heating and hot water pipework and minimisation of dead-legs to avoid standing heat loss (from pipework to dwellings) including no-hot water storage in the dwellings
c. HIUs located away from main living spaces
d. Environmental controls within the common corridors to provide ventilation
e. Increased mechanical ventilation rates beyond minimum Building Regulations requirements.

The results show a hybrid ventilation strategy which enables 100% of living rooms, kitchens and bedrooms assessed to meet the CIBSE TM59 requirements of the first criteria of the adaptive thermal comfort model and 100% of bedrooms meet the second criteria.

All dwellings will be provided with opening windows and therefore the adaptive thermal comfort model has been used as the benchmark in this analysis. The ventilation design includes MVHR to all units to extract stale air and provide fresh background air, with enhanced ventilation rates to provide additional mechanical ventilation during periods of warmer ambient conditions.

As a result of the above considerations, the risk of high internal temperatures in summer has been minimised as far as practically possible from passive measures for the residential dwellings, within architectural and practical constraints, and this has been demonstrated via overheating calculations in compliance with current CIBSE guidance.

2. Introduction.

2.1 The Application

This Energy Strategy has been prepared by Hoare Lea as a revised submission document to the Energy Strategy submitted under Applications A, B and C (refs. 18/0547/FUL, 18/0548/FUL and 18/0549/FUL) ('the Applications'), in respect of the former Stag Brewery Site in Mortlake ('the Site') within the London Borough of Richmond Upon Thames ('LBRuT'). The Applications are for the comprehensive redevelopment of the Site. This document has been prepared on behalf of Reselton Properties Limited ('the Applicant'). A summary of the Applications is set out below:

a. Application A – hybrid planning application for comprehensive mixed use redevelopment of the former Stag Brewery site consisting of:
    i. Land to the east of Ship Lane applied for in detail (referred to as 'Development Area 1' throughout); and
    ii. Land to the west of Ship Lane (excluding the school) applied for in outline (referred to as 'Development Area 2' throughout).
b. Application B – detailed planning application for the school (on land to the west of Ship Lane).
c. Application C – detailed planning application for highways and landscape works at Chalkers Corner.

This document replaces the Energy Strategy and Energy Strategy Addendum.

The Applications were submitted in February 2018 to LBRuT. The Applications are related and were proposed to be linked via a Section 106 Agreement. In May 2019, a package of substitutions was submitted to LBRuT for consideration, which sought to address comments raised by consultees during determination. On 29 January 2020, the Applications were heard at LBRuT's Planning Committee with a recommendation for approval. This scheme is thereafter referred to as "the Original Scheme".

The Committee resolved to grant Applications A and B, and refuse Application C. The granting of Applications A and B was subject to the following:

a. Conditions and informatives as set out in the officer's report, published addendum and agreed verbally at the meeting;
b. Amendments to the Heads of Terms and completion of a Section 106 Legal Agreement which was delegated to the Assistant Director to conclude;
c. No adverse direction from the Greater London Authority ('GLA'); and
d. No call in by the Secretary of State for Housing, Communities and Local Government.

The Applications have been referred to the GLA and the Mayor has given a direction that he will take over the determination of the Applications and act as local planning authority in relation to all three applications.

The Applicant has engaged with the GLA in respect of the proposed amendments to the scheme, referred to throughout this document as the 'Revised Scheme'. As a result of these discussions, a number of changes have been made to the scheme proposals which are summarised as follows:

a. Increase in residential unit provision from up to 813 units (this includes the up to 150 flexible assisted living and / or residential units) to up to 1,250 units;
b. Increase in affordable housing provision from up to 17% to up to 30%;
c. Increase in height for some buildings, of up to three storeys compared to the Original Scheme;
d. Change to the layout of Buildings 18 and 19, conversion of Block 20 from a terrace row of housing to two four storey buildings;
e. Reduction in the size of the western basement, resulting in an overall reduction in car parking spaces of 186 spaces, and introduction of an additional basement storey beneath Building 1 (the cinema);
f. Other amendments to the masterplan including amendments to internal layouts, re-location and change to the quantum and mix of uses across the Site, including the removal of the nursing home and assisted living in Development Area 2;
g. Landscaping amendments, including canopy removal of four trees on the north west corner of the Site; and
h. Associated highways works may be carried out on adopted highways land.

The submission documents have tested an affordable housing provision of 30%. However, it should be noted that the final affordable housing level is subject to further viability testing and discussions with the GLA.

Minor amendments have also been made to the road and pedestrian layouts for the school (Application B). No other amendments are proposed to Application B. No amendments are proposed to the physical works proposed under Application C, although alternative options within the highway boundaries for mitigating the highway impact of the amended proposals have been assessed within the relevant substitution documents for Applications A and B and are the subject of ongoing discussions with the GLA and TfL.

A more detailed summary is included within the Planning Statement Addendum and Design and Access Statement Addendum submitted with the Revised Scheme documents.

These changes are being brought forward as substitutions to Applications A, B and C (refs. 18/0547/FUL, 18/0548/FUL and 18/0549/FUL), which are related applications (to be linked via a Section 106 Agreement).

It is important to note that no changes are proposed to the physical works proposed under Application C – the only change to this application is that the supporting documents (which include all documents submitted under Applications A and B) have been updated in the context of the proposed changes to the scheme as sought under Applications A and B. Application C was resolved to be refused by LBRuT at Committee on 29 January 2020. As a result, whilst the works proposed in Application C are still an available option, the Applicant has progressed alternative approaches for addressing and mitigating the impacts on surrounding highways, and these have been tested within the relevant substitution documents for Applications A and B. All of these options are subject to ongoing discussions and testing with TfL. They are all within the existing highway boundaries and if agreed would not, in themselves, require planning consent.

Accordingly, Application C remains 'live' within this substitution package.

2.2 Site context.

The site plan shows the former Stag Brewery Site is bounded by Lower Richmond Road to the south, the river Thames and the Thames Bank to the north, Williams Lane to the east and Bulls Alley (off Mortlake High Street) to the west. The Site is bisected by Ship Lane. The Site currently comprises a mixture of large-scale industrial brewing structures, large areas of hardstanding and playing fields.

London Plan Intend to Publish Version (dated December 2019)

An updated draft of the new London Plan was published in December 2019 as the intend to publish version. Whilst the Plan has not yet been adopted, the draft policies have been considered, where appropriate, within this strategy for completeness.

2.2.1 Aim

The aim of this strategy is to detail a robust energy demand reduction and supply strategy to enable the Proposed Development to meet the targets set out in the LBRuT Local Plan (2018), and GLA London Plan (2016).

Figure 1: Site Plan

The Proposed Development includes multiple planning applications. This Energy Strategy reviews the whole site encompassing Application A and B and accounts for the comments from the GLA relating to the phasing of the Proposed Development and how the Energy Centres will be developed and commissioned (refer to Appendix J for further detail).

Table 6 shows the area schedule for the Proposed Development, including those uses that will come forward as part of Development Area 1, and those which will follow in Development Area 2. Whilst the school was made as a separate application (Application B), for the purposes of this report it has been included within all calculations for Development Area 1 and the masterplan for Application A.

Table 6: Area schedule for the Proposed Development.

Space use		GIA (m^2)		
		Application A Development Area 1	Application A Development Area 2	Application B
Domestic	Private residential	59,109	29,107	-
	Affordable	4,037	31,285	-
Non-domestic	Flexible Use	5,023	-	-
	Office	5,532	-	-
	Cinema	1,606	-	-
	Hotel	1,765		
	School	-	-	9,319

3. Approach and methodology.

3.1 Definitions.

The following definitions should be understood throughout this strategy:

- Energy demand – the 'room-side' amount of energy which must be input to a space to achieve comfortable conditions. In the context of space heating, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- Energy requirement – the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. the energy demand).
- Regulated CO_2 emissions – the CO_2 emissions emitted as a result of the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated sources (those controlled by Part L of the Building Regulations).

3.2 Limitations.

The appraisals within this strategy are based on Part L calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise. Occupants may operate their systems differently, and / or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

3.3 Approach.

This strategy outlines how the Proposed Development could have a reduced effect on climate change by reducing CO_2 emissions associated with energy use in buildings.

Figure 2 outlines the route followed by the Proposed Development when reducing CO_2 emissions and defines the structure of this statement.

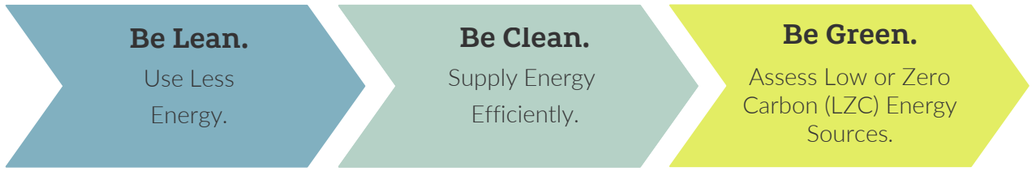


Figure 2: Energy Hierarchy

The strategic approach to the design of the proposed development has been to maximise the energy efficiency of the development through the incorporation of passive design led solutions during the construction process, with the integration of low carbon technology to maximise reduction of carbon emissions from the development.

Further reductions are ensured through the specification of high-efficiency building services to limit losses in energy supply, storage and distribution.

After the inclusion of passive design and energy efficiency measures, various options have been investigated to reduce CO_2 emissions associated with energy supply. The feasibility of LZC technologies has been investigated in line with the policy aspirations.

3.4 Methodology.

The areas outlined in Table 7 have been used to undertake the appraisals described within this strategy as advised by the architect. Please note that these areas refer to conditioned spaces only and excludes the basement car park, energy centres and other non-conditioned spaces that are subject to the CO_2 emissions calculations of Part L of the building regulations.

It should be noted that some flexible commercial floor space is proposed as part of the scheme (Class A1/A2/A3/A4/B1/D1/Boathouse). In the calculations the floor area has been allocated to these uses in the following order to generate a 'worst case' energy demand and CO_2 emissions:

1. B1, (as this category has a minimum floor area of 2000m^2)
2. A3
3. A1

This is not to be taken as a suggestion that these areas are set in the Proposed Development.

Flexible use spaces are set within the following maximum floor area per use with the maximum floor area for flexible uses at 5,023m^2.

Table 7: Flexible Use Maximum Areas

Use	Maximum floorspace (m^2)
Retail (A1)	2,600
Financial and Professional services (A2)	300
Cafes/restaurants (A3)	2,900
Drinking Establishments (A4)	2,600
Offices (B1)	2,600 (minimum 2000)
Community Use (D1)	1,500
Boathouse (Sui Generis)	500

From this proposal the areas used in the calculation of energy use and CO_2 emissions in this Energy Strategy are set out in the table below.

Table 8: Flexible use areas assigned in Energy Strategy

Use	Area used in energy strategy (m^2)
Retail (A1)	623
Financial and Professional services (A2)	0
Cafes/restaurants (A3)	2,400
Drinking Establishments (A4)	0
Offices (B1)	2,000
Community Use (D1)	0
Boathouse (Sui Generis)	0

3.4.1 Whole site application

Calculations demonstrating the energy requirements and associated CO_2 emissions for the dwelling areas have been undertaken using SAP assessment results from the calculations undertaken for the full application of Development Area 1. Calculations for the commercial uses have been carried out using Part L2A modelling using NCM compliant software for the cinema and office areas. The flexible use areas have made use of benchmarks from similar Part L2A 2013 compliant buildings. The Whole Site (Applications A & B) calculations include all areas of the Proposed Development as set out in

Table 6.

The following Part L 2013 compliant carbon factors in Table 9 were used to convert the energy consumption figures into CO_2 emissions for the Proposed Development.

Table 9: Building Regulations Part L 2013 CO_2 Emission Factors.

Fuel	Emission Factor ($kgCO_2/kWh$)
Gas	**0.216**
Electricity	**0.519**

4. Drivers.

This section summarises the pertinent policies and requirements applicable to the Proposed Development. Of these, the principal target is to achieve a reduction in regulated CO_2 emissions of 35% beyond the requirements of the Building Regulations Part L (2013) for the non-domestic elements of the Proposed Development and 'zero carbon' for the residential aspects, corresponding to a 100% reduction in regulated CO_2 emissions beyond the requirements of the Building Regulations Part L (2013), as set out in the London Plan (2016) and set out in the LBRuT Local Plan (2018). The Proposed Development is referable to the Mayor of London. An updated London Plan Intend to Publish Version (dated December 2019)was published in December 2019 as a further revision. The Proposed Development is not required to respond to these draft policies but they have been considered for completeness.

4.1.1 Current policy framework

The policies considered when preparing this strategy are contained in the London Plan (Greater London Authorities (GLA), March 2016) and the Local Plan documents of LBRuT. These policies are reviewed in further detail in Appendix A and summarised below.

4.1.2 Building Regulations Part L 2013

The assessment of the Proposed Development against policy targets has been carried out using Part L 2013 benchmarks.

Criterion One of the Building Regulations Part L (2013) requires that the building as designed is not anticipated to generate CO_2 emissions in excess of that set by a Target Emission Rate (TER) calculated in accordance with the approved National Calculation Methodology (NCM).

On aggregate, Part L 2013 requires the following CO_2 emissions reductions:

- 6% beyond the requirements of Part L 2010 for dwellings.
- 9% beyond the requirements of Part L 2010 for non-domestic buildings.

Criterion Two places upper limits on the efficiency of controlled fittings and services for example, an upper limit to an external wall U-value of 0.35W/m^2.K (new non-domestic buildings).

Criterion Three requires that spaces are not subject to excessive solar gains. This is demonstrated using the procedure given in the National Calculation Methodology.

4.1.3 The London Plan (March 2016) Consolidated with Alterations Since 2011

The regional policies of the GLA are contained within the London Plan (2016), and the relevant SPGs.

The latest version of the consolidated London Plan (2016) was published and adopted in March 2016 and is current for any Stage 1 submissions to the GLA. This constitutes the London Plan 2011 consolidated with:

- Revised Early Minor Alterations to the London Plan (October 2013)
- Further Alterations to the London Plan (March 2015)
- Housing Standards Minor Alterations to the London Plan (March 2016)
- Parking Standards Minor Alterations to the London Plan (March 2016)
- Housing Supplementary Planning Guidance (March 2016)
- GLA guidance on preparing energy statements (March 2016)

The target reduction in CO_2 emissions for Residential Buildings is to achieve 'zero carbon homes' for Stage 1 applications. The definition of this is clarified in the GLA's publication G*uidance on Preparing Energy Assessments*. The target for 'Non-Domestic Buildings' is to achieve 35% reduction in CO_2 emissions.

Table 10: Uplift in CO_2 emissions targets

Use Type	CO_2 Reduction Target (beyond Part L 2013)	
	2013 – 2016	2016 – 2019 (1st October 2016)
Residential Buildings	35%	'Zero Carbon'
Non-Domestic Buildings	35%	35%

4.1.4 London Plan Policy

Development within LBRuT is subject to the policy requirements of the London Plan 2016. The following policies of the London Plan (2016) have informed this strategy.

An updated London Plan Intend to Publish Version (dated December 2019) was published in December 2019 for further consultation. The Proposed Development is not required to respond to these draft policies but have been considered for completeness.

Policy 5.2: Minimising CO_2 Emissions

Policy 5.2 sets out the target CO_2 emission reductions as described above.

Policy 5.6: Decentralised Energy in Development Proposals

Policy 5.6 requires development proposals to evaluate the feasibility of Combined Heat & Power (CHP) systems and where a new CHP system is appropriate, examine opportunities to extend the system beyond the Site boundary. Developments should select energy systems on the following hierarchy:

a. connection to existing heating or cooling networks
b. site wide CHP network
c. communal heating and cooling

Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7: Renewable Energy

Policy 5.7 requires that developments should provide a reduction in expected CO_2 emissions through the use of on-site renewable energy generation, where feasible.

London Plan Policy 5.9: Overheating and Cooling

The GLA have produced a 'Domestic Overheating Checklist' (Appendix G of the 'Energy Planning' guidance) for use early in the design process to identify potential overheating risks and to trigger the incorporation of passive measures within the building envelope. The 'Energy Planning' guidance document also includes an update to the guidance on compliance with overheating policy that design teams should be aware of when undertaking risk analysis and thermal comfort modelling for dwellings.

It is the GLA's expectation that dynamic thermal modelling should be undertaken to determine overheating risk and demonstrate compliance with London Plan Policy 5.9. This should be in addition to the Building Regulations 'Criterion 3' assessment of heat gains in summer months.

The GLA has set out that dynamic modelling should be carried out in accordance with the guidance and data sets in CIBSE TM49 'Design Summer Years' for London (2014) using the three design weather years as follows:

- 1976: a year with a prolonged period of sustained warmth.
- 1989: a moderately warm summer (current design year for London).
- 2003: a year with a very intense single warm spell.

For developments in high density urban areas (e.g. Canary Wharf) and the 'Central Activity Zone' the 'London Weather Centre' data set should be used. In lower density urban and suburban areas, the 'London Heathrow' dataset should be used. These data sets have been adjusted to account for future climate effects.

The modelling should also consider the additional guidance contained in CIBSE TM52 'The Limits of Thermal Comfort: Avoiding Overheating in European Buildings'.

4.1.5 **GLA Sustainable Design and Construction SPG (April 2014)**

This SPG provides more detailed guidance to aid implementation that cannot be covered in the London Plan. It updates the standards that were developed for the Mayor's SPG on Sustainable Design and Construction in 2006 and identifies these as priorities for the Mayor. The SPG provides guidance and practical advice for those designing schemes including architects, developers and engineers as well as those developing planning policy and neighbourhood plans.

4.1.6 **GLA Energy assessment guidance (October 2018)**

This document provides detailed guidance on the preferred methodology and structure to produce an Energy Strategy for a planning application.

4.1.7 **LBRuT Policy**

The pertinent targets of the LBRuT policies are:

London Borough Richmond upon Thames Local Plan, July 2018

The LBR Local Plan details local policies which are applicable to the proposed development.

Policy LP 22 states:

- "Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
- Proposals for commercial areas greater than 100 sqm will be required to meet BREEAM New Construction 'Excellent' standard (where feasible).
- All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy."

4.2 Emerging.

London Plan Intend to Publish Version (dated December 2019)

A London Plan Intend to Publish Version (dated December 2019) has been published for consultation. The policies are yet to be adopted. The notable policy carbon emission changes include non-residential target will be uplifted to 'zero carbon' – i.e. 100% reduction in CO_2 emissions for regulated energy uses. Of this target, 35% reduction should be achieved from on-site measures, and 10-15% from passive design and energy efficiency measures (residential and non-residential areas respectively). Any shortfall is still expected to be made up by a cash-in-lieu payment.

Whilst the Intend to Publish London Plan has not been adopted, we have considered the relevant policies within this document for completeness. The relevant policies which have been considered in this Energy Strategy are set out in Table 11. Other policies have been responded to within the Sustainability Statement document.

Table 11: Summary of London Plan Intend to Publish Version (dated December 2019) policies for energy and CO_2 emissions.

Policy SI1	Improving air quality – Result in neutral or improvement on air quality as result of the proposed development.
Policy SI3	Energy infrastructure – Identify opportunities for energy infrastructure improvement. – Provide a communal low temperature heating system in accordance with the heating hierarchy. – CHP and ultra-low NOx gas boilers are designed in accordance with policy SI1.
Policy S12	Minimising Greenhouse Gas Emissions – Major development to be Net Zero Carbon (taken to mean a 100% reduction in regulated CO_2 emissions from the relevant Building Regulations baseline). – Minimum 35% on-site emissions reduction. – Minimum 15% (commercial)/10% (residential) reduction in regulated CO_2 through energy efficiency measures (Be Lean stage). – Demonstrate a pathway to Zero Carbon by 2050.

5. Cooling and overheating.

In tandem with the energy and CO_2 emissions appraisal, an assessment has been undertaken to determine the risk of summertime overheating and consider measures for the minimisation of cooling demand.

5.1 Cooling hierarchy.

The London Plan Policy 5.9 (Overheating and Cooling) requests that developments should reduce potential overheating risk and reliance on air conditioning systems. A 'cooling hierarchy' is provided and the Proposed Development has sought to follow this hierarchy.

The following cooling hierarchy has been followed to limit the effects of heat gains in summer:

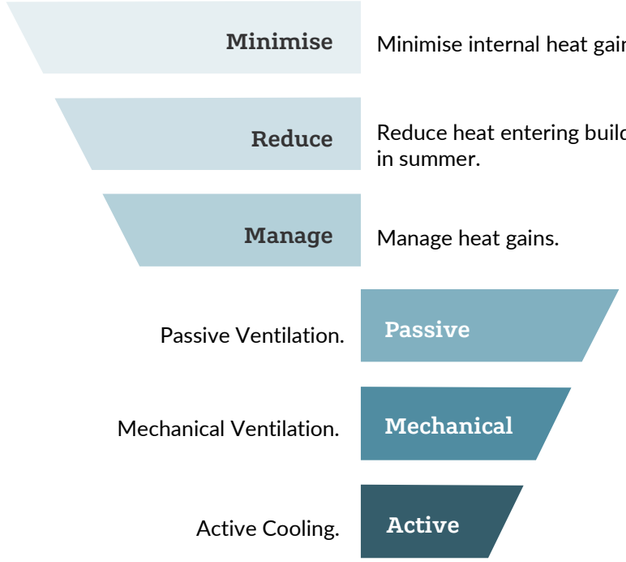


Figure 3: Cooling hierarchy.

5.2 Mitigation strategy.

The following mitigation methods will be implemented at the Proposed Development.

Minimising internal heat generation through energy efficient design
The following mitigation methods will be implemented to minimise the internal heat generation through energy efficient design at the Proposed Development:

- Energy efficient lighting (such as LED or CFL) with low heat output
- Insulation to heating and hot water pipework and minimisation of dead-legs to avoid standing heat loss (from pipework to dwellings)
- Energy efficient white goods with low heat output

Reducing the amount of heat entering the building in summer
The following mitigation methods will be implemented to reduce the amount of heat entering the building in summer at the Proposed Development:

- Suitable glazing ratio responding to orientation and space use
- Glazing with shading devices and suitable g-value to limit solar heat gains (where appropriate)
- High levels of insulation and low fabric air permeability which will retain cool air during summer months

Passive ventilation
The rooms will also benefit from passive solar heating and occupants will be able to adapt their internal environment via openable panels for natural ventilation.

Mechanical ventilation
All residential spaces, as a minimum will be provided with ventilation rate in accordance with Part F through Mechanical Ventilation with Heat Recovery (MVHR) or through central provision of ventilation also taking advantage of Heat Recovery.

MVHR units are an important addition to the building services to maintain good indoor air quality, by providing fresh air to occupied areas and bedrooms and extracting vitiated air from bathrooms and kitchens. Providing fresh air minimises the risk of stale and stagnant air and limits the risk of condensation and mould growth. The heat recovery mechanism will be provided with a bypass to avoid returning hot air to the occupied areas in summer months.

5.3 Part L heat gain check.

It is anticipated that the Proposed Development will achieve compliance with the Building Regulations Part L 2013 Criterion 3 and limit the effects of heat gains in summer months and reduce the need for comfort cooling/air-conditioning.

5.4 Overheating risk assessment.

This provides a summary of overheating risk for the proposed Stag Brewery development.

The typical floor for Block 08 has been used as a best representation of apartments on the site. An assessment has been carried out using weather scenarios Design Summer Year (DSY) 1, 2 and 3 have been used for the appropriate location for completeness.

Three scenarios have been included in the analysis:

- Natural ventilation only with blinds
- Natural ventilation with improved performance parameters and blinds
- Hybrid ventilation (i.e. openable windows and mechanical ventilation with heat recovery (MVHR)), improved performance parameters and blinds.

Please refer to Appendix B for key modelling input parameters.

The results for each summer year are included below and also in Section 4.0.

Table 12 to Table 14 summarise the results of the overheating risk assessments. Results are presented in terms of the percentage of rooms that meet the adaptive comfort criteria.

This method of assessment has been advised by the GLA Energy Assessment Guidance (October 2018). Please refer to Appendix G for the results on a room by room basis.

DSY1

Based on the input parameters and methodology outlined in section 3.0, it has been demonstrated that all of the assessed dwellings can meet the CIBSE TM59 adaptive criteria for DSY1.

The following scenarios have been assessed as part of the analysis:

- Natural ventilation only, with blinds.
- Natural ventilation only with improved performance parameters (Table 12).
- Hybrid ventilation strategy where natural and mechanical ventilation is being used concurrently

It is important to note that where blinds have been used, for the natural ventilation strategy, a reduction in the achieved free area of the windows / opening doors has not been accounted for in the model.

Table 12: Summary of adaptive criteria results based on various ventilation scenarios – DSY1.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**70%** (30/43)	**83%** (25/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**91%** (39/43)	**83%** (25/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**100%** (43/43)	**100%** (30/30)	**100%** (2/2)

DSY2

In addition to the assessment using DSY1, the dwellings have also been assessed using the DSY2 summer year. Results are presented in the table below.

Table 13: Summary of adaptive criteria results based on various ventilation scenarios – DSY2.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**65%** (28/43)	**83%** (25/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**70%** (30/43)	**83%** (25/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**72%** (31/43)	**83%** (25/30)	**100%** (2/2)

DSY3.

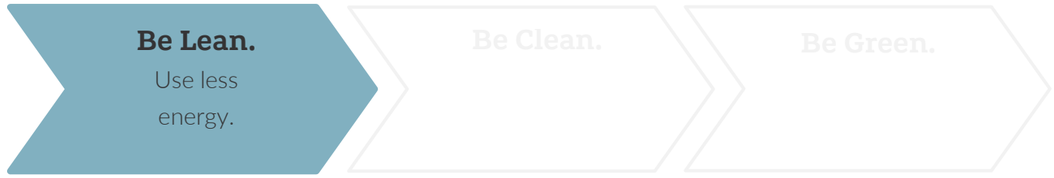
A final model iteration was run using the DSY3 weather file.

Table 14: Summary of adaptive criteria results based on various ventilation scenarios – DSY3.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**2%** (1/43)	**3%** (1/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**7%** (3/43)	**3%** (1/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**7%** (3/43)	**3%** (1/30)	**0%** (0/2)

6. Be Lean.

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for the proposed development. This energy strategy aims to reduce the energy demand initially by optimising the envelope and building services within the development.



6.1 Passive design and energy efficiency features.

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most robust and effective measures for reducing CO_2 emissions as the performance of the solutions, such as wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, it is possible to have confidence that the benefits these measures will continue at a similar level for the duration of their installation. Appendix C details the target fabric and system performance parameters.

Fabric performance
A 'fabric first' approach has been taken in order to reduce the energy demand and CO_2 emissions from the Proposed Development. The overriding objective for the façade design of the building will be to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter and limiting summertime solar gains to reduce space cooling demands.

Thermal insulation
The Proposed Development will benefit from an efficient thermal envelope. Typically, demand for space heating and hot water demand can be dominant in residential accommodation, whilst space heating is less dominant in commercial spaces (lighting dominant). Heat losses and gains will be controlled by the optimisation of the fabric of each building, i.e. ensuring appropriate levels of glazing to control winter heat loss and summer heat gain. Reducing the thermal transmittance of the building envelope where appropriate will help to reduce both heating and cooling requirement and result in lower energy requirements.

Glazing energy and light transmittance
In designing the elevations with a moderate approach to fenestration, the design team has focused to ensure a balance between the benefits of passive solar heating in winter months whilst limiting the likelihood of high internal temperatures in summer.

Fabric air permeability
Fabric air permeability is a measure of the volume of air that can penetrate through the fabric of a building, leading to ventilation heat loss and gain. High air permeability can lead to uncomfortable drafts and dramatically increase the demand for space heating in winter, and space cooling in summer, when the air-flow works in reverse i.e. cool air escaping from the building. The Proposed Development will target an air permeability of $3m^3/(m^2.h)$ at 50 Pa.

Space heating
At the Be Lean stage, space heating has been modelled to be provided by ultra-low NOx, high efficiency (91%) central gas-fired boilers and radiators as advised in the GLA guidance for energy statements (2014).

Space cooling
It is anticipated that the building will not require active cooling to manage overheating risk.

Through considered design of the building fabric and a combined natural and mechanical ventilation strategy, the risk of overheating has been demonstrated through an overheating risk assessment in line with CIBSE TM59 to be mitigated.

Mechanical ventilation and heat recovery
All spaces, as a minimum will be provided with ventilation rate in accordance with Part F. The majority of spaces will be served by local MVHR units. All dwellings will have openable windows to provide natural ventilation.

Mechanical ventilation is an important addition to the building services strategy to maintain good indoor air quality, by providing fresh air to living rooms and bedrooms and extracting vitiated air from bathrooms and kitchens. Providing fresh air minimises the risk of stale and stagnant air and limits the risk of condensation and mould growth.

Coupled to a heat exchanger, the warmth in extracted air can be recovered and delivered to the supply air. In this mode, the MVHR reduces space heating demand. The heat recovery mechanism will be provided with a bypass to avoid returning hot air to the dwellings in summer months.

Domestic hot water (DHW) system
To limit the demand for hot water, all spaces will include the use of water-efficient fixtures and fittings including flow reducers in the taps of wash hand basins and aerated shower heads and also WCs with low flush volume to limit overall water consumption in line with Building Regulations Part G.

At the Be Lean stage, the Domestic Hot Water has been modelled to use a central gas boiler with 91% efficiency, in-line with the GLA guidance on preparing energy assessments.

Natural daylight and lighting strategy
The Proposed Development will be provided with low-energy, efficient light fittings throughout, External lighting for amenity and communal areas will also be low-energy efficient fittings and will be linked to daylight sensors and / or presence detectors to prevent unnecessary use.

It is anticipated that the Proposed Development will be supplied with efficient electric lighting that could include 'Compact Fluorescent Lamps' (CFL), 'Light Emitting Diodes' (LED) or similar low energy lamps. The lighting specification for the Proposed Development will be carried out in conjunction with lighting control systems incorporating daylight linkage and presence detection in suitable areas.

As well as reduced energy requirement that will be achieved by implementing these strategies, the contribution to the cooling requirements and internal heat gains will be reduced. This will further reduce the total energy requirements and CO_2 emissions of each building.

6.2 Be Lean results.

The results presented below are based on Building Regulations Part L1A 2013 compliance modelling carried out on the dwellings of Development Area 1 of Application A. The results have been applied to the residential areas of the whole 'Application A' site on an area weighted basis. The calculations demonstrating the energy requirements and associated CO_2 emissions for dwellings have been carried out using Building Regulations Part L1A approved SAP 2012 v9.92 methodology.

The following table sets out the dwelling units that SAP calculations were undertaken on to form the sample set used in the calculations in the submitted energy strategy to represent the dwellings throughout the development. The calculation has been undertaken on units within the typical floors provided by the architect. SAP Outputs of TER and DER are summarised in the table below.

Table 15: Summary of TER and DER Results

SAP Dwelling Reference	DER	TER
B08-TR-02 v1	14.19	14.91
B08-TY-03 v1	17.48	18.8
B08-TY-04 v1	9.84	11.62
B08-TY-05 v1	16.71	18.31
B08-TY-06 v1	14.63	15.43
B08-TY-07 v1	13.53	14.49
B08-TY-10 v1	14.05	15.3
B08-TY-11 v1	13.33	15.38
B08-TY-12 v1	11.46	13.92
B08-TY-13 v1	14.28	15.23
B06-TY-03_3 v1	15.21	14.74
B09-TY-01_3 v1	14.59	14.62
B09-TY-02_2 v1	15.66	15.09
B09-TY-03_3 v1	14.1	15.15
B09-TY-04_2 v1	14.87	14.93
B10-TY-03_3 v1	17.04	17.91

Calculations for the non-domestic uses have been carried out using software in compliance with Part L2A of the building regulations for school, office and cinema and for the remaining areas benchmarks from similar Part L2A 2013 compliant buildings have been used.

The results summarised overleaf demonstrate that prior to the implementation of any 'be clean' or 'be green' measures, on a site wide (Application A and B) basis the annual regulated energy requirement of the Proposed Development is anticipated to be approximately 9,080 MWh with associated regulated CO_2 emissions of 2,455tonnes.

The majority of the regulated energy requirement, approximately 82%, is as a result of thermal energy requirements (domestic hot water and space heating), of which hot water is the most significant contributor. It is anticipated that the cooling requirement would be minimised through the implementation of passive design and energy efficiency measures and represent approximately 1% of the total regulated annual energy requirement.

It is anticipated that based on the calculations undertaken on a site wide (Application A and B) basis, ~5.1% reduction in annual regulated CO_2 emissions would be made beyond the requirements of the Building Regulations Part L 2013 with a Part L gas boiler baseline, through passive design and energy efficiency measures.

Therefore, the Proposed Development achieves Part L 2013 compliance via Be Lean measures, i.e. prior to the consideration of any LZC technologies.

When considering the domestic uses in isolation, an anticipated annual regulated energy requirement of 6,905 MWh with associated CO_2 emissions of 1,859 tonnes has been calculated.

The majority of the regulated energy requirement (~88%) for the residential uses is associated with thermal energy requirements (domestic hot water and space heating). Consequently, thermal loads contribute most to regulated CO_2 emissions from the domestic uses (~71%).

It is anticipated that the domestic uses would achieve ~6.3% reduction in annual regulated CO_2 emissions beyond the requirements of the Building Regulations part L 2013 through passive design and energy efficiency measures alone.

It would be demonstrated that on an area weighted basis, the dwellings fabric energy efficiency levels calculated alongside the CO_2 emissions calculation would improve upon the requirements of the Building Regulations Part L 2013.

When considering the non-domestic elements (excluding the school) in isolation, these spaces have been calculated to have an annual regulated energy requirement of 1,217 MWh with associated CO_2 emission of 551tonnes.

The majority of the regulated energy requirement (~63%) for the non-domestic uses is associated with thermal energy, i.e. space heating and hot water. However, non-thermal energy use contributes the greatest proportion of CO_2 emissions (~51%) due to the higher carbon intensity of electricity compared to mains gas (Part L2013 figures).

When considering the school in isolation, it has been calculated to have an annual regulated energy requirement of 614MWh with associated CO_2 emission of 167tonnes.

The majority of the regulated energy requirement (~58%) for the school is associated with heating and hot water requirements. Heating and hot water also contribute the greatest proportion of CO_2 emissions (~66%).

6.2.1 **Summary tables & charts.**

The following tables and figures provide a summary of the anticipated the annual energy requirement and associated CO_2 emissions at the Proposed Development.

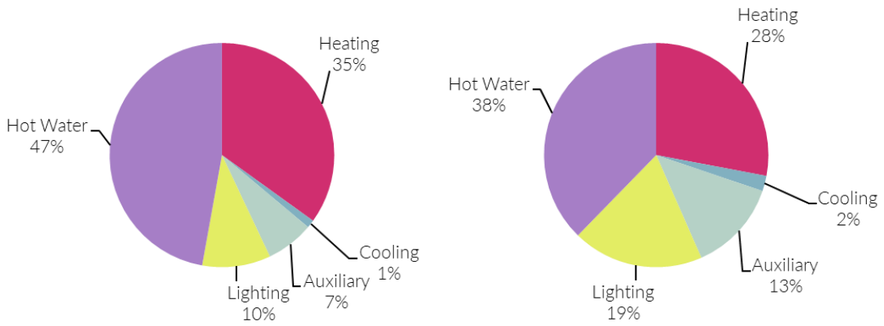


Figure 4: Summary of Regulated Energy Requirement (left) and CO_2 emissions (right) for the Whole Site, Application A and B.

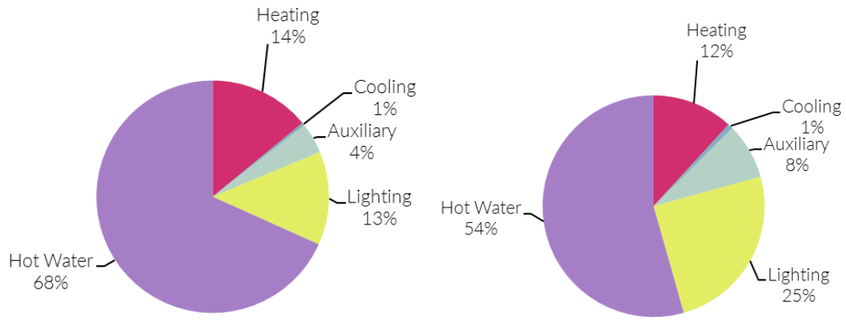


Figure 5: Summary of Regulated Energy Requirement (left) and CO_2 emissions (right) for the school (Application B).

Figure 6 demonstrates that the majority of the CO_2 emissions that would arise from the Proposed Development are associated with thermal sources. For the domestic areas only, emissions are significantly associated with thermal loads as shown in Figure 7. For the non-domestic areas alone the CO_2 emissions are more evenly associated with electrical loads. The distribution for the school is shown in Figure 8.

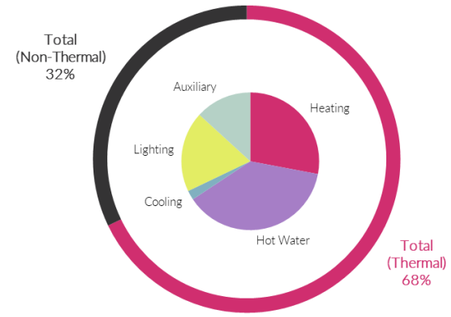


Figure 6: Annual CO_2 Emissions by Type (Whole Site).

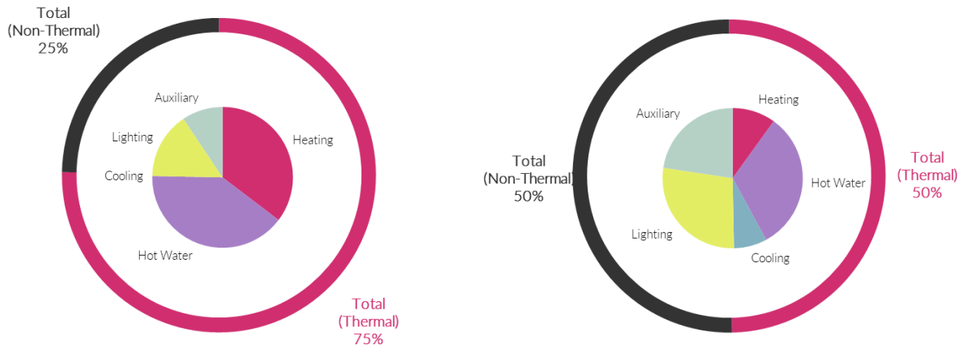


Figure 7: Annual CO_2 Emissions by Type (Domestic Areas Left; Non-domestic areas right).

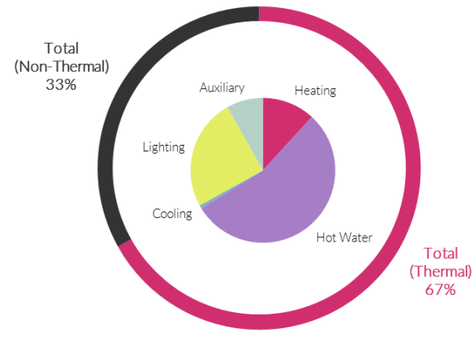


Figure 8: Annual CO_2 Emissions by Type (School)

6.3 Site-wide performance.

The anticipated regulated CO_2 emissions at the 'Be Lean' stage of the energy hierarchy are determined based on the performance parameters outlined within Appendix C. The results detailed below for the 'Be Lean' assessment demonstrate the percentage variance against Approved Document Part L1A and L2A for the Proposed Development.

Table 16: 'Be Lean' sitewide carbon performance.

Stage	Energy Consumption		Regulated CO_2 Emissions	
	MWh/yr	% Reduction	tCO2/yr	% Reduction
Part L Gas Boiler Baseline	9,913	-	2,588	-
Be Lean	9,080	8.4%	2,455	5.1%

6.4 Be Lean summary.

The results show that at this stage, the site-wide development demonstrates a 5.1% reduction over the baseline carbon dioxide emissions.

7. Be Clean.

This' stage of the energy hierarchy refers to the use of heat networks or on-site Combined Heat and Power (CHP) in order to provide energy and reducing consumption from the national grid and gas networks, through the generation of electricity, heating and cooling on-site.

Be Lean. → **Be Clean.** Supply energy efficiently. → Be Green.

7.1 Development demand.

The Proposed Development's anticipated non-thermal energy demand has been calculated to be 32% compared to 68% for thermal demand.

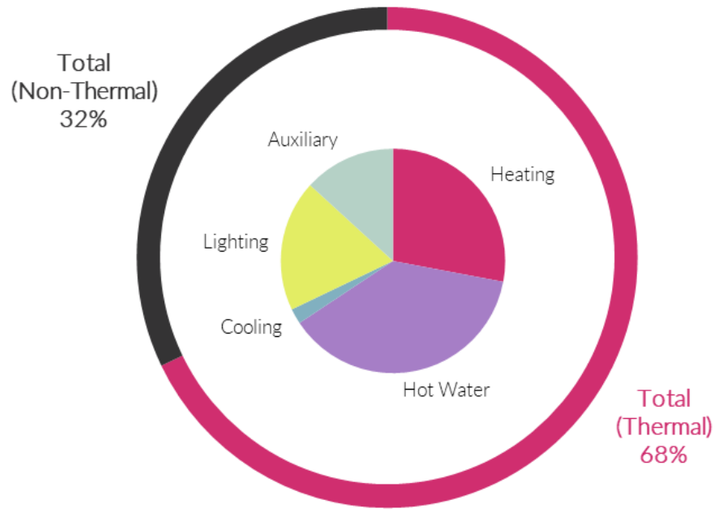


Figure 9: Thermal and non-thermal CO_2 emissions breakdown.

7.2 Be Clean: network and technologies.

In line with policy aspirations, the following sections summarise the considerations of the low-carbon energy supply measures that have been considered, and those which will be implemented at the Proposed Development.

Decentralised Heat and Energy Networks

Offsite heating/cooling network

By reference to the London Heat Map (http://www.londonheatmap.org.uk), the proposed development is not in close proximity to an existing energy network, the closest being some 5.4miles away in Westminster. This is an unavailable connection, with no known plans to develop or extend as far as Richmond. There are opportunities for potential networks in the Hammersmith area although this remains at a distance that is beyond what could be considered reasonable to connect to at 2.3miles. Figure 4.10 shows the area of the site and the potential networks from the London Heat Map.

From viewing the current London Heat Map data for the area, we understand that there are no current plans to create new or extend existing networks to the proximity of the site. Consideration would therefore be given for the Proposed Development to develop a heat network on the site with an on-site CHP and district energy network (DEN).

Onsite heating/cooling network

There is significant thermal demand across both Development Area 1 and Development Area 2 to allow cost-effective operation of the heat network, providing increased emissions reductions when using SAP 2012 carbon factors. The intention would be that the site wide network would be provided in when Development Area 2 is brought forward for development.

Combined heat and power (CHP)

Considering the high proportion of CO_2 emissions arising from thermal sources in particular with reference to the dwellings, a gas fired Combined Heat and Power (CHP) system could be suitable for the scheme. There are CO_2 emission reduction benefits when using a gas-fired CHP engine in the Development Area 2 energy centre supplying a heat network connecting Development Area 1 and Development Area 2.

The GLA Energy Strategy Planning Guidance (2016) indicates that a CHP engine with heat network feeding greater than 620 dwellings is deemed to provide the minimum demand for effective use. As such, it may not be considered suitable for Development Area 1 to include a CHP engine.

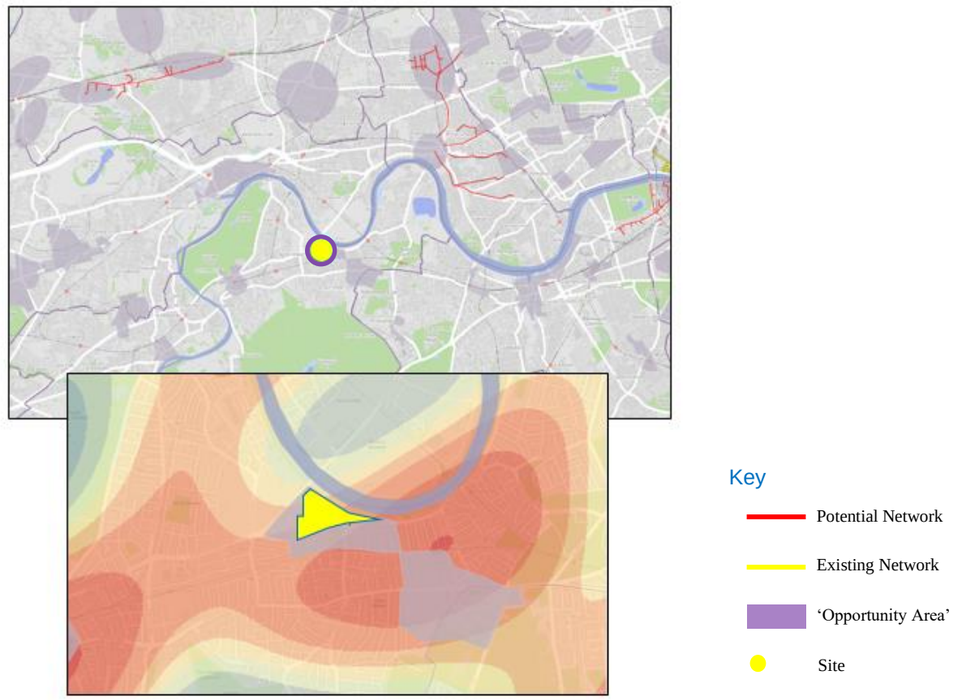


Figure 10: Extract from the London Heat Map showing existing (yellow lines) and proposed (red lines) heat networks in the vicinity of the Site (marked in yellow).

The Proposed Development would seek to utilise a Combined Heat and Power engine within the energy centre for Development Area 2 as the lead generator of heating, hot water and also supplying some electricity to landlord uses. This would be backed up by high efficiency gas fired condensing boilers.

The calculations include for the school (Application B) to be serviced by a CHP of its own. The School is within Application B and is not intended to connect to the heat network. It is anticipated that the school will be serviced from a plant room within the building, independently from the heat networks associated with Application A. The programme for construction of the school is anticipated to be brought forward at the same time as Development Area 1. The development of the school site is not under the applicant's control and therefore the energy strategy allows for Application B to be brought forward independently.

It is anticipated that the school design team will evaluate the most suitable and feasible opportunities for appropriate LZC technologies to be included in the detailed design of the school such as connecting to the site wide network or incorporating its own technology.

The townhouses within Development Area 2 are also considered to be serviced separately with individual heat generation located within each town house. The system to be implemented will be set out in the reserved matters submission for Development Area 2.

For Application A on the basis that CHP engines would provide for approximately 99% of the domestic hot water demand and up to 48% of the space heating demand of the Proposed Development, the energy centre would require a CHP engine to provide a total rated output of 1,137kW$_e$ and 1,313kW$_{th}$.

It is anticipated that with a CHP of this size in Application A, allowing for losses and pumping associated with the heat network, would reduce regulated CO_2 emissions by approximately 860 tonnes per annum. This is equivalent to a reduction of ~35.7% beyond the Part L gas boiler 'baseline'. The anticipated thermal profile of the Proposed Development is shown in Figure 12.

The townhouses within Development Area 2 are also considered to be serviced separately with individual heat generation located within each town house. The system to be implemented will be set out in the reserved matters submission for Development Area 2.

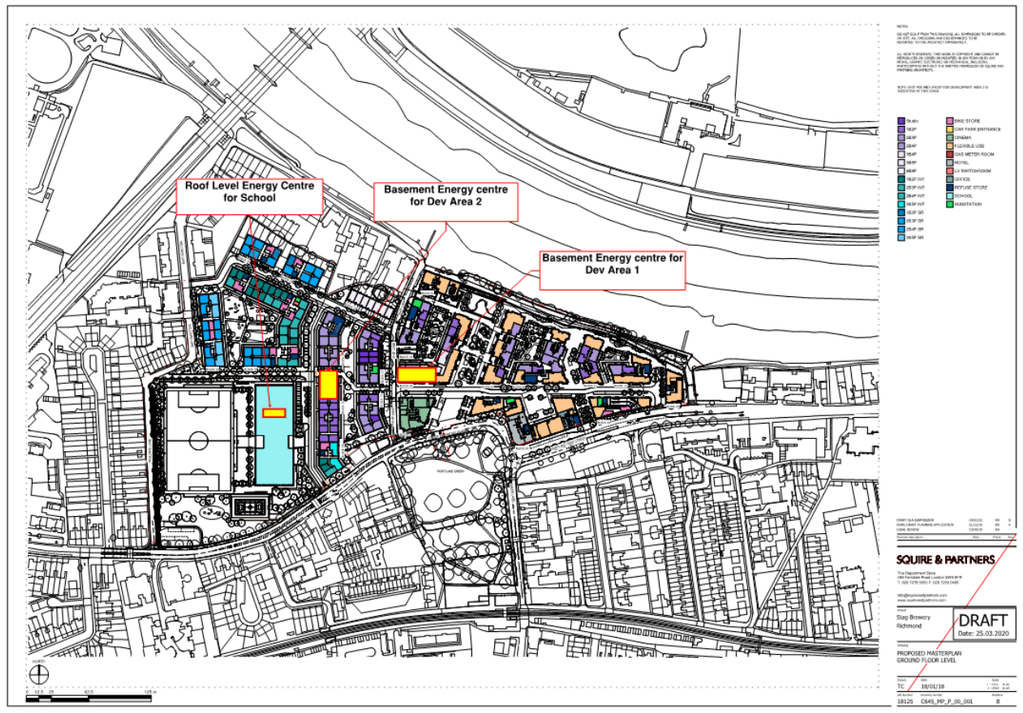


Figure 11: Energy centre locations.

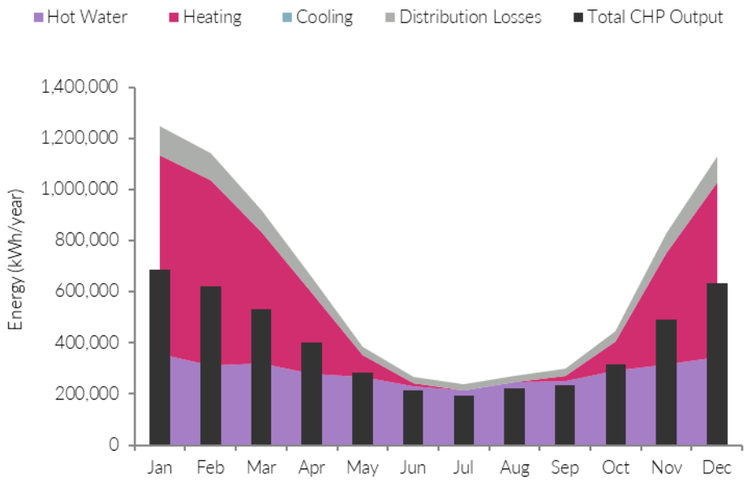


Figure 12: Annual Thermal Load Profile and Potential CHP Contribution (Application A).

When considering the dwellings in isolation, where the thermal demand is most prevalent, it is anticipated that the energy centres connected to the respective heat network supplied by CHP would reduce regulated CO_2 emissions by approximately **748 tonnes** per annum. This is equivalent to a reduction of **40.2%** beyond the Part L gas boiler 'baseline'.

For the school (Application B) the anticipated CHP size would be 71kWe and 109kWth. It is anticipated that with a CHP engine of this size, allowing for distribution losses, would reduce regulated CO_2 emissions by approximately **42 tonnes** per annum. This is equivalent to a reduction of **~23.9%** beyond the Part L gas boiler 'baseline'. The anticipated thermal profile of the Proposed Development is shown in Figure 13.

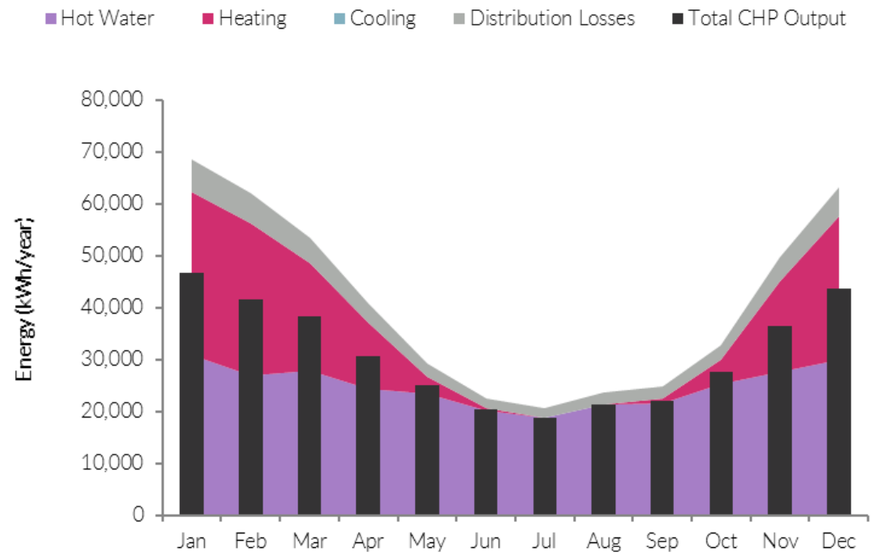


Figure 13: Annual Thermal Load Profile from Part L model and Potential CHP Contribution (Application B).

7.2.1 **Combined cooling heat and power**

CCHP is the use of a CHP engine as described above, with a matched absorption chiller, which produces chilled water for cooling from the CHP waste heat.

However, as the cooling demand for the development is expected to be minimal (less than 1%), a CCHP would not be suitable.

7.2.2 **Summary**

Considering the relative merits of the options appraised above, it is considered that the Proposed Development would utilise a single CHP engine within the energy centre for Development Area 2 to supply heating and hot water to a site wide heat network, with the capacity for future connection to a District Heating Network providing it is technically, legally and economically feasible to do so.

Table 17: CHP Appraisal Summary.

Technology	Annual Thermal Output (kWh/year)	Annual Electrical Output (kWh/year)	CO_2 Emissions Reduction ($kgCO_2$/year)	CO_2 Emissions Reduction (beyond GBB) (%)	Notes
~1,137kWe CHP with DEN – Application A	4,830,905	4,183,350	826,286	34.7%	Running for ~3,700 hours per year to provide 47%sh and 90%hw demand.
~71kWe CHP - School	372,068	242,356	34,652	19.6%	Running for ~3,500 hours per year to provide 50%sh and 100%hw demand.

Key:

(h)	heating and hot water output
(c)	cooling output
hw	hot water
sh	space heating
sc	space cooling

The strategy outlined above has been agreed with LBRuT and GLA through discussions on the Original Scheme. This agreement was on the basis of conditions which sought to secure:

- Creation of a site wide heat network.
- Review of low carbon energy options.
- Provision in case of delay.

This agreed strategy has been brought forward for the Revised Scheme, which is being submitted as substitutions to the Original Scheme.

8. Be Green.

The final step of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the production of renewable energy onsite in order to offer a further reduction in carbon emissions.

The Be Green elements of the scheme remain as per the Original Scheme (as set out in the Energy strategy for the original application that has been agreed with the LBRuT and GLA). The only changes to this approach are changes to the results of calculations due to the changes to floor areas.

Be Lean. → Be Clean. → **Be Green.**

Assess 'low or zero carbon' (LZC) energy sources.

8.1 Low and zero carbon (LZC) technology assessment.

The following technologies have been considered as part of this Energy Strategy and assesses according to suitability by taking into account opportunities and constraints including the nature and location of the site.

Photovoltaics	Solar thermal panels	Biomass boilers	Heat pumps (closed and open loop ground-source/ air-source)	Wind turbines

8.1.1 Air / Ground Source Heat Pumps

Air Source Heat Pumps (ASHP) and Ground Source Heat Pumps (GSHP) work to extract heat from the air or the ground. Generally, GSHPs are more efficient as the ground temperature is more stable over the course of the year relative to the air temperature.

GSHPs have three common varieties:

- horizontal, closed loop
- vertical, closed loop
- vertical, open loop

ASHPs have two common varieties:

- air to water
- air to air

The performance characteristics and technical requirements of each vary. Typically, however, vertical open loop GSHP systems operate at the highest efficiencies and are capable of producing the most thermal output.

Open loop boreholes require an abstraction license from the Environment Agency. To gain a licence, a scheme is typically required to operate in balance such that over the year, the amount of heat extracted from the ground is equivalent to the amount of heat rejected to the ground.

Given the low amount of cooling at the Proposed Development (Application A and B) (approximately 1% of the overall regulated energy requirement), if a large amount of heat were to be extracted from the ground in winter there would be a large imbalance between amount of heat extracted and heat rejected to the ground over a yearly cycle, which could lead to permafrost, rendering the system unusable and potentially damaging nearby structures and local ecology.

Impacts to ground conditions are a valid consideration for all GSHP technologies, meaning a balanced heating and cooling strategy should be applied.

When assuming a GSHP could operate at Seasonal Energy Efficiency Ratio (SEER) of 5.0 (i.e. five units of useful heat or coolth for every unit of electricity consumed), to deliver 100% of space cooling and balanced to deliver an equivalent amount of heating (approx. 8% of requirement) but no hot water, it is estimated that a reduction in CO_2 emissions of 42 tonnes per annum could be achieved.

This is equivalent to a reduction in regulated CO_2 emissions of 1.6% beyond the Part L gas boiler 'baseline'.

Considering the low potential CO_2 emissions reduction, the use of GSHP will not be implemented at the Proposed Development.

ASHPs do not operate as efficiently as GSHPs. Moreover, during times of peak demand (i.e. during winter months) the ambient air temperatures are at their minimum, meaning the ASHP needs to work harder to extract the desired amount of heat. Systems have been noted to perform poorly in operation, in particular those systems which are also providing hot water.

To accommodate the demands at the Proposed Development, large external condenser units would be required. These would need to be accommodated sensitively to minimise the visual impact on-site and would be a source of noise that would possibly require attenuation to prevent nuisance.

When assuming an ASHP could operate at Seasonal Energy Efficiency Ratio (SEER) of 4.0 (i.e. four units of useful heat for every unit of electricity consumed), to deliver 100% of space heating, and 100% of space cooling, but no hot water, it is estimated that a reduction in CO_2 emissions of 385 tonnes per annum could be achieved.

This is equivalent to a reduction in regulated CO_2 emissions of 14.9% beyond the Part L gas boiler 'baseline'.

A significant proportion of roof area has been allocated to green and brown roof leaving limited area to locate sufficient external plant to accommodate ASHP for the whole development. It is expected that this would not be taken forward. However, the significant potential for ASHP to reduce CO_2 emissions would be considered at the detailed design stages if appropriate for parts of the Application A at reserved matters submission(s).

8.1.2 Biomass heating

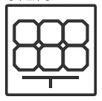
Biomass boilers burn wood fuel, or other bio-fuel sources, to generate heat. These boilers can operate at high efficiencies, comparable to condensing gas boilers. However, they require a large fuel store to maintain continuous operation during the winter months. As such, area take for such plant is high. Furthermore, fuel deliveries in city-centre locations can prove difficult and security of fuel supply is an important consideration.

Biomass boilers also result in higher emission of Nitrous Oxide (NOx) in comparison with gas boilers. This can have a negative impact on the local air quality. Policies in London seek to protect and enhance local air quality. Any proposal for biomass heating would be required to demonstrate the scheme would be 'air quality neutral'.

If a biomass boiler was to be implemented to provide 99% of the hot water demand, and 48% of the space heating demand, requiring a large fuel store, a reduction in CO_2 emissions of 838tonnes per annum could be achieved. This is equivalent to a reduction in regulated CO_2 emissions of 32.4% beyond the Part L gas boiler 'baseline'.

However, due to the constraints of this site, the potential negative impact on air quality, and large store footprint of ~85m^2, biomass heating is not favoured for the Proposed Development.

8.1.3 Photovoltaic panels



An appraisal of the available roof space at the Proposed Development has been undertaken. The roof layouts have been designed in response to the need to balance many factors such as:

- area required for plant (chillers, flues from boilers, CHP and generator)
- area required for access
- building heights in respect of the parameter plan thresholds
- potential area for PV arrays
- location of green and brown roofs

Considering the available roof space, and allowing for access and maintenance requirements, a total solar PV system size in the region of 360m^2 array area could be included on Development Area 1 at the Proposed Development. At reserved matters stage for the outline element of Application A consideration would be given to include a further area of PV to reduce CO_2 emissions for Development Area 2.

Based on the solar irradiance data for London, an array of this size would generate approximately 62,400kWh of electricity per annum, reducing CO_2 emissions by 32.4 tonnes per annum. This is equivalent to a reduction in regulated CO_2 emissions of 1.3% beyond the Building Regulations Part L (2013) 'baseline'.

PV is therefore anticipated to be a suitable addition to the Proposed Development in pursuit of further reductions in regulated CO_2 emissions.

The school has limited roof space available for the installation of a PV array due to the location of plant, roof lights and the location of the play area on the roof. Therefore, PV is not currently proposed for the school application.

8.1.4 Solar thermal panels

The appraisal of solar thermal panels has been undertaken with the same approach as for PV.

Considering the available roof space, and allowing for access and maintenance requirements, a total solar thermal system size of 260kWp could be installed at the Proposed Development.

Based on the solar irradiance data for London, an array of this size would generate approximately 237,000kWh of heat per annum. This level of thermal generation is equivalent to 5% of the annual hot water demand, reducing CO_2 emissions by 57 tonnes per annum. This is equivalent to a reduction in regulated CO_2 emissions of 2.2% beyond the Part L gas boiler 'baseline'.

However, in providing solar thermal panels, a portion of the hot water baseload (9%) would be offset, meaning a CHP engine would generate less heat and electricity. As a result, CO_2 emissions reductions associated with a CHP would be reduced.

The reduction in use of a CHP engine would lead to an overall increase in net CO_2 emissions from the Proposed Development owing to the high carbon content of grid electricity using Part L2013 carbon emission factors (0.519kgCO_2/kWh compared with 0.216kgCO_2/kwh for gas).

As such, the use of solar thermal panels is not suitable where CHP is included and would not be implemented at the Proposed Development.

8.1.5 Micro wind turbines

The installation of micro wind turbines at the Proposed Development could generate useful electricity.

On the basis of providing 25No. 6kW vertical axis wind turbines, it is estimated that approximately 24,075kWh of electricity could be generated annually, reducing CO_2 emissions by 12.5 tonnes per annum.

This is equivalent to a reduction in regulated CO_2 emissions of 0.5% beyond the Part L gas boiler 'baseline'.

Despite manufacturer claims that vertical axis wind turbines work well in city-centre locations, turbulent air flow patterns caused by the rough and irregular urban landscape are not conducive to high annual yields from wind turbines.

Moreover, mounting wind turbines on the roofs of the Proposed Development could result in unacceptable vibration and resonance being felt within top floor apartments. This scenario is likely to result in the turbines being switched off. As such, the use of micro wind turbines would not be implemented at the Proposed Development.

8.1.6 Summary

Table 18 provides a summary of the estimated emissions reductions for Application A and B associated with each of the suitable technologies identified above.

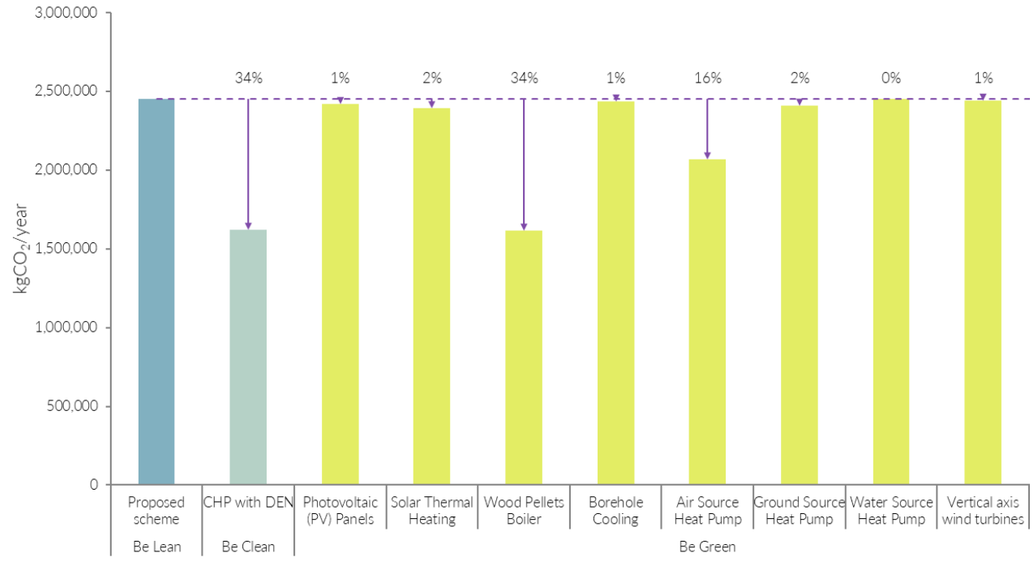


Table 18: Summary of LZC Technology Appraisal for Whole Site.

8.1.7 Assessment summary.

Based on the assessment conducted, it is proposed that a solar PV array of 360m^2 will be provided, achieving a 1.3% reduction in regulated CO_2 emissions over the GLA gas boiler baseline.

8.2 Be Green summary.

It is anticipated that the Proposed Development of Application A will achieve up to a 1.3% reduction in CO_2 emissions beyond the GLA gas boiler baseline factors through the implementation of low and zero carbon technologies specified.

Overall, the Proposed Development is anticipated to achieve up to a 42.1% reduction in CO_2 emissions beyond the GLA gas boiler baseline.

The following considerations are noted at this stage for each of the technologies assessed in brief above. These considerations would require further review if the need for a detailed feasibility assessment is triggered, as per the condition.

The condition in question has been agreed and wording can be seen below for reference:

“Applications for Reserved Matters pursuant to the Outline Element of this planning permission shall be accompanied by a report containing a review of suitable low and zero carbon technologies that could be incorporated to provide a carbon dioxide emissions reduction at least commensurate with the Energy Strategy submitted for Application A (Development Area 1 and Development Area 2). The review would be undertaken where feasible to do so in line with the energy policy in place at the time of submission of the Reserved Matters submission. Development shall not commence on the Outline Element until this report is approved by the Local Planning Authority, in consultation with the GLA. The development shall be implemented in accordance with the approved details and thereafter maintained”.

9. Anticipated CO_2 emissions reduction .

9.1 Domestic uses (Application A).

Table 19 shows the equivalent reductions in regulated CO_2 emissions when considering the domestic uses alone for the whole site. These results account for the benefit of connecting to the on-site CHP, and the PV array.

When considering the domestic uses alone, an overall reduction of ~6.3% beyond the Part L gas boiler 'baseline' can be achieved through passive design and energy efficiency measures. The CO_2 emission savings for the domestic uses are represented graphically in . CO_2 emissions reductions are represented cumulatively in the graph.

Table 19: CO_2 Emissions after Each Stage of the Energy Hierarchy for the **Domestic Uses**.

Dwellings	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	1,859	58
Reduction from Be Lean	1,743	58
Reduction from Be Clean	995	58
Reduction from Be Green	995	58

Table 20 Summary of CO_2 emissions reductions and carbon emissions to be offset for **Domestic Uses**.

Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	117	6.3%
Reduction from Be Clean	748	40.2%
Reduction from Be Green	0	0.0%
Total Reduction	864	46.5%
Total Target Reduction	1,859	100%
Annual Surplus / Shortfall	-995	-53.5%

9.2 Non-Domestic uses – Application A.

Table 21 shows the equivalent reductions in regulated CO_2 emissions when considering the non-residential uses alone. These results account for the benefit of connecting to the proposed energy centres and the inclusion of on-site CHP within the respective energy centre but excluding the school.

When considering the non-domestic uses alone, an overall reduction of 1.0% beyond the Building Regulations Part L 2013 'baseline' can be achieved through passive design and energy efficiency measures. The CO_2 emission savings for the non-domestic uses are represented graphically in . CO_2 emissions reductions are represented cumulatively in the graph.

Table 21: CO_2 Emissions after Each Stage of the Energy Hierarchy for the Non-residential areas.

Non-Dwellings	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	551	396
Reduction from Be Lean	546	396
Reduction from Be Clean	433	396
Reduction from Be Green	401	396

Table 22: Summary of CO_2 emissions reductions.

Non-Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	5	1.0%
Reduction from Be Clean	113	20.4%
Reduction from Be Green	32	5.9%
Total Reduction	150	27.3%
Total Target Reduction	193	35%
Annual Surplus / Shortfall	-43	-7.7%

9.3 Non-Domestic Uses – School (Application B).

Table 23 shows the equivalent reductions in regulated CO_2 emissions when considering the school use alone. These results account for the benefit of connecting to the proposed on-site CHP.

When considering the school alone, an overall reduction of 5.7% beyond the Building Regulations Part L 2013 'baseline' can be achieved through passive design and energy efficiency measures. The CO_2 emission savings for the non-domestic uses are represented graphically in Figure 14. CO_2 emissions reductions are represented cumulatively in the graph.

Table 23: CO_2 Emissions after Each Stage of the Energy Hierarchy for the school.

Non-Dwellings	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	177	99
Reduction from Be Lean	167	99
Reduction from Be Clean	124	99
Reduction from Be Green	124	99

Table 24: Summary of CO_2 emissions reductions and offset payment for non-residential areas.

Non-Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	10	5.7%
Reduction from Be Clean	42	23.9%
Reduction from Be Green	0	0.0%
Total Reduction	53	29.9%
Total Target Reduction	62	35.0%
Annual Surplus / Shortfall	-9	5.1%

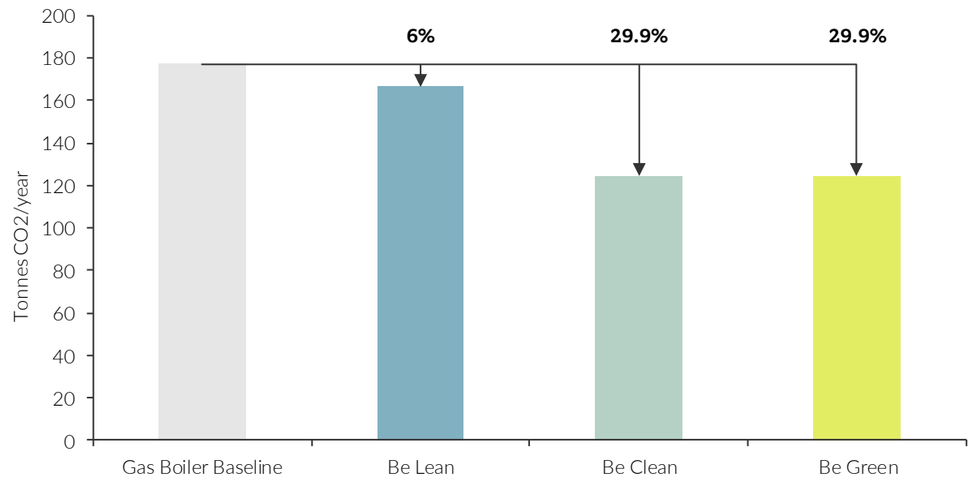


Figure 14: Summary of Regulated CO_2 Emissions Reduction for the school (Application B).

9.4 Whole site total (Application A and B).

Following the energy hierarchy, reductions in regulated energy requirements and associated CO_2 emissions have been made at each stage as demonstrated by Table 25.

When considering the whole site, it is anticipated that a 41.3 overall reduction in CO_2 emissions beyond the Building Regulations Part L 2013 'baseline' can be achieved.

The CO_2 emissions savings for the whole site are represented cumulatively in Table 25 and Table 26.

Table 25: CO_2 Emissions after Each Stage of the Energy Hierarchy for the whole site.

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	(Regulated)	(Unregulated)
Part L Gas Boiler Baseline	2,588	554
Reduction from Be Lean	2,454	554
Reduction from Be Clean	1,552	554
Reduction from Be Green	1,520	554

Table 26: Summary of CO_2 emissions reductions and offset payment for the whole site.

	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Reduction from Be Lean	132	5.1%
Reduction from Be Clean	903	34.9%
Reduction from Be Green	32	1.3%
Total Reduction	1,068	41.3%
Dwelling Reduction	864	33.4%
Non-Dwelling Reduction	203	7.9%

9.5 Carbon offset payment.

The Proposed Development is anticipated to require to offset the remaining 1,029 tonnes for 30 years. The GLA has set the price for Carbon Offset at £60 per tonne per year.

The calculation of the Carbon Offset payment needs to be dealt with on a bespoke basis for a mixed-use scheme of this scale.

Table 27: CO_2 Emissions Offset for the **Whole Site**

Whole Site (Application A and B) Total		Carbon Offset (tonnes)	Cost (£)
Development Area 1	Annual Offset (Residential Areas)	474 tCO_2	£853,200
	Annual Offset (Non-residential Areas)	43 tCO_2	£77,400
Development Area 2	Annual Offset (Residential Areas)	521 tCO_2	£937,800
	Annual Offset (Non-residential Areas)	n/a	
School	Annual Offset (School)	9 tCO_2	£16,200
Total carbon offset		1,047	**£ 1,884,600**

The School (application B) carbon offset charge is £16,200 which is included in the table above but set out separately for clarity.

10. Conclusion.

This document has been prepared on behalf of Reselton Properties Ltd to support of the application for planning permission for the Proposed Development of the former Stag Brewery.

This Energy Strategy summarises the pertinent regulatory and planning policies applicable to the Proposed Development and sets out how the Proposed Development addresses the relevant policy requirements.

10.1 The energy strategy.

The strategy has been developed using the 'Be Lean, Clean and Green' energy hierarchy which utilises a fabric first approach to maximise reduction in energy through passive design measures. This energy strategy is aligned with the approved submitted Energy Strategy Addendum for the original application that has been accepted by the GLA and LBRuT with conditions.

The following table provides a summary of the energy strategy for the Proposed Development for both the dwelling and site wide scale.

Table 28: Energy strategy summary.

Be Lean	5.1% sitewide betterment achieved against GLA gas boiler baseline. Highly energy efficient building fabric and building services have been utilised to reduce carbon emissions and energy demand through good practice passive measures.
Be Clean	'Be Clean' measures have been selected to achieve a further 34.9% reduction. Incorporation of an onsite district heating network and a CHP system. The Proposed Development would seek to utilise a Combined Heat and Power engine within the energy centre for Development Area 2 as the lead generator of heating, hot water and also supplying some electricity to landlord uses. This would be backed up by high efficiency gas fired condensing boilers.
Be Green	A further 1.3% sitewide betterment achieved through LZC technologies. The incorporation of a 360m^2 74KWp photovoltaic array offsets the proposed development's carbon emissions.

Results

Table 29 summarises the emissions reductions for the Proposed Development using the Part L2013 carbon factors, as required by the updated GLA guidance.

Table 29: Carbon reduction breakdown for Application A.

	Domestic		Non-Domestic	
	Tonnes CO_2/year	Percentage	Tonnes CO_2/year	Percentage
Savings from Be lean.	117	6.3%	5	1.0%
Savings from Be clean.	748	40.2%	113	20.4%
Savings from Be green.	0	0.0%	32	5.9%

	Domestic		Non-Domestic	
Total reduction:	864	46.5%	150	27.3%
Target reduction:	1,859	100%	255	35%
Annual shortfall	-995	-53.5%	43	-7.7%

Through the measures outlined in the energy strategy, it is anticipated that overall up to a 42.1% reduction in CO_2 emissions can be achieved beyond the Part L gas boiler baseline, inclusive of all measures.

10.2 Proposed site-wide energy strategy.

A fabric first approach utilising high performance building fabric and efficient systems. Heating and hot water to be provided by a site wide heat network fed by a gas fired CHP engine and high efficiency gas boilers. Finally, a solar PV array will be provided on the available roof areas.

Carbon dioxide emissions after each stage of the energy hierarchy

Table 30: Carbon emissions after each stage of energy hierarchy.

	Dwellings		Non-Dwellings	
	Regulated Tonnes CO_2/year	Unregulated Tonnes CO_2/year	Regulated Tonnes CO_2/year	Unregulated Tonnes CO_2/year
Part L 2013 baseline	1,859	58	551	396
Be Lean.	1,743	58	546	396
Be Clean.	995	58	433	396
Be Green.	995	58	401	396

10.3 Carbon offset payments.

Table 31 shows a summary of the emissions reductions at each stage of the hierarchy, as well as the carbon offset contribution required to meet the London Plan 100% emissions reduction target for dwellings.

Table 31: Summary of the regulated CO_2 emissions reductions for the Proposed Development at each stage of the Energy Hierarchy.

Whole Site (Application A and B) Total		Carbon Offset (tonnes)	Cost (£)
Development Area 1	Annual Offset (Residential Areas)	474 tCO_2	£853,200
	Annual Offset (Non-residential Areas)	43 tCO_2	£77,400
Development Area 2	Annual Offset (Residential Areas)	521 tCO_2	£937,800
	Annual Offset (Non-residential Areas)	n/a	
School	Annual Offset (School)	9 tCO_2	£16,200
Total carbon offset		1,047	**£ 1,884,600**

The carbon offset contribution required to meet the regulated CO_2 emissions reduction targets has been calculated is £1,884,600. The School (application B) carbon offset charge is £16,200 which is included in the overall total above but set out separately for clarity..

10.4 Overheating risk assessment.

Overheating Risk Criteria
The sample units have been assessed against the CIBSE TM59 adaptive comfort criteria to assess the risk associated with the dwellings with operable windows.

Three scenarios have been included in the analysis:

- Natural ventilation only with blinds
- Natural ventilation with improved performance parameters and blinds
- Hybrid ventilation (i.e. openable windows and mechanical ventilation with heat recovery (MVHR)), improved performance parameters and blinds.

The following criteria have been applied (adaptive comfort):

- The operative temperature in living rooms, kitchens and bedrooms shall not exceed the adaptive threshold comfort temperature for more than 3% of occupied hours in summer months (May to September).
- The operative temperature in bedrooms shall not exceed 26°C for more than 1% of annual hours during the night (22:00 to 07:00).

DSY1
Based on the input parameters and methodology outlined in section 5.0, it has been demonstrated that all of the assessed dwellings can meet the CIBSE TM59 adaptive criteria for DSY1.

The following scenarios have been assessed as part of the analysis:

- Natural ventilation only, with blinds
- Natural ventilation only with improved performance parameters
- Hybrid ventilation strategy where natural and mechanical ventilation is being used concurrently

It is important to note that where blinds have been used, for the natural ventilation strategy, a reduction in the achieved free area of the windows / opening doors has not been accounted for in the model.

Table 32: Summary of adaptive criteria results based on various ventilation scenarios – DSY1.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**70%** (30/43)	**83%** (25/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**91%** (39/43)	**83%** (25/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**100%** (43/43)	**100%** (30/30)	**100%** (2/2)

DSY2.
In addition to the assessment using DSY1, the dwellings have also been assessed using the DSY2 summer year. Results are presented in the table below.

Table 33: Summary of adaptive criteria results based on various ventilation scenarios – DSY2.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**65%** (28/43)	**83%** (25/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**70%** (30/43)	**83%** (25/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**72%** (31/43)	**83%** (25/30)	**100%** (2/2)

DSY3.
A final model iteration was run using the DSY3 weather file.

Table 34: Summary of adaptive criteria results based on various ventilation scenarios – DSY3.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**2%** (1/43)	**3%** (1/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**7%** (3/43)	**3%** (1/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**7%** (3/43)	**3%** (1/30)	**0%** (0/2)

10.5 Outcomes.

It is anticipated that, using the methodology detailed in the Building Regulations Part L 2013 document, up to a 29.4% reduction in CO_2 emissions will be achieved beyond the GLA gas boiler baseline.

Appendix A: Planning policies.

Current policy framework.

The policies considered when preparing this strategy are contained in the London Plan (GLA, 2016) and the local planning policy of London Borough of Richmond upon Thames.

The Proposed Development constitutes a 'major development' (>10 dwellings and/or >1,000m^2 of non-residential floor space) and is therefore subject to the policies of the GLA, contained within the London Plan.

National.

Approved Document Part L

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO_2 emissions from new buildings.

Current requirements: Part L 2013

Part L has five key criteria which must be satisfied as follows:

a. Criterion 1 - Achieving the Target Emission Rate (TER)
b. Criterion 2 - Limits on design flexibility
c. Criterion 3 - Limiting the effects of solar gains in summer
d. Criterion 4 - Building performance consistent with the Building Emission Rate (BER)
e. Criterion 5 - Provision for energy efficient operation of the building

Criterion one requires that the building as designed is not predicted to generate CO_2 emissions in excess of that set by the Target Emission Rate (TER) calculated in accordance with the approved Standard Assessment Procedure (SAP) 2012. Part L (2013) requires the following reductions:

a. A 6% aggregate reduction in CO_2 emissions beyond the requirements of Part L 2010 for dwellings; and
b. A 9% aggregate reduction in CO_2 emissions beyond the requirements of Part L 2010 for non-domestic buildings.

Criterion two places upper limits on the efficiency of controlled fittings and services for example, an upper limit to an external wall U-value of 0.35W/m^2.K (non-domestic buildings).

A Fabric Energy Efficiency Standard (FEES) has been introduced for new buildings although no definitive targets have been set in this regard. Part L 2013 requires the following Fabric Energy Efficiency performance targets to be met:

– Target Fabric Energy Efficiency (TFEE). The TFEE is calculated for the building, based upon an elemental recipe of efficiency parameters, applied to the geometry of the building in question. This would generate a notional value which would then be relaxed by 15% to generate the TFEE

Criterion three requires that zones in non-residential buildings are not subject to excessive solar gains. This is demonstrated using the Simplified Building Energy Model (SBEM) or Dynamic Simulation Method (DSM) for non-residential buildings.

Regional

London Plan - 'Minor Alterations to the London Plan' (MALP)

Final versions of the 'Minor Alterations to the London Plan (MALPs) were published and adopted in March 2016 and are current for any Stage 1 submissions to the GLA. The MALPs address parking and housing standards.

Recent alterations also include amendments to the 'Housing Supplementary Planning Guidance' (SPG) and 'Energy Planning' guidance, clarifying the CO_2 emissions reduction targets that currently apply and the changes that were introduced from 1st October 2016 are summarised in the table below.

Table 35: Uplift in CO_2 emissions targets.

Use Type	CO_2 Reduction Target (beyond Part L 2013)	
	2013 – 2016	2016 – 2019 (1st October 2016)
Residential Buildings	35%	'Zero Carbon'
Non-Domestic Buildings	35%	35%

The target reduction in CO_2 emissions for 'Residential Buildings' was historically 35% until 1st October 2016, at which point it was uplifted to 'Zero Carbon' for Stage 1 applications. In this context, this is assumed to be a 100% reduction in regulated CO_2 emissions. The policy requires that at least 35% should be achieved on site, with the remainder achieved by a combination of off-site measures and a cash in lieu payment (currently set at £1,800 per tonne of CO_2 of remaining emissions to achieve a total reduction of 100%).

The target reduction in CO_2 emissions for 'Non-domestic Buildings' remains at 35% and will not be uplifted in the near future, despite the consultation document indicating that this would be set at 50%. The GLA comment that the 35% target will provide a smooth trajectory towards the upcoming requirement for 'Nearly Zero Energy Buildings' by 2020. It should be noted that the UK Government has yet to ratify the EU requirement for 'Nearly Zero Energy Buildings' and this may not occur in light of the UK vote to leave the EU.

The 'Energy Planning' guidance document (March 2016) also includes an update to the guidance on compliance with overheating policy that design teams should be aware of when undertaking risk analysis and thermal comfort modelling.

It is the GLA's expectation that dynamic thermal modelling should be undertaken to determine overheating risk and demonstrate compliance with London Plan Policy 5.9. This should be in addition to the Building Regulations 'Criterion 3' assessment of heat gains in summer months.

The GLA has set out that dynamic modelling should be carried out in accordance with the guidance and data sets in CIBSE TM49 'Design Summer Years' for London (2014) using the three design weather years as follows:

– 1976: a year with a prolonged period of sustained warmth.
– 1989: a moderately warm summer (current design year for London).
– 2003: a year with a very intense single warm spell.

For developments in high density urban areas (e.g. Canary Wharf) and the 'Central Activity Zone' the 'London Weather Centre' data set should be used. In lower density urban and suburban areas the 'London Heathrow' dataset should be used. These data sets have been adjusted to account for future climate effects.

The modelling should also consider the additional guidance contained in CIBSE TM52 'The Limits of Thermal Comfort: Avoiding Overheating in European Buildings'.

London Plan

The following policies of the London Plan (2016) have informed this strategy.

Policy 5.2: Minimising CO_2 Emissions

From October 1st 2016, Policy 5.2 requires new-build domestic homes to be 'zero carbon' (equivalent to reducing regulated CO_2 emissions by 100%). Non-domestic development are to reduce CO_2 emissions by 35% beyond the Building Regulations Part L (2013) Target Emission Rate (TER). A minimum of a 35% reduction of

CO_2 emissions is expected to apply for planning for domestic developments, with the remainder provided through a carbon offset payment to the relevant borough.

Policy 5.3: Sustainable Design and Construction
Policy 5.3 requires the highest standards of sustainable design and construction to be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in the London Plan and the following sustainable design principles:

- minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
- avoiding internal overheating and contributing to the urban heat island effect
- efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
- minimising pollution (including noise, air and urban runoff)
- minimising the generation of waste and maximising reuse or recycling
- avoiding impacts from natural hazards (including flooding)
- ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
- securing sustainable procurement of materials, using local supplies where feasible, and
- promoting and protecting biodiversity and green infrastructure.

Policy 5.6: Decentralised Energy in Development Proposals
Policy 5.6 requires development proposals to evaluate the feasibility of Combined Heat & Power (CHP) systems and where a new CHP system is appropriate, examine opportunities to extend the system beyond the Site boundary. Developments should select energy systems on the following hierarchy:

a. Connection to existing heating or cooling networks
b. Site wide CHP network
c. Communal heating and cooling

Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7: Renewable Energy
Policy 5.7 requires that developments should provide a reduction in expected CO_2 emissions through the use of on-site renewable energy generation, where feasible.

Policy 5.9: Overheating and Cooling
Policy 5.9 requires that development proposals reduce potential overheating & reliance on air conditioning systems, demonstrated in consideration of the following cooling hierarchy:

a. Minimisation of internal heat generation through efficient design
b. Reduction of external heat gains through consideration of orientation, shading, albedo, fenestration, insulation, and green roofs & walls
c. Management of internal heat gains through exposed thermal mass
d. Passive ventilation
e. Mechanical ventilation
f. Active cooling

Development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs.

Policy 5.13: Sustainable Drainage
A Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer.

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

Policy 5.15: Water Use and Supplies
Development should minimise the use of mains water by:

a. Incorporating water saving measures and equipment
b. Designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day

Policy 7.1: Lifetime Neighbourhoods
Development should be designed so that the layout, tenure and mix of uses interface with surrounding land and improve people's access to social and community infrastructure (including green spaces), the Blue Ribbon Network, local shops, employment and training opportunities, commercial services and public transport.

Development should enable people to live healthy, active lives; should maximize the opportunity for community diversity, inclusion and cohesion; and should contribute to people's sense of place, safety and security. Places of work and leisure, streets, neighbourhoods, parks and open spaces should be designed to meet the needs of the community at all stages of people's lives, and should meet the principles of lifetime neighbourhoods.

The design of new buildings and the spaces they create should help reinforce or enhance the character, legibility, permeability, and accessibility of the neighbourhood.

Policy 7.2: An Inclusive Environment
Design and access statements submitted with development proposals should explain how, following engagement with relevant user groups, the principles of inclusive design, including the specific needs of older and disabled people, have been integrated into the Proposed Development, whether relevant best practice standards such as British Standard BS 8300:2009 + A1:2010 have been complied with, and how inclusion will be maintained and managed.

Policy 7.3: Designing Out Crime
Development should reduce the opportunities for criminal behaviour and contribute to a sense of security without being overbearing or intimidating. In particular:

a. Routes and spaces should be legible and well maintained, providing for convenient movement without compromising security
b. There should be a clear indication of whether a space is private, semi-public or public, with natural surveillance of publicly accessible spaces from buildings at their lower floors
c. Design should encourage a level of human activity that is appropriate to the location, incorporating a mix of uses where appropriate, to maximize activity throughout the day and night, creating a reduced risk of crime and a sense of safety at all times
d. Places should be designed to promote an appropriate sense of ownership over communal spaces
e. Places, buildings and structures should incorporate appropriately designed security features
f. Schemes should be designed to minimise on-going management and future maintenance costs of the particular safety and security measures proposed

The above measures should be incorporated at the design stage to ensure that overall design quality is not compromised.

London Plan Intend to Publish Version (dated December 2019)

The London Plan Intend to Publish Version (dated December 2019), draft policies will have some weight in the determination of planning applications, they will only have full weight once the Plan is formally adopted.

Policy GG2 Making the Best Use of Land
- Creating high density development in order to "make the best use of land", whilst protecting London's open spaces.
- Promote urban greening.
- Encourage development that can encourage sustainable transport connections.

Policy GG3 Creating a healthy city
- Improve overall health and reduce health inequality.
- Promote a more active and healthy lifestyle, encouraging healthy choice (empowering healthy choice).
- Healthy streets approach, prioritise health in planning.
- Consider health and wellbeing on communities in planning applications - both health and health inequality (use Health Impact Assessments)
- Include access to green spaces and provision of green infrastructure.
- Ensure high quality, well insulated ventilated to avoid issues associated with damp, heat and cold.
- Create healthy food environments. Restrict unhealthy options.

Policy GG5 Growing a Good Economy
- Promote strength and potential of the wider city region
- Encourage diversified economy, with the benefits being shared more equitably across London.
- Plan for sufficient employment and industrial space in the right locations - supporting development/regeneration.
- Provide high quality housing and infrastructure to support growth
- Continue to provide innovation. Be an incubator and centre for learning
- Develop/enhance future transport network.

Policy GG6 Increasing Efficiency and resilience
- Improve energy efficiency, movement toward low carbon, circular economy. Target of zero carbon city by 2050.
- Buildings/infrastructure resilient against a changing climate, efficient use of water, reduction of impact from natural hazards such as flooding and heatwaves
- Avoid contribution to the heat island effect.
- Safe and secure environments, resilient against impacts such as fire/terrorism etc.
- Stakeholder contributions taken from all relevant public, private, community sectors.

Policy D1 London's form and characteristics
- Developments should optimise density and connectivity, be inclusive and use street spaces that have well defined public and private realm, provide outlook, privacy and amenity, be safe and secure, provide spaces for social interaction, play relaxation and physical activity.
- Provide and facilitate active travel with convenient and inclusive pedestrian and cycling routes.
- Mitigate or prevent the impacts of noise and poor air quality.
- Development design should respond to local context by delivering developments of appropriate scale, appearance and shape that responds successfully to the character of the local area.
- Be of high quality architecture that includes flexibility and appropriate building lifespan, delivering attractive robust materials that will mature well.
- Respect/enhance the heritage assets
- Maximise opportunities for urban greening to create attractive resilient places that effectively manage surface water.
- Achieve comfortable indoor and outdoor environments.

Policy D2 Delivering good design
- Boroughs should determine Development Plans and Strategies that include a wide range of physical and socio economic factors.
- Development should inform the type and scale of development projects taking account of:

  Design analysis and visualisation

  Design quality and development certainty

  Design scrutiny

  Managing design quality

Policy D3 Inclusive design
Deliver an inclusive environment and meet the needs of all Londoners: Proposals to be accessible and inclusive to allow development that can be entered and used safely (and with dignity by all), are convenient and welcoming with no disabling barriers. That can provide independent access without undue effort separation or special treatment including safe and dignified emergency evacuation to all users.

Policy D7 Public realm
- Development plans should ensure they are of good design, including being safe attractive spaces, landscaping, planting etc. The spaces should maximise the contributions public realm can make to active travel, discouraging travel by car and excessive on street parking, traffic noise etc.
- Public realm should develop sense of place and enhance relationships between the realm and its surrounding buildings.
- Incorporate Green Infrastructure to support rainwater/surface water management, exposure to air pollution, urban heat island and nature corridors
- Create spaces that are attractive and encouraging for community events.

Policy D8 Tall buildings
Tall building locations should be considered as part of development plans, identifying where tall buildings would be appropriate and their potential heights. Visual, Functional and Environmental Impact should be fully considered and include Wind, daylight, sunlight penetration and temperature conditions. The buildings must not compromise comfort or enjoyment of open spaces including around the building, air movement around the building and the building itself should not reduce the quality of surrounding spaces in terms of noise and air pollution.

Cumulative impacts from consented buildings should be fully included.

Policy D12 Agent of Change
Particularly in reference to the noise environment, the Agent of Change aims to encourage mitigation of existing impacts through the design of the proposed development (particularly in the case of residential development).

Policy D13 Noise
- Reduce manage and mitigate noise levels. The policy aims to encourage the use of the Agent of Change principle to ensure measures do not unduly impact on existing noise levels. Where levels unduly impact on the development, mitigation of the existing noise levels is considered.
- Noise levels of the development itself are limited. Quiet areas and spaces of Tranquillity are protected, and if possible improved and enhanced. Separation of new noise sensitive development from major noise sources, through the use of distance, screening or internal layout in preference to using sound insulation is encouraged. If standards are not achieved, acoustic design principles and insulation are then encouraged.

Policy D1 London's form and characteristics
- Developments should optimise density and connectivity, be inclusive and use street spaces that have well defined public and private realm, provide outlook, privacy and amenity, be safe and secure, provide spaces for social interaction, play relaxation and physical activity.
- Provide and facilitate active travel with convenient and inclusive pedestrian and cycling routes.
- Mitigate or prevent the impacts of noise and poor air quality.
- Development design should respond to local context by delivering developments of appropriate scale, appearance and shape that responds successfully to the character of the local area.
- Be of high-quality architecture that includes flexibility and appropriate building lifespan, delivering attractive robust materials that will mature well.
- Respect/enhance the heritage assets
- Maximise opportunities for urban greening to create attractive resilient places that effectively manage surface water.
- Achieve comfortable indoor and outdoor environments.

Policy G1 Green infrastructure
Green network of infrastructure to be protected and managed as integrated features across the city. Boroughs to prepare green infrastructure strategies that integrate open space provision, biodiversity, flood management, health and wellbeing and sports and recreation.

Policy G5 Urban greening
Major development should contribute to greening as a fundamental part of the design. Boroughs to develop urban greening factor to identify appropriate level for new development proposals.

Policy G6 Biodiversity and access to nature
- Site of importance should be fully protected, including identifying all relevant areas within the proximity of any development proposals. Any locations or linkages that may be impacted upon by development proposals should be assessed and mitigated.
- Proposals should seek to create or enhance habitats of relevance in an urban context.
- Where harm is identified to be unavoidable, a hierarchy approach should be taken to limit the proposed damage as much as possible.

Policy G7 Trees and woodlands
- Trees should be protected wherever possible with new trees provided wherever possible to increase the urban forest proportion.
- Boroughs to identify locations for strategic tree planting.

Policy SI2 Minimising Greenhouse Gas Emissions
A. Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1. Be Lean: use less energy and manage demand during construction and operation.

Be Clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.

Be Green: generate, store and use renewable energy on-site.

As a minimum, energy strategies should contain the following information:

A calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (i.e. the unregulated emissions), at each stage of the energy hierarchy.

Proposals to reduce carbon dioxide emissions beyond Building Regulations through the energy efficient design of the site, buildings and services, whether it is categorised as a new build, a major refurbishment or a consequential improvement.

Proposals to further reduce carbon dioxide emissions through the use of zero or low-emission decentralised energy where feasible, prioritising connection to district heating and cooling networks and utilising local secondary heat sources. (Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure).

Proposals to further reduce carbon dioxide emissions through the generation and use of on-site renewable energy, utilising storage technologies where appropriate.

Proposals to address air quality risks (see Policy SI1 Improving air quality). Where an air quality assessment has been undertaken, this could be referenced instead.

The results of dynamic overheating modelling which should be undertaken in line with relevant Chartered Institution of Building Services Engineers (CIBSE) guidance, along with any mitigating actions (see Policy SI4 Managing heat risk).

Proposals for demand-side response, specifically through installation of smart meters, minimising peak energy demand and promoting short-term energy storage, as well as consideration of smart grids and local micro grids where feasible.

Proposals for how energy demand and carbon dioxide emissions post-construction will be monitored annually (for at least five years).

Proposals explaining how the site has been future-proofed to achieve zero-carbon on-site emissions by 2050.

Confirmation of offsetting arrangements, if required.

Proposals to minimise the embodied carbon in construction.

Analysis of the expected cost to occupants associated with the proposed energy strategy.

B. Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C. In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent 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:

1. Through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or

Off-site provided that an alternative proposal is identified, and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver greenhouse gas reductions. The operation of offset funds should be monitored and reported on annually.

Policy SI3 Energy Infrastructure

A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy requirements and infrastructure arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

B. Energy masterplans should be developed for large-scale development locations which establish the most effective energy supply options. Energy masterplans should identify:

- major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
- heat loads from existing buildings that can be connected to future phases of a heat network
- major heat supply plant
- possible opportunities to utilise energy from waste
- secondary heat sources
- opportunities for low temperature heat networks
- possible land for energy centres and/or energy storage
- possible heating and cooling network routes

- opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
- Infrastructure and land requirements for electricity and gas supplies
- Implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector.

C. Development Plans should:

Identify the need for, and suitable sites for, any necessary energy infrastructure requirements including upgrades to existing infrastructure

Identify existing heating and cooling networks and opportunities for expanding existing networks and establishing new networks.

D. Major development proposals within Heat Network Priority Areas should have a communal heating system

The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

- connect to local existing or planned heat networks
- use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)
- generate clean heat and/or power from zero-emission sources
- use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
- use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
- use ultra-low NOx gas boilers.
- CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that there is no significant impact on local air quality.
- Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

Policy SI4 Managing heat risk

A. Development proposals should minimise internal heat gain and the impacts of the urban heat island through design, layout, orientation and materials.

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

1. minimise internal heat generation through energy efficient design
2. reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls
3. manage the heat within the building through exposed internal thermal mass and high ceilings
4. provide passive ventilation
5. provide mechanical ventilation
6. provide active cooling systems.

Policy SI5 Water infrastructure

- Development plans to be produced to identify areas of specific water stress. Development proposals should minimise the use of water in residential developments in line with Building Regulations. Commercial developments should achieve at least the BREEAM Excellent standard.

- Smart metering encouraged including in retrofit situations.
- Development proposals to take account of local wastewater infrastructure, reduce instanced of shared sewerage connections.

Policy SI6 Digital connectivity infrastructure

Provide sufficient digital infrastructure to allow for current and future connections of digital infrastructure. Use public realm features, such as street furniture to camouflage mobile digital infrastructure

Policy SI7 Reducing waste and supporting the circular economy

Waste reduction, improved recycling rates and improved reuse rates are targeted by:

- Promotion of a circular economy, improving resource efficiency and innovation, encourages waste minimisation waste avoidance through reuse of materials and through using fewer resources in the production and distribution of products.
- Target of zero biodegradable or recyclable waste to landfill by 2026.
- Recycling targets for London in line with the below:

  Municipal waste: 65% by 2030.

  Construction, demolition and excavation waste: 95% by 2020
- Applications where relevant to include a circular economy statement identifying how above aims will be achieved.

Local

The policies of the London Borough of Richmond upon Thames (LBRuT) applicable to the Proposed Development are contained in the development plan. The following documents have been reviewed:

- London Borough of Richmond upon Thames (LBRuT) Local Plan (2018)

Policy Local Plan 10: Local Environmental Impacts, Pollution and Land Contamination

The Council will seek to ensure that local environmental impacts of all development proposals do not lead to detrimental effects on the health, safety and the amenity of existing and new users or occupiers of the development site, or the surrounding land. These potential impacts can include, but are not limited to, air pollution, noise and vibration, light pollution, odours and fumes, solar glare and solar dazzle as well as land contamination.

Developers should follow any guidance provided by the Council on local environmental impacts and pollution as well as on noise generating and noise sensitive development. Where necessary, the Council will set planning conditions to reduce local environmental impacts on adjacent land uses to acceptable levels.

Air Quality

The Council promotes good air quality design and new technologies. Developers should secure at least 'Emissions Neutral' development. To consider the impact of introducing new developments in areas already subject to poor air quality, the following will be required:

- an air quality impact assessment, including where necessary, modelled data;
- mitigation measures to reduce the development's impact upon air quality, including the type of equipment installed, thermal insulation and ducting abatement technology;
- measures to protect the occupiers of new developments from existing sources;
- strict mitigation for developments to be used by sensitive receptors such as schools, hospitals and care homes in areas of existing poor air quality; this also applies to proposals close to developments used by sensitive receptors.

Noise and Vibration

The Council encourages good acoustic design to ensure occupiers of new and existing noise sensitive buildings are protected. The following will be required, where necessary:

- a noise assessment of any new plant and equipment and its impact upon both receptors and the general background noise levels;
- mitigation measures where noise needs to be controlled and managed;
- time limits and restrictions for activities where noise cannot be sufficiently mitigated;
- promotion of good acoustic design and use of new technologies;
- measures to protect the occupiers of new developments from existing sources.

Light Pollution

The Council will seek to ensure that artificial lighting in new developments does not lead to unacceptable impacts by requiring the following, where necessary:

- an assessment of any new lighting and its impact upon any receptors;
- mitigation measures, including the type and positioning of light sources;
- promotion of good lighting design and use of new technologies.

Odours and Fume Control

The Council will seek to ensure that any potential impacts relating to odour and fumes from commercial activities are adequately mitigated by requiring the following:

- an impact assessment where necessary;
- the type and nature of filtration to be used;
- the height and position of any chimney or outlet;
- promotion and use of new abatement technologies;

Land Contamination

The Council promotes, where necessary, the remediation of contaminated land where development comes forward. Potential contamination risks will need to be properly considered and adequately mitigated before development proceeds.

Construction and demolition

The Council will seek to manage and limit environmental disturbances during construction and demolition as well as during excavations and construction of basements and subterranean developments. To deliver this the Council requires the submission of Construction Management Statements (CMS) for the following types of developments:

- all major developments;
- any basement and subterranean developments;
- developments of sites in confined locations or near sensitive receptors; or
- if substantial demolition/excavation works are proposed.

Where applicable and considered necessary, the Council may seek a bespoke charge specific to the proposal to cover the cost of monitoring the CMS.

Policy LP 12: Green Infrastructure

Green infrastructure is a network of multi-functional green spaces and green features, which provides multiple benefits for people, nature and the economy.

To ensure all development proposals protect, and where opportunities arise enhance, green infrastructure, the following will be taken into account when assessing development proposals:

- the need to protect the integrity of the green spaces and features that are part of the wider green infrastructure network; improvements and enhancements to the green infrastructure network are supported;
- its contribution to the wider green infrastructure network by delivering landscape enhancement, restoration or re-creation;
- incorporating green infrastructure features, which make a positive contribution to the wider green infrastructure network.

The hierarchy of open spaces, as set out in the table within the local plan, will be protected and used in accordance with the functions shown.

Policy LP 15: Biodiversity
The Council will protect and enhance the borough's biodiversity, in particular, but not exclusively, the sites designated for their biodiversity and nature conservation value, including the connectivity between habitats. Weighted priority in terms of their importance will be afforded to protected species and priority species and habitats including National Nature Reserves, Sites of Special Scientific Interest (SSSI) and Other Sites of Nature Importance as set out in the Biodiversity Strategy for England, and the London and Richmond upon Thames Biodiversity Action Plans. This will be achieved by:

- protecting biodiversity in, and adjacent to, the borough's designated sites for biodiversity and nature conservation importance (including buffer zones), as well as other existing habitats and features of biodiversity value;
- supporting enhancements to biodiversity;
- incorporating and creating new habitats or biodiversity features, including trees, into development sites and into the design of buildings themselves where appropriate; major developments are required to deliver net gain for biodiversity, through incorporation of ecological enhancements, wherever possible;
- ensuring new biodiversity features or habitats connect to the wider ecological and green infrastructure networks and complement surrounding habitats;
- enhancing wildlife corridors for the movement of species, including river corridors, where opportunities arise; and
- maximising the provision of soft landscaping, including trees, shrubs and other vegetation that support the borough-wide Biodiversity Action Plan.

Where development would impact on species or a habitat, especially where identified in the relevant Biodiversity Action Plan at London or local level, or the Biodiversity Strategy for England, the potential harm should:

- Frstly be avoided (the applicant has to demonstrate that there is no alternative site with less harmful impacts),
- secondly be adequately mitigated; or
- as a last resort, appropriately compensated for.

Policy LP 16: Trees, Woodlands and Landscape
The Council will require the protection of existing trees and the provision of new trees, shrubs and other vegetation of landscape significance that complement existing, or create new, high quality green areas, which deliver amenity and biodiversity benefits.

To ensure development protects, respects, contributes to and enhances trees and landscapes, the Council, when assessing development proposals, will:

Trees and Woodlands

- resist the loss of trees, including aged or veteran trees, unless the tree is dead, dying or dangerous; or the tree is causing significant damage to adjacent structures; or the tree has little or no amenity value; or felling is for reasons of good arboricultural practice; resist development that would result in the loss or deterioration of irreplaceable habitat such as ancient woodland;
- resist development which results in the damage or loss of trees that are considered to be of townscape or amenity value; the Council will require that site design or layout ensures a harmonious relationship between trees and their surroundings and will resist development which will be likely to result in pressure to significantly prune or remove trees;
- require, where practicable, an appropriate replacement for any tree that is felled; a financial contribution to the provision for an off-site tree in line with the monetary value of the existing tree to be felled will be required in line with the 'Capital Asset Value for Amenity Trees' (CAVAT);
- require new trees to be of a suitable species for the location in terms of height and root spread, taking account of space required for trees to mature; the use of native species is encouraged where appropriate;
- require that trees are adequately protected throughout the course of development, in accordance with British Standard 5837 (Trees in relation to design, demolition and construction – Recommendations).

The Council may serve Tree Preservation Orders or attach planning conditions to protect trees considered to be of value to the townscape and amenity and which are threatened by development.

Landscape

- require the retention of important existing landscape features where practicable;
- require landscape design and materials to be of high quality and compatible with the surrounding landscape and character; and
- encourage planting, including new trees, shrubs and other significant vegetation where appropriate.

Policy LP 17: Green roofs and walls
Green roofs and/or brown roofs should be incorporated into new major developments with roof plate areas of 100sqm or more where technically feasible and subject to considerations of visual impact. The aim should be to use at least 70% of any potential roof plate area as a green / brown roof.

The onus is on an applicant to provide evidence and justification if a green roof cannot be incorporated. The Council will expect a green wall to be incorporated, where appropriate, if it has been demonstrated that a green / brown roof is not feasible.

The use of green / brown roofs and green walls is encouraged and supported in smaller developments, renovations, conversions and extensions.

Policy LP 20: Climate Change Adaption
The Council will promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property.

New development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy:

- minimise internal heat generation through energy efficient design
- reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls
- manage the heat within the building through exposed internal thermal mass and high ceilings
- passive ventilation

- mechanical ventilation
- active cooling systems (ensuring they are the lowest carbon options).

Opportunities to adapt existing buildings, places and spaces to the likely effects of climate change should be maximised and will be supported.

Policy LP 21: Flood Risk and Sustainable Drainage
All developments should avoid, or minimise, contributing to all sources of flooding, including fluvial, tidal, surface water, groundwater and flooding from sewers, taking account of climate change and without increasing flood risk elsewhere. Development will be guided to areas of lower risk by applying the 'Sequential Test' as set out in national policy guidance, and where necessary, the 'Exception Test' will be applied.

Unacceptable developments and land uses will be refused in line with national policy and guidance, the Council's Strategic Flood Risk Assessment (SFRA) and as outlined in the table within the policy.

In Flood Zones 2 and 3, all proposals on sites of 10 dwellings or more or 1000sqm of non-residential development or more, or on any other proposal where safe access/egress cannot be achieved, a Flood Emergency Plan must be submitted.

Where a Flood Risk Assessment is required, on-site attenuation to alleviate fluvial and/or surface water flooding over and above the Environment Agency's floodplain compensation is required where feasible.

Policy LP 22: Sustainable Design and Construction
Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

- Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
- Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
- New non-residential buildings over 100sqm will be required to meet BREEAM ‘Excellent’ standard.
- Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).

Reducing Carbon Dioxide Emissions

Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

- All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
- All other new residential buildings should achieve a 35% reduction.
- All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.

Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.

This should be achieved by following the Energy Hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

Decentralised Energy Networks

The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:

- All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.
- Development proposals of 50 units or more, or new non-residential development of 1000sqm or more, will need to provide an assessment of the provision of on-site decentralised energy (DE) networks and combined heat and power (CHP).
- Where feasible, new development of 50 units or more, or new non-residential development of 1000sqm or more, as well as schemes for the Proposal Sites identified in this Plan, will need to provide on-site DE and CHP; this is particularly necessary within the clusters identified for DE opportunities in the borough-wide Heat Mapping Study. Where on-site provision is not feasible, provision should be made for future connection to a local DE network should one become available.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.

Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.

Policy LP 23: Water Resources and Infrastructure
The borough’s water resources and supplies will be protected by resisting development proposals that would pose an unacceptable threat to the borough's rivers, surface water and groundwater quantity and quality. This includes pollution caused by water run-off from developments into nearby waterways.

Water Quality

The Council encourages proposals that seek to increase water availability or protect and improve the quality of rivers or groundwater.

The development or expansion of water supply or waste water facilities will normally be permitted, either where needed to serve existing or proposed new development, or in the interests of long term water supply and waste water management, provided that the need for such facilities outweighs any adverse land use or environmental impact.

Where rivers have been classified by the Environment Agency as having ‘poor’ status, any development affecting such rivers is encouraged to improve the water quality in these areas.

Water and sewerage provision

New major residential or major non-residential development will need to ensure that there is adequate water supply, surface water, foul drainage and sewerage treatment capacity to serve the development. Planning permission will only be granted for developments which increase the demand for off-site service infrastructure where:

- sufficient capacity already exists, or
- extra capacity can be provided in time to serve the development, which will ensure that the environment and the amenities of local residents are not adversely affected.

Applicants for major developments will be required to provide evidence in the form of written confirmation as part of the planning application that capacity exists in the public sewerage and water supply network to serve their development.

Any new water supply, sewerage or waste water treatment infrastructure must be in place prior to occupation of the development. Financial contributions may be required for new developments towards the provision of, or improvements to, such infrastructure.

Policy LP 24: Waste Management
The Council will ensure that waste is managed in accordance with the waste hierarchy, which is to reduce, reuse or recycle waste as close as possible to where it is produced. The Council will require the following:

- All developments, including conversions and changes of use are required to provide adequate refuse and recycling storage space and facilities, which allows for ease of collection and which residents and occupiers can easily access, in line with the guidance and advice set out in the Council's SPD on Refuse and Recycling Storage Requirements.
- All developments need to ensure that the management of waste, including the location and design of refuse and recycling facilities, is sensitively integrated within the overall design of the scheme, in accordance with policies on Local Character and Design.
- Development proposals, where appropriate, should make use of the rail and the waterway network for the transportation of construction, demolition and other waste. Development proposals in close proximity to the river should utilise the river for the transport of construction materials and waste where practicable.
- All major developments, and where appropriate developments that are likely to generate large amounts of waste, are required to produce site waste management plans to arrange for the efficient handling of construction, excavation and demolition waste and materials.

Proposals affecting existing waste management sites, as well as proposals for new or additional waste management facilities, will be assessed against the policies of the West London Waste Plan (2015).

Policy LP 28: Social and Community Infrastructure
The Council will work with service providers and developers to ensure the adequate provision of community services and facilities, especially in areas where there is an identified need or shortage.

New social and community infrastructure

Proposals for new or extensions to existing social and community infrastructure will be supported where:

- it provides for an identified need;
- is of a high quality and inclusive design providing access for all; and
- where practicable is provided in multi-use, flexible and adaptable buildings or co-located with other social infrastructure uses which increases public access.

Loss of social or community infrastructure

Loss of social or community infrastructure will be resisted. Proposals involving the loss of such infrastructure will need to demonstrate clearly:

- that there is no longer an identified community need for the facilities or they no longer meet the needs of users and cannot be adapted; or
- that the existing facilities are being adequately re-provided in a different way or elsewhere in a convenient alternative location accessible to the current community it supports, or that there are sufficient suitable alternative facilities in the locality; and
- the potential of re-using or redeveloping the existing site for the same or an alternative social infrastructure use for which there is a local need has been fully assessed. This should include evidence of completion of a full and proper marketing exercise of the site for a period of at least two consecutive years in line with the requirements set out in Appendix 5.

Where the Council is satisfied that the above evidence has been provided and the change of use away from social and community infrastructure use has been justified, redevelopment for other employment generating uses or affordable housing should be considered.

Impacts on existing social infrastructure

Development proposals for 10 or more residential units should assess the potential impacts on existing social and community infrastructure in order to demonstrate to the Council that there is sufficient capacity within the existing infrastructure to accommodate the needs arising from the new development.

Policy LP 29: Education and Training
The Council will work with partners to encourage the provision of facilities and services for education and training of all age groups to help reduce inequalities and support the local economy, by the following means:

- supporting the provision of facilities to meet the needs for primary and secondary school places as well as pre-school and other education and training facilities;
- safeguarding land and buildings in educational use;
- identifying new sites for educational uses as part of this Plan; the Council will work with landowners and developers to secure sites for pre-schools, primary and secondary schools as well as sixth forms to ensure sufficient spaces can be provided for children aged 2-18;
- encouraging the potential to maximise existing educational sites through extensions, redevelopment or refurbishment to meet identified educational needs;
- encouraging flexible and adaptable buildings, multi-use and co-location with other social infrastructure.

The Council will promote local employment opportunities and training programmes. Where the employment opportunities generated by construction as well as the end use of the development create more than 20 (Full Time Equivalent) jobs, a Local Employment Agreement, secured through a Section 106 agreement, will be required.

Policy LP 30: Health and Wellbeing
Planning, at all levels, can play a crucial role in creating environments that enhance people's health and wellbeing. The Council promotes and supports healthy and active lifestyles and measures to reduce health inequalities.

The Council will support development that results in a pattern of land uses and facilities that encourage:

- Sustainable modes of travel such as safe cycling routes, attractive walking routes and easy access to public transport to reduce car dependency.
- Access to green infrastructure, including river corridors, local open spaces as well as leisure, recreation and play facilities to encourage physical activity.
- Access to local community facilities, services and shops which encourage opportunities for social interaction and active living, as well as contributing to dementia-friendly environments.
- Access to local healthy food, for example, allotments and food growing spaces.
- Access to toilet facilities which are open to all in major developments where appropriate (linked to the Council's Community Toilet Scheme).
- An inclusive development layout and public realm that considers the needs of all, including the older population and disabled people.
- Active Design which encourages wellbeing and greater physical movement as part of everyday routines.

This policy will be delivered by requiring developments to comply with the following:

- A Health Impact Assessment must be submitted with all major development proposals.

- The Council will manage proposals for new fast food takeaways (A5 uses) located within 400 metres of the boundaries of a primary or secondary school in order to promote the availability of healthy foods.
- Existing health facilities will need to be retained where these continue to meet, or can be adapted to meet, residents' needs.
- Applications for new or improved facilities or loss of health and social care facilities will be assessed in line with the criteria set out in the Social and Community Infrastructure policy.

Policy LP 40: Employment and local economy
The Council will support a diverse and strong local economy in line with the following principles:

- Land in employment use should be retained in employment use for business, industrial or storage purposes.
- Major new employment development should be directed towards Richmond and Twickenham centres. Other employment floorspace of an appropriate scale may be located elsewhere.
- The provision of small units, affordable units and flexible workspace such as co-working space is encouraged.
- In exceptional circumstances, mixed use development proposals which come forward for specific employment sites should retain, and where possible enhance, the level of existing employment floorspace. The inclusion of residential use within mixed use schemes will not be appropriate where it would adversely impact on the continued operation of other established employment uses within that site or on neighbouring sites.

Policy LP 44: Sustainable Travel Choices
The Council will work in partnership to promote safe, sustainable and accessible transport solutions, which minimise the impacts of development including in relation to congestion, air pollution and carbon dioxide emissions, and maximise opportunities including for health benefits and providing access to services, facilities and employment. The Council will:

Location of development

Encourage high trip generating development to be located in areas with good public transport with sufficient capacity, or which are capable of supporting improvements to provide good public transport accessibility and capacity, taking account of local character and context.

Walking and cycling

Ensure that new development is designed to maximise permeability within and to the immediate vicinity of the development site through the provision of safe and convenient walking and cycling routes, and to provide opportunities for walking and cycling, including through the provision of links and enhancements to existing networks.

Public transport

Ensure that major new developments maximise opportunities to provide safe and convenient access to public transport services. Proposals will be expected to support improvements to existing services and infrastructure where no capacity currently exists or is planned to be provided.

Protect existing public transport interchange facilities unless suitable alternative facilities can be provided which ensure the maintenance of the existing public transport operations. Applications will need to include details setting out how such re-provision will be secured and provided in a timely manner.

The road network

Ensure that new development does not have a severe impact on the operation, safety or accessibility to the local or strategic highway networks. Any impacts on the local or strategic highway networks, arising from the development itself or the cumulative effects of development, including in relation to on-street parking, should be mitigated through the provision of, or contributions towards, necessary and relevant transport improvements.

In assessing planning applications, the cumulative impacts of development on the transport network will be taken into account. Planning applications will need to be supported by the provision of a Transport Assessment if it is a major development, and a Transport Statement if it is a minor development.

Safeguarding of routes and facilities

Land required for proposed transport schemes as identified in the London Plan and the Council's Local Implementation Plan for Transport will be protected from developments which would prevent their proper implementation.

Local filling stations and supporting services such as car repair facilities will be protected from redevelopment for alternative uses unless exceptional circumstances can be demonstrated that warrant their loss.

Appendix B: Technical parameters.

Compliance software and procedure.

The Proposed Development has been assessed using The National Calculation Methodology for demonstrating compliance with Approved Document Part L.

Part L1A compliance

In order to assess the residential aspects of the Proposed Developments, the methodology detailed in the Standard Assessment Procedure (SAP) 2012 was used. Calculations used compliant modelling software were conducted for the Be Lean stage of the energy hierarchy.

Assumed building fabric and services performance are detailed in the 'calculation parameters' section.

Part L2A compliance

A dynamic simulation model was created to assess the design of the non-dwelling areas, cinema, office and school.

Integrated Environmental Solutions Virtual Environment (IES VE) is a Dynamic Simulations Modelling (DSM) software package which has the capabilities of enabling the user to create a virtual representation of a building. The results presented in this report were calculated using the approved compliance software IES VE 2018 (v2018.1.0.0).

The IES model for the Proposed Development was drawn to geometry received from Squire and Partners.

IES modelling disclaimer

The calculations produced by Hoare Lea have been carried out with the information provided by Squire and Partners to determine whether the Proposed Development can achieve compliance with Approved Document Part L2A of the Building Regulations.

It should be noted that the data generated by this work is obtained using computer simulations. These simulations are the best means of predicting the performance of the building at this stage. Full certainty can only be achieved by measuring the performance of the building and associated systems after a period of use.

The actual energy usage for the building once occupied may vary from the calculated values submitted to Building Control. These differences will occur due to a number of variable parameters between the modelled building and the actual building. Such differences will include the hours, levels of occupancy, how the plant is used and the design criteria with regards to how the rooms are environmentally controlled.

Whilst the simulations have been undertaken in good faith using reasonable skill and care, Hoare Lea can take no responsibility for differences between the computer simulations and the actual performance of the completed building due to the inherent complexity and variability of the physics in a building and its environment.

Calculation parameters.

The following tables give the parameters used to conduct the Part L compliant modelling for the Proposed Development.

Fabric parameters

The fabric performance parameters used to model the Proposed Development are as follows.

Table 36: Target building fabric performance parameters.

Parameter	Dwellings	Non-dwellings
Exposed Floor U-value (W/m^2K)	0.15	0.20
External Wall U-value (W/m^2K)	0.12	0.18 – 0.20
Roof U-value (W/m^2K)	0.15	0.15 - 0.20
Glazing U-value (W/m^2K)	1.20 (g value: 0.29)	1.30 – 1.60
Roof Light Glazing U-value (W/m^2K)	N/A	0.40
Air Permeability ($m^3/h.m^2$) @ 50Pa	3.00	5.00

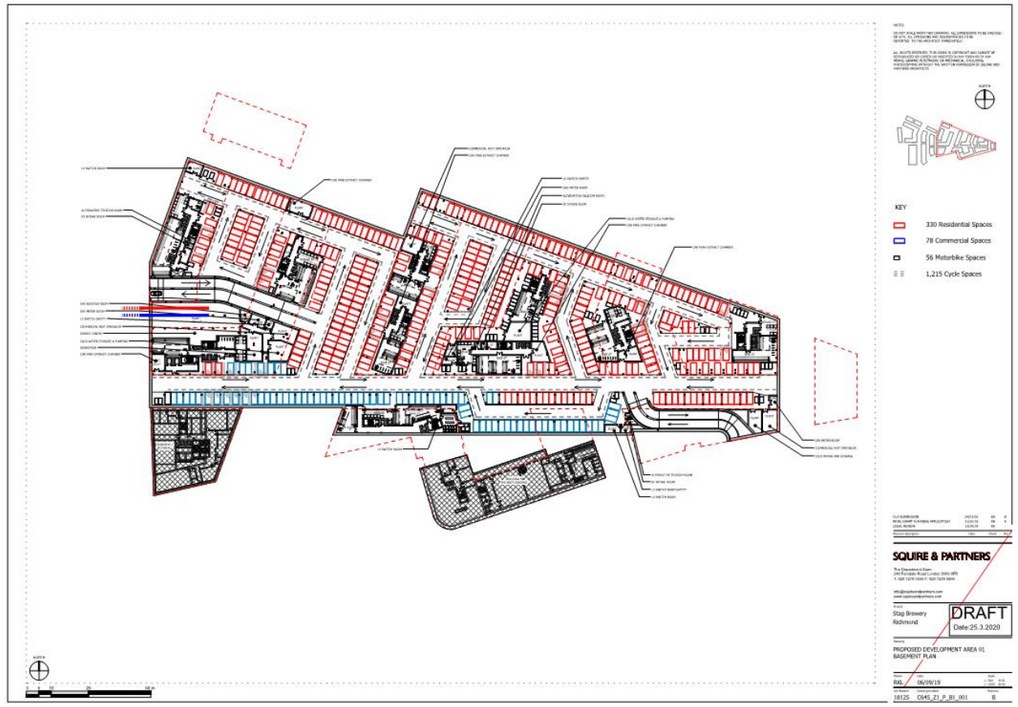
System parameters

The systems performance parameters used to model the Proposed Development are as follows.

Table 37: System parameters per space type.

	Dwelling Areas	Non-dwellings
Space Heating & Cooling	DEN fuelled by CHP and high-efficiency condensing gas boilers (94% efficiency) with Heat Interface Units (HIU) per dwelling coupled to hot water systems and fan coil units / underfloor heating.	DEN fuelled by CHP and high-efficiency condensing gas boilers (94% efficiency) with heat exchangers and Fan Coil Units.
Domestic Hot Water	Water efficient fixtures and fittings to minimise water demand. HIU with minimal heat loss	
Cooling	No cooling.	High-efficiency chillers with an SEER of 5.0.
Ventilation	MVHR with specific fan power 0.4-0.53 with Heat Recovery of 91-94%	Target SFP of 1.6W/l/s and HR of 75%
Lighting	High efficiency lighting. Daylight and presence detection in common areas / roof terraces.	Target efficacy of >70 luminaire lumens per circuit Watt.

Appendix C: Indicative Heat Network Distribution.



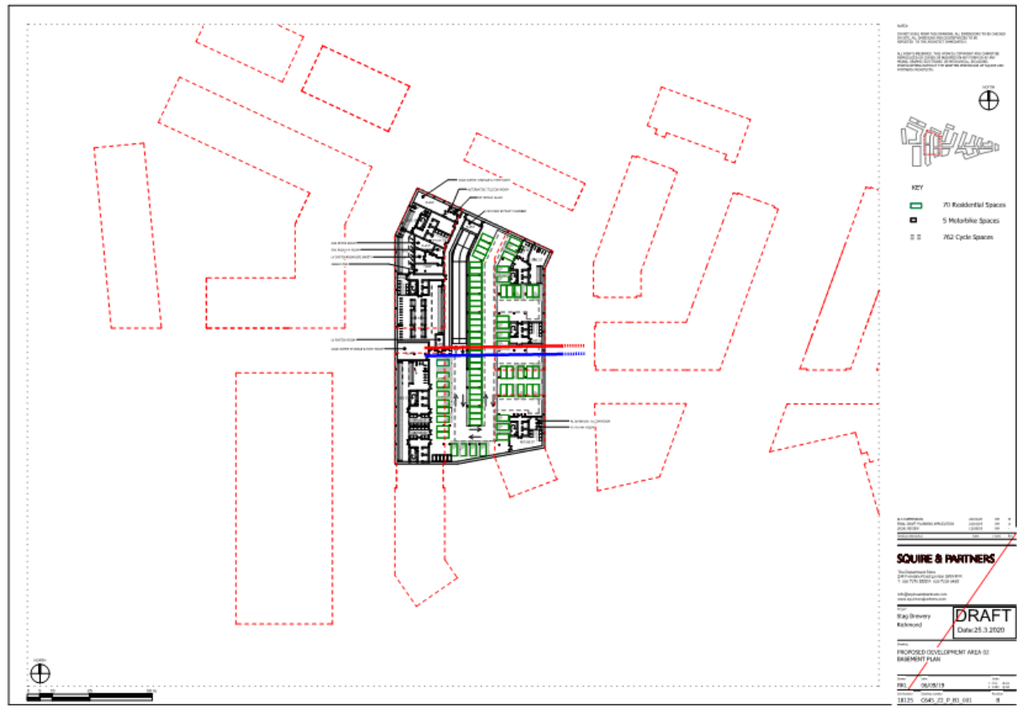


Figure 15: Basement plans with potential connection between energy centres

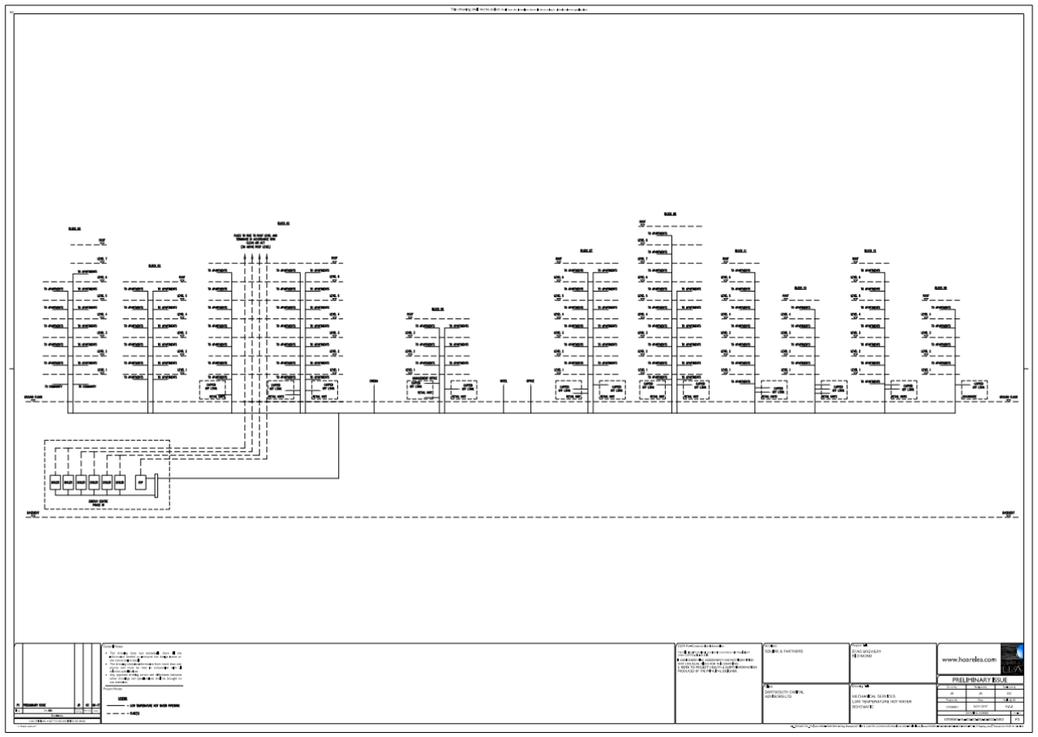


Figure 16: Schematic showing blocks connections to the heat network and an indicative site plan showing connections.

Appendix D: Indicative Gas Boiler Specification.

Extracts from HOVAL Gas Condensing Boiler Catalogue

DESCRIPTION

UltraGas® (250D-2300D)

10 YEAR HEAT EXCHANGER WARRANTY AVAILABLE

Flexibility to suit any need

With the move towards renewable energy, an ever-evolving range of technologies is being integrated into building heating systems. TopTronic®E can control systems with up to eight heat generators and sixteen mixing circuits. Therefore, a wide range of energy sources such as solar and biomass can be utilised together, delivering a well-coordinated system to meet your heating demands

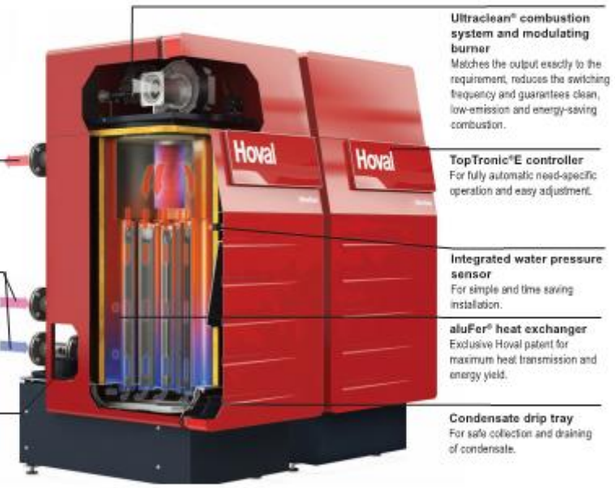
Domestic hot water

Hoval offers a wide variety of domestic hot water storage units ranging from 160 to 10,000 litres.

Our extensive product range can provide solutions to meet most building conditions producing hot water as economically and ecologically as possible.

DESCRIPTION

UltraGas® (250D - 2300D)
Highly efficient, low-NOx design for large commercial applications



UltraGas® (250D-2300D)

Hoval

TECHNICAL DATA

Type			(1440D)	(1700D)	(2000D)	(2300D)
• Nominal output 80/ 60 °C with natural gas		kW	127-1330	148-1576	199-1854	208-2120
• Nominal output 40/ 30 °C with natural gas		kW	142-1440	166-1700	224-2000	233-2300
• Nominal output 80/ 60 °C with liquid gas [1]		kW	169-1310	235-1578	269-1854	-
• Nominal output 40/ 30 °C with liquid gas [1]		kW	185-1440	257-1701	295-2000	-
• Heat input net CV basis with natural gas		kW	130-1354	152-1604	205-1886	214-2164
• Heat input net CV basis with liquid gas [1]		kW	175-1354	238-1606	272-1886	-
• Working pressure heating max./min. [2]		bar	6.0 / 1.2	6.0 / 1.2	6.0 / 1.2	6.0 / 1.2
• Working temperature max.		°C	90	90	90	90
• Boiler water content		l	956	1720	1586	1474
• Minimum water flow rate [3]		l/h	0	0	0	0
• Boiler weight (without water content, incl. casing)		kg	2792	3700	3930	4046
• Boiler efficiency	Part load 30% at 50/30°C (gross)	%	97.3	97.4	97.4	97.4
• Boiler efficiency	Full load 100% at 80/60°C (gross)	%	88.6	88.6	88.6	88.6
• Part L UK Seasonal efficiency		%	95.6	95.7	95.7	95.7
• Stand-by loss at 70 °C		Watt	2000	2400	2400	2400
• Emission rate	Nitrogen oxides [4]	mg/kWh	35	37	39	38
	Carbon monoxide	mg/kWh	20	20	16	-
• Content of CO_2 in the exhaust gas maximum/minimum output		%	9.0 / 8.8	9.0 / 8.8	9.0 / 8.8	9.0 / 8.8
• Dimensions			See table of dimensions			
• Connections	Flow/return	DN	DN150/PN6	DN150/PN6	DN150/PN6	DN150/PN6
	Gas x2	Inches	2"	2"	2"	2"
	Flue gas Ø inside	mm	356	502	502	502
• Gas flow pressure minimum/maximum						
Natural gas E		mbar	18-80	15-30	15-30	15-30
Propane gas		mbar	37-57	37-57	37-57	-
• Gas connection value at 0 °C / 1013 mbar:						
Natural gas E - (Wo = 15,0 kWh/m³) H_s = 9,97 kWh/m³		m³/h	135.5	160.5	188.6	216.4
Propane gas (H_s = 32,7 kWh/m³)		m³/h	52.3	61.9	72.8	-
• Operation voltage		V/Hz	230/50	230/50	1x 230/50 3x400/50	1x 230/50 3x400/50
• Control voltage		V/Hz	24/50	24/50	24/50	24/50
• Minimum/maximum electrical power consumption		Watt	65/2300	52/2020	212/4840	212/5460
• Stand-by		Watt	18	18	18	18
• IP rating (integral protection)		IP	20	20	20	20
Acoustic power level max.		dB(A)	80	80	85	-
• Acoustic pressure level max.		dB(A)	70	70	75	-
• Condensate quantity (natural gas) at 40/ 30 °C		l/h	127.3	150.8	177.8	204.4
• pH value of the condensate		pH	ca. 4.2	ca. 4.2	ca. 4.2	ca. 4.2
• Values for flue calculation:						
Temperature class			T120	T120	T120	T120
Flue gas mass flow		kg/h	2248	2663	3130	3600
Flue gas temperature with operating conditions 80/ 60 °C		°C	71	69	69	71
Flue gas temperature with operating conditions 40/ 30 °C		°C	46	49	49	50
Volume flow rate combustion air		Nm³/h	1676	1984	2334	3684
usable overpressure for air duct/flue system		Pa	60	60	60	60

[1] UltraGas (1440D-2000D) can also be operated with propane/butane (liquid gas) mixtures.
[2] Boiler test pressure is 1.5 times max. operating pressure.
[3] Although generally the UltraGas boilers do not require a minimum water flow, it does not mean that the pump and burner can be switched off together when the unit is operating at full output. There should be a pump overrun to dissipate any residual heat within the boiler to avoid nuisance high temperature lockouts.
[4] NOx emissions to EN676 are dry and at 0% excess oxygen.
• Boiler flow resistance see separate page.
• Note, from a controls point of view UltraGas D boilers are seen as two units. This means that each unit will require its own power supply and controls signals.

Appendix E: Energy Centre Layouts.

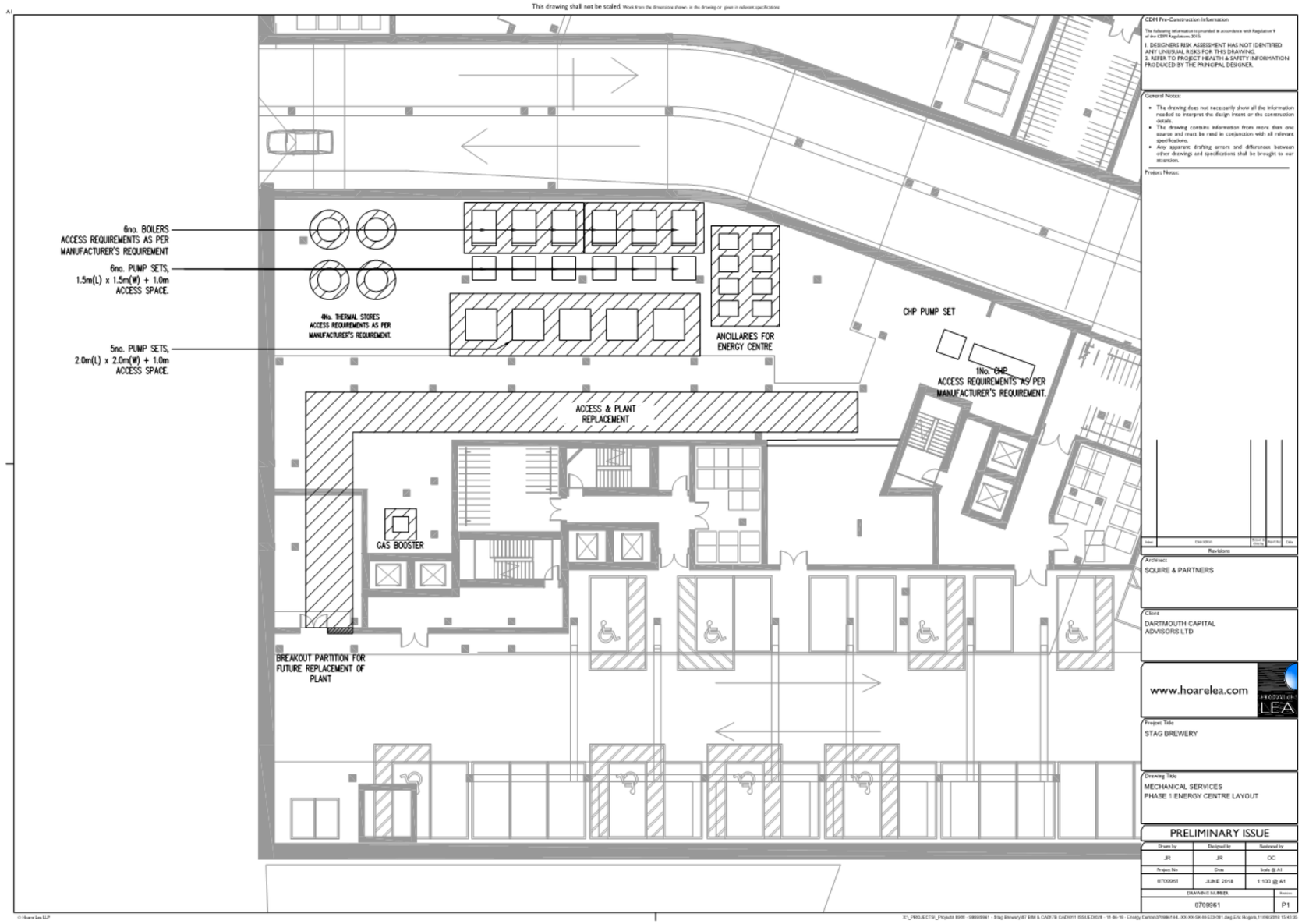


Figure E1: Development Area 1 basement energy centre indicative layout.

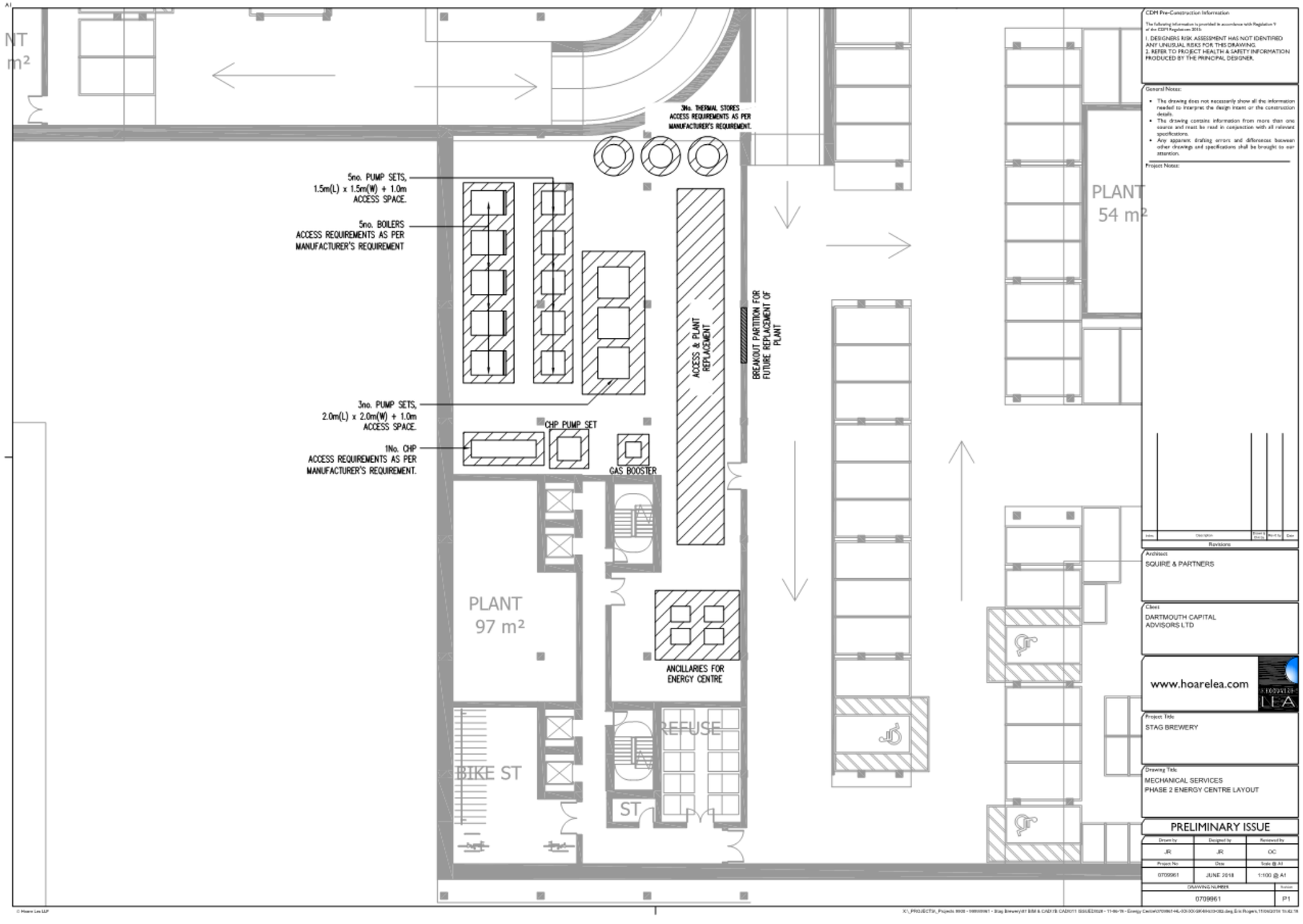
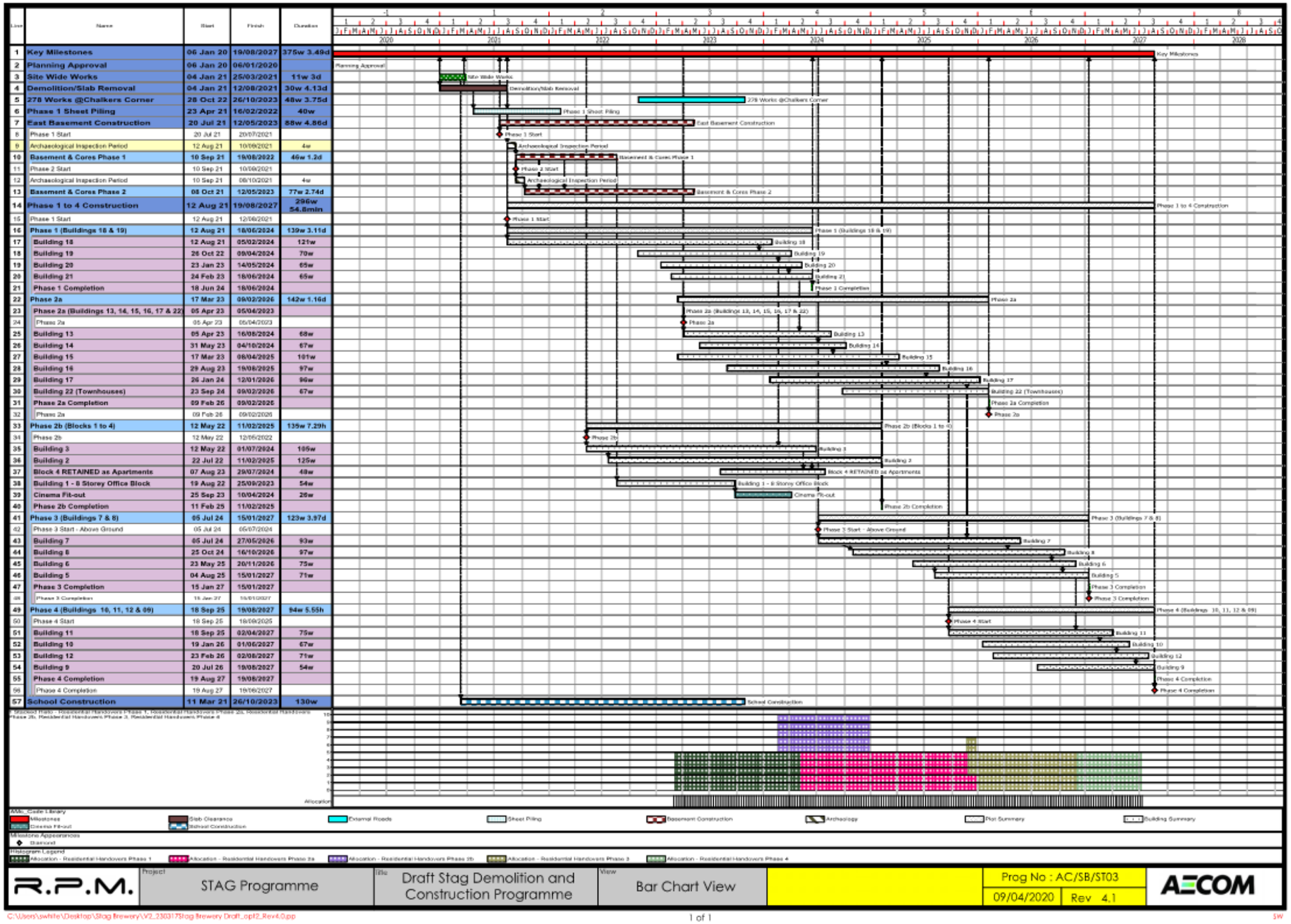


Figure E2: Development Area 2 basement energy centre indicative layout

Appendix F: Framework construction management plan programme.



Line	Name	Start	Finish	Duration
1	Key Milestones	06 Jan 20	19/08/2027	375w 3.49d
2	Planning Approval	06 Jan 20	06/01/2020	
3	Site Wide Works	04 Jan 21	25/03/2021	11w 3d
4	Demolition/Slab Removal	04 Jan 21	12/08/2021	30w 4.13d
5	278 Works @Chalkers Corner	28 Oct 22	26/10/2023	48w 3.75d
6	Phase 1 Sheet Piling	23 Apr 21	16/02/2022	40w
7	East Basement Construction	20 Jul 21	12/05/2023	88w 4.86d
8	Phase 1 Start	20 Jul 21	20/07/2021	
9	Archaeological Inspection Period	12 Aug 21	10/09/2021	4w
10	Basement & Cores Phase 1	10 Sep 21	19/08/2022	46w 1.2d
11	Phase 2 Start	10 Sep 21	10/09/2021	
12	Archaeological Inspection Period	10 Sep 21	08/10/2021	4w
13	Basement & Cores Phase 2	08 Oct 21	12/05/2023	77w 2.74d
14	Phase 1 to 4 Construction	12 Aug 21	19/08/2027	286w 54.8min
15	Phase 1 Start	12 Aug 21	12/08/2021	
16	Phase 1 (Buildings 18 & 19)	12 Aug 21	18/06/2024	139w 3.11d
17	Building 18	12 Aug 21	05/02/2024	121w
18	Building 19	26 Oct 22	09/04/2024	70w
19	Building 20	23 Jan 23	14/05/2024	65w
20	Building 21	24 Feb 23	18/06/2024	65w
21	Phase 1 Completion	18 Jun 24	18/06/2024	
22	Phase 2a	17 Mar 23	09/02/2026	142w 1.16d
23	Phase 2a (Buildings 13, 14, 15, 16, 17 & 22)	05 Apr 23	05/04/2023	
24	Phase 2a	05 Apr 23	05/04/2023	
25	Building 13	05 Apr 23	16/05/2024	68w
26	Building 14	31 May 23	04/10/2024	67w
27	Building 15	17 Mar 23	08/04/2025	101w
28	Building 16	29 Aug 23	19/08/2025	97w
29	Building 17	26 Jan 24	12/01/2026	96w
30	Building 22 (Townhouses)	23 Sep 24	09/02/2026	67w
31	Phase 2a Completion	09 Feb 26	09/02/2026	
32	Phase 2a	09 Feb 26	09/02/2026	
33	Phase 2b (Blocks 1 to 4)	12 May 22	11/02/2025	135w 7.29h
34	Phase 2b	12 May 22	12/05/2022	
35	Building 3	12 May 22	01/07/2024	105w
36	Building 2	22 Jul 22	11/02/2025	125w
37	Block 4 RETAINED as Apartments	07 Aug 23	29/07/2024	48w
38	Building 1 - 8 Storey Office Block	19 Aug 22	25/09/2023	54w
39	Cinema Fit-out	25 Sep 23	10/04/2024	28w
40	Phase 2b Completion	11 Feb 25	11/02/2025	
41	Phase 3 (Buildings 7 & 8)	05 Jul 24	15/01/2027	123w 3.97d
42	Phase 3 Start - Above Ground	05 Jul 24	05/07/2024	
43	Building 7	05 Jul 24	27/05/2026	93w
44	Building 8	25 Oct 24	16/10/2026	97w
45	Building 6	23 May 25	20/11/2026	75w
46	Building 5	04 Aug 25	15/01/2027	71w
47	Phase 3 Completion	15 Jan 27	15/01/2027	
48	Phase 3 Completion	15 Jan 27	15/01/2027	
49	Phase 4 (Buildings 10, 11, 12 & 09)	18 Sep 25	19/08/2027	94w 5.55h
50	Phase 4 Start	18 Sep 25	18/09/2025	
51	Building 11	18 Sep 25	02/04/2027	75w
52	Building 10	19 Jan 26	01/06/2027	67w
53	Building 12	23 Feb 26	02/08/2027	71w
54	Building 9	20 Jul 26	19/08/2027	54w
55	Phase 4 Completion	19 Aug 27	19/08/2027	
56	Phase 4 Completion	19 Aug 27	19/08/2027	
57	School Construction	11 Mar 21	26/10/2023	130w

R.P.M. | Project: STAG Programme | Title: Draft Stag Demolition and Construction Programme | View: Bar Chart View | Prog No : AC/SB/ST03 | 09/04/2020 | Rev 4.1 | AECOM

C:\Users\swhite\Desktop\Stag Brewery\V2_230317Stag Brewery Draft_opt2_Rev4.0.pp

1 of 1

SW

Appendix G: Overheating analysis.

The GLA domestic overheating checklist is provided below for reference. A TM59 analysis of the dwellings and residential accommodation was also undertaken to assess the risk of overheating.

Table 38: GLA domestic overheating checklist

Section 1 – Site Features Affecting Vulnerability to Overheating		Yes or No?
Site Location	Urban – within central London or high density conurbation	No
	Peri-urban – on the suburban fringes of London	Yes - Richmond
Air Quality and/or Noise sensitivity – are any of the following in the vicinity of the building	Busy roads / A roads	Yes
	Railways / Overground / DLR	No
	Airport / Flight Path	Yes
	Industrial uses / waste facility	No
Proposed Building Uses	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Yes
	Are residents likely to be at home during the day (e.g. students)?	No.
Dwelling Aspect	Are there any single aspect units?	Yes
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	Yes
	If yes, is this to allow acceptable levels of daylighting?	Yes
Security – Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	Yes
	Vulnerable areas identified by the Police Architectural Liaison Officer	TBC
	Other	No
Section 2 – Design Features Implemented to Mitigate Overheating Risk		Please Respond
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Yes
	Will green roofs be provided?	Yes
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	Yes
Materials	Have high albedo (light colour) materials been specified?	Yes – preference of material selection with high albedo
Dwelling Aspect	% of total units that are single aspect	Refer to architect's drawings and DAS.
	% of single aspect with N/NE/NW orientation	
	% single aspect with E orientation	
	% single aspect with S/SE/SW orientation	
	% single aspect with W orientation	
	N/NE/NW	

Section 1 – Site Features Affecting Vulnerability to Overheating		Yes or No?
Glazing Ratio – What is the glazing ratio (glazing – internal floor area) on each façade?	E	Refer to architect's drawings and DAS.
	S/SE/SW	
	W	
Daylighting Window Opening	What is the average daylight factor range	*TBC*
	Are windows openable?	Yes
	What is the average percentage of openable area for the windows?	90% - accounting for frame factor
Window Opening – what is the extent of the opening?	Fully openable	Yes - sliding doors and french doors
	Limited (e.g. for security, safety, wind loading reasons)	Yes - restrictions on top hung and side hung windows of 300mm opening.
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	No – MVHR provides ventilation
Shading	Is there any external shading?	Yes – accounted in the massing e.g. balconies
	Is there any internal shading?	Yes – Blinds to be included in the base build.
Glazing Specification	Is there any solar control glazing?	Glazing with g-value of 0.35 will be specified.
Ventilation – what is the ventilation strategy?	Natural - background	Yes – openable windows
	Natural – purge	Yes – openable windows
	Mechanical – background (e.g. MVHR)	Yes - MVHR
	Mechanical – purge	Yes –boost via MVHR and mechanical extract fans
Heating System	Average Design ACH	Up to 4 ACH
	Is communal heating present?	Yes – connections via HIU
	What is the flow/return temperature?	Subject to detailed design
	Have horizontal pipe runs been minimized?	Yes
	Do the specifications include insulation levels in line with the London Heat Network Manual?	Yes

The typical floor for Block 08 has been used as a best representation of apartments on the site. An assessment has been carried out using weather scenarios Design Summer Year (DSY) 1, 2 and 3 have been used for the appropriate location for completeness.

The model used for the basis of the assessment is outlined in Figure 17.

Residential buildings that overheat cause significant discomfort and stress to their occupants and reduce sleep quality. There are several reasons for the increase in overheating risk in residential buildings. Contributing factors include the increase in single aspect building forms (that don't allow sufficient cross-flow ventilation), the trend towards larger areas of glazing, climate change, the urban heat island effect and inadequate means of ventilation.

It has also become increasingly evident that the limitations of how overheating risk is assessed within Building Regulations Criterion 3 are not always completely understood or fully communicated to project stakeholders.

CIBSE have published guidance documents which present methodologies for assessing overheating risk based on dynamic thermal simulation of buildings. The CIBSE guidance also references BS EN 15251 which is the applicable standard. The most recent guidance (TM59 - 2017) includes a standardised methodology for thermal modelling of residential buildings during design, which specifies occupancy densities, occupancy profiles and internal heat gains to be used within the assessment. It also clarifies the criteria which apply, based on the predominant ventilation method (i.e. natural or mechanical ventilation).

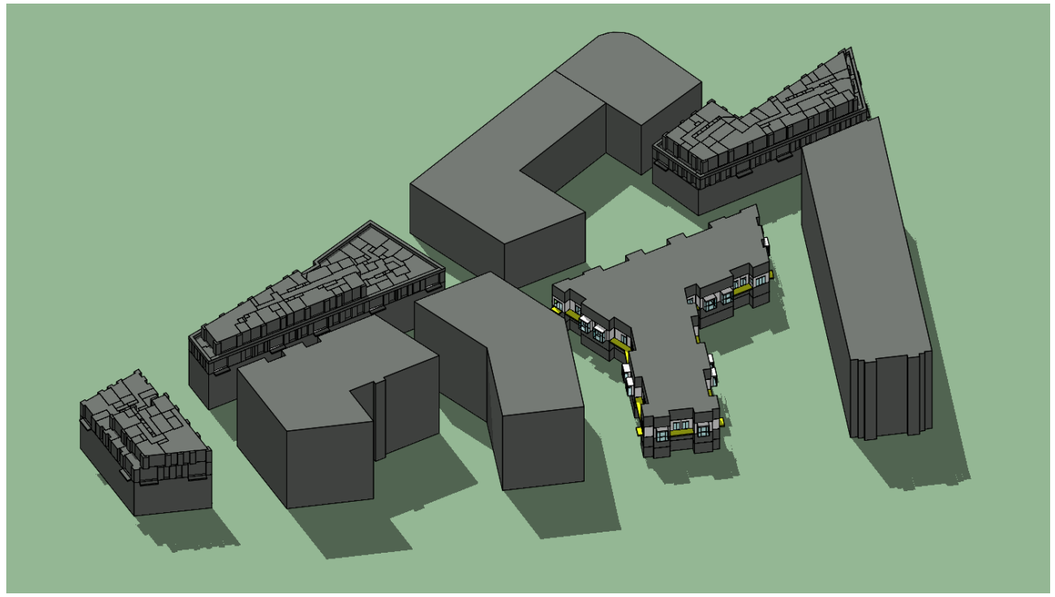


Figure 17: IES model used for the assessment.

10.6 Assessment criteria.

10.6.1 **CIBSE TM59.**

CIBSE TM59:2017 is a guidance document for assessing overheating risk in residential buildings. The guidance builds upon the requirements outlined in CIBSE TM52: 2013 Limits of thermal comfort: avoiding overheating in European Buildings (2013) and CIBSE Guide A 2015: Environmental Design.

CIBSE TM59 provides a standardised methodology for assessing and reporting overheating risk in new and refurbished homes and is now the industry standard for assessing overheating risk in residential projects.

The guidance includes a set of prescriptive internal gains and their associated timed profiles that represent reasonable usage patterns for a home suitable for evaluating overheating risk.

Risk assessment criteria

TM59 provides a standardised methodology for assessing and reporting overheating risk in new and refurbished homes.

Table 39 provides a summary of the overheating risk criteria.

Table 39: Summary of TM59 Assessment Criteria.

CIBSE Residential Overheating Criteria	
Adaptive Criteria:	For living rooms, kitchens and bedrooms: Internal temperatures should not exceed a threshold (linked to outside air temperature) for more than 3% of occupied hours (May – Sept). Additionally, for bedrooms only: At night (22:00-07:00hrs) internal temperatures should not exceed 26°C for more than 1% of occupied hours (Jan – Dec).
Communal Corridors	
Recommended test to ensure that corridors do not exceed operative temperature of 28°C for more than 3% of total annual hours (262 hours or less).	

10.7 Methodology.

10.7.1 **Initial input parameters.**

The following table provides an overview of the input parameters and modelling assumptions used to carry out the preliminary analysis.

Table 40: Modelling inputs.

Software	IES 2018.2.0.0	Wall U-value	0.12 W/m^2.K
Weather Data	Design Summer Year (DSY1) LHR_DSY1_2020High50	Window U-value	1.40 W/m^2.K
Assessment Criteria	CIBSE TM59	Window g-value	0.4
Assessment Season	Non-heating season (1st May-30th September)	Roof U-value	0.15 W/m^2.K
Occupancy	Bedrooms: 24/7 Communal living/kitchen: 9am-10pm	Floor U-value	0.15 W/m^2.K
Max Occupancy	Single bedroom – 1 person Double bedroom – 2 person Living / dining: – 1 bedroom – 1 person – 2 bedroom – 2 people – 3 bedroom – 3 people – 4 bedroom – 4 people	Window covering (SF = shading factor)	Blinds – shading coefficient 0.4 (black out)
Occupancy Heat Gains	75W / person (Sensible) 55W / person (Latent)	Infiltration	0.15 ACH

Software	IES 2018.2.0.0	Wall U-value	0.12 W/m^2.K
Communal Corridor and Riser Internal Gains	8 W/m flow and return	Lighting gains	2 W/m^2 (All areas)
Max equipment gains – Kitchen and living	Kitchen – 300W peak Living – 150W peak	Max equipment gains – bedroom	80 W (as per CIBSE TM59)
Domestic hot water storage losses	Heat interface unit heat loss: – 78W	MVHR ventilation rate and pick up (°C)	Please refer to Table 42. 1°C pick up assumed. (Used in Iteration 3 only)

10.7.2 **Improved parameters.**

The following table provides an overview of the improved parameters and modelling assumptions that were used to demonstrate a route to meet compliance with TM59 for the assessed dwellings.

Table 41: Modelling inputs (improved).

Parameter	Improved performance
Communal corridor and riser internal gains	7 W/m flow and return
Window g-value	0.29
Window covering (SF = Shading factor)	Blinds – shading Coefficient 0.1 (black out)

10.7.3 **Sample spaces.**

A typical floor of Block 08 has been assessed which is considered representative of the dwellings at the Proposed Development. The floor consists of thirteen apartments in total. The sample dwellings account for changes in orientation, glazing ratio, internal layouts and external environmental conditions.

Figure 18 shows the floor plan for Typical Floor Block 08 which has been used in this assessment.

10.7.4 **Weather files.**

The results for the Dynamic Simulation Modelling (DSM) presented in this report have been based on the following weather files appropriate to the location:

1. Design Summer Year 1 (DSY1) – London_LHR_DSY1_2020High50
2. Design Summer Year 2 (DSY2) – London_LHR_DSY2_2020High50
3. Design Summer Year 3 (DSY3) – London_LHR_DSY3_2020High50

10.8 Reporting criteria.

As per the results submitted as part of the planning application, the building has been assessed in accordance with the adaptive comfort criteria as listed in Table 39.

10.9 Ventilation.

10.9.1 **Mechanical**

Mechanical ventilation rates assumed for the model are as follows.

Table 42: Mechanical ventilation rates.

Unit type	Total flow rate (l/s)	Flow rate to living, kitchen, diner (l/s)	Flow rate to bedrooms (l/s)
One-bedroom unit	200	120	80
Two-bedroom unit	280	120	80
Three-bedroom unit	360	120	80
Four-bedroom unit	440	120	80

10.9.2 **Natural – window openings**

Windows have been assumed to be open 24 hours.

Table 43: Summary of window opening type.

Opening type	Restriction	Degree of opening (°)	Equivalent free area (%)
Top hung No.1	300mm restriction	13° – 21°	45-65%
Sliding Juliet balcony	No restriction	N/A	100%
Balcony door	No restriction	90°	100%

10.10 Blinds.

Dark coloured/black out internal blinds included in all iterations. It is important to note that where blinds have been used, for the natural ventilation strategy, a reduction in the achieved free area of the windows / opening doors has not been accounted for in the model.

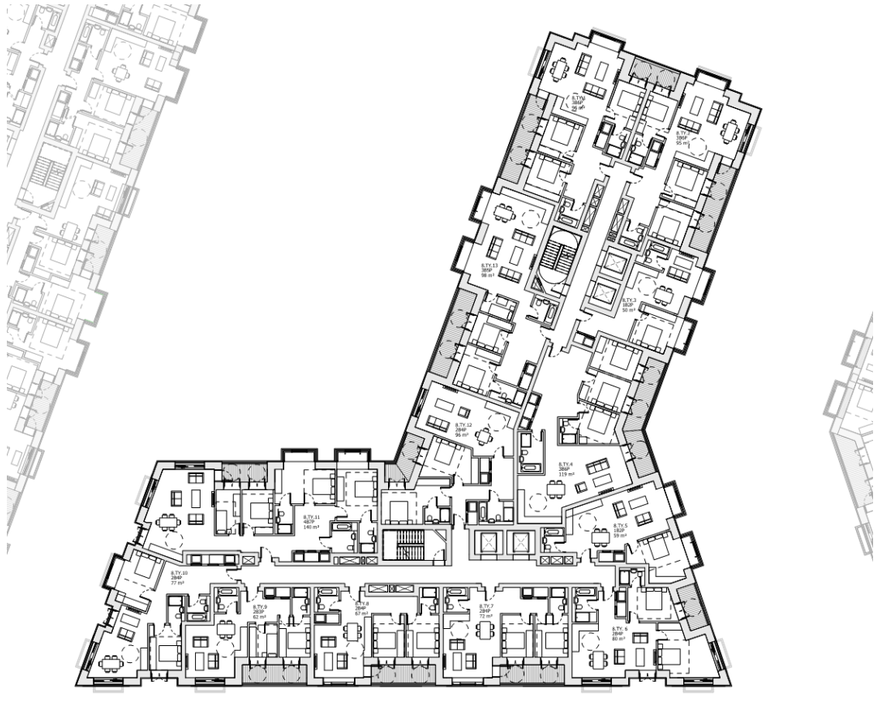


Figure 18: Dwellings assessed.

10.11 Results.

10.11.1 DSY1.

Based on the input parameters and methodology outlined in section 3.0, it has been demonstrated that the majority of assessed dwellings can meet the CIBSE TM59 adaptive criteria for DSY1.

The following scenarios have been assessed as part of the analysis:

- Natural ventilation only, with blinds.
- Natural ventilation only with improved performance parameters (Table 41).
- Hybrid ventilation strategy where natural and mechanical ventilation is being used concurrently

It is important to note that where blinds have been used, for the natural ventilation strategy, a reduction in the achieved free area of the windows / opening doors has not been accounted for in the model.

Table 44: Summary of adaptive criteria results based on various ventilation scenarios – DSY1.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**70%** (30/43)	**83%** (25/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**93%** (40/43)	**83%** (25/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**100%** (43/43)	**100%** (30/30)	**100%** (2/2)

10.11.2 DSY2.

In addition to the assessment using DSY1, the dwellings have also been assessed using the DSY2 summer year. Results are presented in the table below.

Table 45: Summary of adaptive criteria results based on various ventilation scenarios – DSY2.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**65%** (28/43)	**83%** (25/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**70%** (30/43)	**83%** (25/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**72%** (31/43)	**83%** (25/30)	**100%** (2/2)

10.11.3 DSY3.

A final model iteration was run using the DSY3 weather file.

Table 46: Summary of adaptive criteria results based on various ventilation scenarios – DSY3.

	% meeting adaptive comfort criteria		Corridors
	TM59 criterion 1 Kitchens, living rooms and bedrooms <3% occ. hours exceed comfort temp (May – Sept)	TM59 criterion 2 Bedrooms only <26°C for <1% occ. hours	28°C operative temperature target <3% of annual hours
Natural ventilation only with blinds	**2%** (1/43)	**3%** (1/30)	**0%** (0/2)
Natural ventilation with improved parameters (Table 41)	**7%** (3/43)	**3%** (1/30)	**0%** (0/2)
Improved parameters with hybrid ventilation	**7%** (3/43)	**3%** (1/30)	**0%** (0/2)

10.12 Conclusion.

This document has presented the results of an updated overheating assessment on a sample of dwellings at the Stag Brewery development.

This Energy Strategy summarises the results of additional risk assessments undertaken following the amendments of the development design and layouts. The typical floor for Block 08 has been used as a best representation of apartments on the site. An assessment has been carried out using weather scenarios Design Summer Year (DSY) 1, 2 and 3 have been used for the appropriate location for completeness.

Three scenarios have been included in the analysis:

- Natural ventilation only with blinds
- Natural ventilation with improved performance parameters and blinds
- Hybrid ventilation (i.e. openable windows and mechanical ventilation with heat recovery (MVHR)), improved performance parameters and blinds.

The results demonstrate that based on the updated design and parameters used within this report, the majority all assessed dwellings are able to meet the TM59 criteria for DSY1 climate based on a hybrid ventilation strategy and 'black out' blinds.

In regard to the communal corridors, as they are internal to the core of the building (i.e. no windows) they will rely on mechanical ventilation to meet the criteria. If this is provided, the criteria can be met.

10.13 Appendix A – Results on a room by room basis.

10.13.1 DSY 1.

Iteration 1 – Natural ventilation only

Table 47: Iteration 1 - Overheating risk results on a room by room basis (DSY1).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	1.91%	0.64%	Risk criteria met
B08 8.TY.9 2B Bedroom 2	2.18%	0.67%	Risk criteria met
B08 8.TY.9 2B Bedroom 1	2.23%	0.64%	Risk criteria met
B08 8.TY.8 2B Bedroom 1	2.07%	0.64%	Risk criteria met
B08 8.TY.8 2B Bedroom 2	1.96%	0.64%	Risk criteria met
B08 8.TY.7 2B Bedroom 2	2.04%	0.64%	Risk criteria met
B08 8.TY.7 2B Bedroom 1	2.07%	0.64%	Risk criteria met
B08 8.TY.6 2B Bedroom	1.99%	0.46%	Risk criteria met
B08 8.TY.6 2B Bedroom2	1.85%	0.67%	Risk criteria met
B08 8.TY.11 4B Bedroom 4	1.96%	0.49%	Risk criteria met
B08 8.TY.11 4B Bedroom 3	1.77%	0.61%	Risk criteria met
B08 8.TY.12 2B Bedroom 1	1.20%	0.61%	Risk criteria met
B08 8.TY.12 2B Bedroom 2	1.55%	0.67%	Risk criteria met
B08 8.TY.13 3B Bedroom	1.77%	0.64%	Risk criteria met
B08 8.TY.13 3B Bedroom 2	2.02%	0.64%	Risk criteria met
B08 8.TY.13 3B Bedroom 3	2.29%	0.61%	Risk criteria met
B08 8.TY.4 3B Bedroom 3	1.85%	0.64%	Risk criteria met
B08 8.TY.4 3B Bedroom 2	1.82%	0.64%	Risk criteria met
B08 8.TY.4 3B Bedroom 1	1.66%	0.64%	Risk criteria met
B08 8.TY.2 3B Bedroom 2	1.91%	0.64%	Risk criteria met
B08 8.TY.2 3B Bedroom 1	1.72%	0.64%	Risk criteria met
B08 8.TY.1 3B Bedroom 3	1.91%	0.64%	Risk criteria met
B08 8.TY.1 3B Bedroom 2	1.93%	0.64%	Risk criteria met
B08 8.TY.1 3B Bedroom 1	1.93%	0.64%	Risk criteria met
B08 8.TY.5 1B Bedroom	2.45%	1.92%	Risk criteria not met
B08 8.TY.3 1B Bedroom	3.46%	1.70%	Risk criteria not met
B08 8.TY.11 4B Bedroom	1.47%	1.31%	Risk criteria not met
B08 8.TY.11 4B Bedroom	1.74%	1.37%	Risk criteria not met
B08 8.TY.10 2B Bedroom	2.29%	1.34%	Risk criteria not met
B08 8.TY.2 3B Bedroom	1.93%	0.64%	Risk criteria met
B08 8.TY.10 2B () Living Area	3.52%		Risk criteria not met
B08 8.TY.9 2B Living Area	3.97%		Risk criteria not met
B08 8.TY.8 2B Living Area	5.13%		Risk criteria not met
B08 8.TY.7 2B Living Area	4.37%		Risk criteria not met
B08 8.TY.6 2B Living Area	4.22%		Risk criteria not met
B08 8.TY.11 4B () Living Area	3.17%		Risk criteria not met
B08 8.TY.12 2B Living Area	3.17%		Risk criteria not met
B08 8.TY.4 3B Living Area	1.66%		Risk criteria met
B08 8.TY.3 1B living Area	3.22%		Risk criteria not met
B08 8.TY.1 3B Living Area	3.57%		Risk criteria not met
B08 8.TY.13 Living Area	3.27%		Risk criteria not met
B08 8.TY.5 1B living Area	3.67%		Risk criteria not met
B08 8.TY.2 3B Living Area	3.12%		Risk criteria not met

Iteration 2 – Natural ventilation with improved parameters

Table 48: Iteration 2 - Overheating risk results on a room by room basis (DSY1).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	1.72%	0.61%	Risk criteria met
B08 8.TY.9 2B Bedroom 2	1.93%	0.64%	Risk criteria met
B08 8.TY.9 2B Bedroom 1	1.96%	0.64%	Risk criteria met
B08 8.TY.8 2B Bedroom 1	1.93%	0.64%	Risk criteria met
B08 8.TY.8 2B Bedroom 2	1.82%	0.64%	Risk criteria met
B08 8.TY.7 2B Bedroom 2	1.85%	0.64%	Risk criteria met
B08 8.TY.7 2B Bedroom 1	1.88%	0.64%	Risk criteria met
B08 8.TY.6 2B Bedroom	1.80%	0.43%	Risk criteria met
B08 8.TY.6 2B Bedroom2	1.58%	0.64%	Risk criteria met
B08 8.TY.11 4B Bedroom 4	1.91%	0.49%	Risk criteria met
B08 8.TY.11 4B Bedroom 3	1.61%	0.58%	Risk criteria met
B08 8.TY.12 2B Bedroom 1	1.12%	0.61%	Risk criteria met
B08 8.TY.12 2B Bedroom 2	1.42%	0.64%	Risk criteria met
B08 8.TY.13 3B Bedroom	1.58%	0.61%	Risk criteria met

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.13 3B Bedroom 2	1.85%	0.58%	Risk criteria met
B08 8.TY.13 3B Bedroom 3	2.04%	0.58%	Risk criteria met
B08 8.TY.4 3B Bedroom 3	1.55%	0.64%	Risk criteria met
B08 8.TY.4 3B Bedroom 2	1.63%	0.61%	Risk criteria met
B08 8.TY.4 3B Bedroom 1	1.53%	0.61%	Risk criteria met
B08 8.TY.2 3B Bedroom 2	1.66%	0.61%	Risk criteria met
B08 8.TY.2 3B Bedroom 1	1.53%	0.58%	Risk criteria met
B08 8.TY.1 3B Bedroom 3	1.63%	0.61%	Risk criteria met
B08 8.TY.1 3B Bedroom 2	1.74%	0.64%	Risk criteria met
B08 8.TY.1 3B Bedroom 1	1.66%	0.61%	Risk criteria met
B08 8.TY.5 1B Bedroom	1.12%	1.64%	Risk criteria not met
B08 8.TY.3 1B Bedroom	1.53%	1.34%	Risk criteria not met
B08 8.TY.11 4B Bedroom	0.71%	1.10%	Risk criteria not met
B08 8.TY.11 4B Bedroom	0.79%	1.22%	Risk criteria not met
B08 8.TY.10 2B Bedroom	1.36%	1.28%	Risk criteria not met
B08 8.TY.2 3B Bedroom	1.63%	0.61%	Risk criteria met
B08 8.TY.10 2B () Living Area	3.07%		Risk criteria not met
B08 8.TY.9 2B Living Area	2.82%		Risk criteria met
B08 8.TY.8 2B Living Area	3.92%		Risk criteria not met
B08 8.TY.7 2B Living Area	3.07%		Risk criteria not met
B08 8.TY.6 2B Living Area	3.67%		Risk criteria not met
B08 8.TY.11 4B () Living Area	2.77%		Risk criteria met
B08 8.TY.12 2B Living Area	2.41%		Risk criteria met
B08 8.TY.4 3B Living Area	1.46%		Risk criteria met
B08 8.TY.3 1B living Area	1.56%		Risk criteria met
B08 8.TY.1 3B Living Area	2.61%		Risk criteria met
B08 8.TY.13 Living Area	2.16%		Risk criteria met
B08 8.TY.5 1B living Area	2.11%		Risk criteria met
B08 8.TY.2 3B Living Area	2.46%		Risk criteria met

Iteration 3 – Hybrid ventilation with improved parameters

Table 49: Iteration 3 - Overheating risk results on a room by room basis (DSY1).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	1.85%	0.58%	Risk criteria met
B08 8.TY.9 2B Bedroom 2	1.93%	0.61%	Risk criteria met
B08 8.TY.9 2B Bedroom 1	1.96%	0.55%	Risk criteria met
B08 8.TY.8 2B Bedroom 1	1.93%	0.58%	Risk criteria met
B08 8.TY.8 2B Bedroom 2	1.88%	0.58%	Risk criteria met
B08 8.TY.7 2B Bedroom 2	1.91%	0.61%	Risk criteria met
B08 8.TY.7 2B Bedroom 1	1.93%	0.58%	Risk criteria met
B08 8.TY.6 2B Bedroom	1.82%	0.43%	Risk criteria met
B08 8.TY.6 2B Bedroom2	1.77%	0.61%	Risk criteria met
B08 8.TY.11 4B Bedroom 4	1.96%	0.49%	Risk criteria met
B08 8.TY.11 4B Bedroom 3	1.82%	0.55%	Risk criteria met
B08 8.TY.12 2B Bedroom 1	1.17%	0.58%	Risk criteria met
B08 8.TY.12 2B Bedroom 2	1.44%	0.61%	Risk criteria met
B08 8.TY.13 3B Bedroom	1.74%	0.58%	Risk criteria met
B08 8.TY.13 3B Bedroom 2	1.99%	0.55%	Risk criteria met
B08 8.TY.13 3B Bedroom 3	2.10%	0.55%	Risk criteria met
B08 8.TY.4 3B Bedroom 3	1.80%	0.58%	Risk criteria met
B08 8.TY.4 3B Bedroom 2	1.88%	0.55%	Risk criteria met
B08 8.TY.4 3B Bedroom 1	1.66%	0.58%	Risk criteria met
B08 8.TY.2 3B Bedroom 2	1.85%	0.58%	Risk criteria met
B08 8.TY.2 3B Bedroom 1	1.63%	0.58%	Risk criteria met
B08 8.TY.1 3B Bedroom 3	1.88%	0.58%	Risk criteria met
B08 8.TY.1 3B Bedroom 2	1.91%	0.58%	Risk criteria met
B08 8.TY.1 3B Bedroom 1	1.85%	0.58%	Risk criteria met
B08 8.TY.5 1B Bedroom	1.17%	0.88%	Risk criteria met
B08 8.TY.3 1B Bedroom	1.61%	0.88%	Risk criteria met
B08 8.TY.11 4B Bedroom	0.98%	0.82%	Risk criteria met
B08 8.TY.11 4B Bedroom	1.20%	0.85%	Risk criteria met
B08 8.TY.10 2B Bedroom	1.61%	0.88%	Risk criteria met
B08 8.TY.2 3B Bedroom	1.82%	0.58%	Risk criteria met
B08 8.TY.10 2B () Living Area	2.92%		Risk criteria met

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.9 2B Living Area	2.21%		Risk criteria met
B08 8.TY.8 2B Living Area	2.71%		Risk criteria met
B08 8.TY.7 2B Living Area	2.26%		Risk criteria met
B08 8.TY.6 2B Living Area	2.97%		Risk criteria met
B08 8.TY.11 4B () Living Area	2.56%		Risk criteria met
B08 8.TY.12 2B Living Area	2.11%		Risk criteria met
B08 8.TY.4 3B Living Area	1.11%		Risk criteria met
B08 8.TY.3 1B living Area	1.31%		Risk criteria met
B08 8.TY.1 3B Living Area	2.41%		Risk criteria met
B08 8.TY.13 Living Area	1.86%		Risk criteria met
B08 8.TY.5 1B living Area	1.46%		Risk criteria met
B08 8.TY.2 3B Living Area	2.26%		Risk criteria met

10.13.2 **DSY 2.**

Iteration 1 – Natural ventilation only

Table 50: Iteration 1 - Overheating risk results on a room by room basis (DSY2).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	2.53%	0.91%	Risk criteria met
B08 8.TY.9 2B Bedroom 2	2.72%	0.91%	Risk criteria met
B08 8.TY.9 2B Bedroom 1	2.72%	0.79%	Risk criteria met
B08 8.TY.8 2B Bedroom 1	2.67%	0.88%	Risk criteria met
B08 8.TY.8 2B Bedroom 2	2.64%	0.91%	Risk criteria met
B08 8.TY.7 2B Bedroom 2	2.67%	0.91%	Risk criteria met
B08 8.TY.7 2B Bedroom 1	2.61%	0.88%	Risk criteria met
B08 8.TY.6 2B Bedroom	2.53%	0.67%	Risk criteria met
B08 8.TY.6 2B Bedroom2	2.34%	0.91%	Risk criteria met
B08 8.TY.11 4B Bedroom 4	2.40%	0.73%	Risk criteria met
B08 8.TY.11 4B Bedroom 3	2.29%	0.76%	Risk criteria met
B08 8.TY.12 2B Bedroom 1	1.85%	0.91%	Risk criteria met
B08 8.TY.12 2B Bedroom 2	2.23%	0.97%	Risk criteria met
B08 8.TY.13 3B Bedroom	2.34%	0.88%	Risk criteria met
B08 8.TY.13 3B Bedroom 2	2.53%	0.76%	Risk criteria met
B08 8.TY.13 3B Bedroom 3	2.75%	0.73%	Risk criteria met
B08 8.TY.4 3B Bedroom 3	2.37%	0.91%	Risk criteria met
B08 8.TY.4 3B Bedroom 2	2.34%	0.76%	Risk criteria met
B08 8.TY.4 3B Bedroom 1	2.29%	0.85%	Risk criteria met
B08 8.TY.2 3B Bedroom 2	2.34%	0.76%	Risk criteria met
B08 8.TY.2 3B Bedroom 1	2.29%	0.79%	Risk criteria met
B08 8.TY.1 3B Bedroom 3	2.34%	0.79%	Risk criteria met
B08 8.TY.1 3B Bedroom 2	2.37%	0.76%	Risk criteria met
B08 8.TY.1 3B Bedroom 1	2.34%	0.79%	Risk criteria met
B08 8.TY.5 1B Bedroom	3.08%	2.62%	Risk criteria not met
B08 8.TY.3 1B Bedroom	3.92%	2.19%	Risk criteria not met
B08 8.TY.11 4B Bedroom	2.31%	1.95%	Risk criteria not met
B08 8.TY.11 4B Bedroom	2.53%	2.04%	Risk criteria not met
B08 8.TY.10 2B Bedroom	2.94%	2.13%	Risk criteria not met
B08 8.TY.2 3B Bedroom	2.34%	0.82%	Risk criteria met
B08 8.TY.10 2B () Living Area	4.58%		Risk criteria not met
B08 8.TY.9 2B Living Area	5.08%		Risk criteria not met
B08 8.TY.8 2B Living Area	6.18%		Risk criteria not met
B08 8.TY.7 2B Living Area	5.93%		Risk criteria not met
B08 8.TY.6 2B Living Area	5.33%		Risk criteria not met
B08 8.TY.11 4B () Living Area	4.12%		Risk criteria not met
B08 8.TY.12 2B Living Area	4.27%		Risk criteria not met
B08 8.TY.4 3B Living Area	3.52%		Risk criteria not met
B08 8.TY.3 1B living Area	4.78%		Risk criteria not met
B08 8.TY.1 3B Living Area	4.42%		Risk criteria not met
B08 8.TY.13 Living Area	4.63%		Risk criteria not met
B08 8.TY.5 1B living Area	5.43%		Risk criteria not met
B08 8.TY.2 3B Living Area	4.42%		Risk criteria not met

Iteration 2 – Natural ventilation with improved parameters

Table 51: Iteration 2 - Overheating risk results on a room by room basis (DSY2).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	2.26%	0.85%	Risk criteria met
B08 8.TY.9 2B Bedroom 2	2.42%	0.91%	Risk criteria met
B08 8.TY.9 2B Bedroom 1	2.40%	0.79%	Risk criteria met
B08 8.TY.8 2B Bedroom 1	2.37%	0.82%	Risk criteria met
B08 8.TY.8 2B Bedroom 2	2.34%	0.82%	Risk criteria met
B08 8.TY.7 2B Bedroom 2	2.37%	0.88%	Risk criteria met
B08 8.TY.7 2B Bedroom 1	2.37%	0.82%	Risk criteria met
B08 8.TY.6 2B Bedroom	2.29%	0.67%	Risk criteria met
B08 8.TY.6 2B Bedroom2	2.26%	0.91%	Risk criteria met
B08 8.TY.11 4B Bedroom 4	2.34%	0.70%	Risk criteria met
B08 8.TY.11 4B Bedroom 3	2.21%	0.76%	Risk criteria met
B08 8.TY.12 2B Bedroom 1	1.80%	0.91%	Risk criteria met
B08 8.TY.12 2B Bedroom 2	2.02%	0.91%	Risk criteria met
B08 8.TY.13 3B Bedroom	2.21%	0.79%	Risk criteria met
B08 8.TY.13 3B Bedroom 2	2.31%	0.73%	Risk criteria met

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.13 3B Bedroom 3	2.51%	0.70%	Risk criteria met
B08 8.TY.4 3B Bedroom 3	2.18%	0.79%	Risk criteria met
B08 8.TY.4 3B Bedroom 2	2.21%	0.76%	Risk criteria met
B08 8.TY.4 3B Bedroom 1	2.15%	0.79%	Risk criteria met
B08 8.TY.2 3B Bedroom 2	2.23%	0.76%	Risk criteria met
B08 8.TY.2 3B Bedroom 1	2.15%	0.76%	Risk criteria met
B08 8.TY.1 3B Bedroom 3	2.26%	0.76%	Risk criteria met
B08 8.TY.1 3B Bedroom 2	2.31%	0.76%	Risk criteria met
B08 8.TY.1 3B Bedroom 1	2.21%	0.76%	Risk criteria met
B08 8.TY.5 1B Bedroom	2.18%	2.13%	Risk criteria not met
B08 8.TY.3 1B Bedroom	2.42%	1.98%	Risk criteria not met
B08 8.TY.11 4B Bedroom	1.58%	1.83%	Risk criteria not met
B08 8.TY.11 4B Bedroom	1.74%	1.95%	Risk criteria not met
B08 8.TY.10 2B Bedroom	2.12%	2.01%	Risk criteria not met
B08 8.TY.2 3B Bedroom	2.23%	0.76%	Risk criteria met
B08 8.TY.10 2B () Living Area	4.22%		Risk criteria not met
B08 8.TY.9 2B Living Area	4.12%		Risk criteria not met
B08 8.TY.8 2B Living Area	4.93%		Risk criteria not met
B08 8.TY.7 2B Living Area	4.58%		Risk criteria not met
B08 8.TY.6 2B Living Area	4.42%		Risk criteria not met
B08 8.TY.11 4B () Living Area	3.82%		Risk criteria not met
B08 8.TY.12 2B Living Area	3.87%		Risk criteria not met
B08 8.TY.4 3B Living Area	3.12%		Risk criteria not met
B08 8.TY.3 1B living Area	3.22%		Risk criteria not met
B08 8.TY.1 3B Living Area	3.72%		Risk criteria not met
B08 8.TY.13 Living Area	3.57%		Risk criteria not met
B08 8.TY.5 1B living Area	3.72%		Risk criteria not met
B08 8.TY.2 3B Living Area	3.67%		Risk criteria not met

Iteration 3 – Hybrid ventilation with improved parameters

Table 52: Iteration 3 - Overheating risk results on a room by room basis (DSY2).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	2.37%	0.76%	Risk criteria met
B08 8.TY.9 2B Bedroom 2	2.40%	0.79%	Risk criteria met
B08 8.TY.9 2B Bedroom 1	2.51%	0.79%	Risk criteria met
B08 8.TY.8 2B Bedroom 1	2.40%	0.79%	Risk criteria met
B08 8.TY.8 2B Bedroom 2	2.37%	0.76%	Risk criteria met
B08 8.TY.7 2B Bedroom 2	2.40%	0.79%	Risk criteria met
B08 8.TY.7 2B Bedroom 1	2.40%	0.79%	Risk criteria met
B08 8.TY.6 2B Bedroom	2.31%	0.67%	Risk criteria met
B08 8.TY.6 2B Bedroom2	2.31%	0.88%	Risk criteria met
B08 8.TY.11 4B Bedroom 4	2.37%	0.70%	Risk criteria met
B08 8.TY.11 4B Bedroom 3	2.29%	0.76%	Risk criteria met
B08 8.TY.12 2B Bedroom 1	1.88%	0.91%	Risk criteria met
B08 8.TY.12 2B Bedroom 2	2.18%	0.88%	Risk criteria met
B08 8.TY.13 3B Bedroom	2.26%	0.76%	Risk criteria met
B08 8.TY.13 3B Bedroom 2	2.37%	0.73%	Risk criteria met
B08 8.TY.13 3B Bedroom 3	2.61%	0.70%	Risk criteria met
B08 8.TY.4 3B Bedroom 3	2.31%	0.76%	Risk criteria met
B08 8.TY.4 3B Bedroom 2	2.34%	0.76%	Risk criteria met
B08 8.TY.4 3B Bedroom 1	2.29%	0.76%	Risk criteria met
B08 8.TY.2 3B Bedroom 2	2.34%	0.76%	Risk criteria met
B08 8.TY.2 3B Bedroom 1	2.23%	0.76%	Risk criteria met
B08 8.TY.1 3B Bedroom 3	2.31%	0.76%	Risk criteria met
B08 8.TY.1 3B Bedroom 2	2.37%	0.76%	Risk criteria met
B08 8.TY.1 3B Bedroom 1	2.29%	0.76%	Risk criteria met
B08 8.TY.5 1B Bedroom	2.10%	1.61%	Risk criteria not met
B08 8.TY.3 1B Bedroom	2.42%	1.37%	Risk criteria not met
B08 8.TY.11 4B Bedroom	1.91%	1.43%	Risk criteria not met
B08 8.TY.11 4B Bedroom	1.99%	1.46%	Risk criteria not met
B08 8.TY.10 2B Bedroom	2.26%	1.43%	Risk criteria not met
B08 8.TY.2 3B Bedroom	2.34%	0.76%	Risk criteria met
B08 8.TY.10 2B () Living Area	4.02%		Risk criteria not met

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.9 2B Living Area	3.92%		Risk criteria not met
B08 8.TY.8 2B Living Area	4.22%		Risk criteria not met
B08 8.TY.7 2B Living Area	4.22%		Risk criteria not met
B08 8.TY.6 2B Living Area	4.12%		Risk criteria not met
B08 8.TY.11 4B () Living Area	3.82%		Risk criteria not met
B08 8.TY.12 2B Living Area	3.62%		Risk criteria not met
B08 8.TY.4 3B Living Area	2.92%		Risk criteria met
B08 8.TY.3 1B living Area	3.07%		Risk criteria not met
B08 8.TY.1 3B Living Area	3.77%		Risk criteria not met
B08 8.TY.13 Living Area	3.47%		Risk criteria not met
B08 8.TY.5 1B living Area	3.22%		Risk criteria not met
B08 8.TY.2 3B Living Area	3.62%		Risk criteria not met

10.13.3 **DSY 3**

Iteration 1 – Natural ventilation only

Table 53: Iteration 1 - Overheating risk results on a room by room basis (DSY3).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	3.92%	1.37%	Risk criteria not met
B08 8.TY.9 2B Bedroom 2	4.11%	1.37%	Risk criteria not met
B08 8.TY.9 2B Bedroom 1	4.14%	1.28%	Risk criteria not met
B08 8.TY.8 2B Bedroom 1	4.03%	1.31%	Risk criteria not met
B08 8.TY.8 2B Bedroom 2	3.95%	1.34%	Risk criteria not met
B08 8.TY.7 2B Bedroom 2	4.06%	1.34%	Risk criteria not met
B08 8.TY.7 2B Bedroom 1	3.98%	1.31%	Risk criteria not met
B08 8.TY.6 2B Bedroom	3.87%	0.97%	Risk criteria not met
B08 8.TY.6 2B Bedroom2	3.81%	1.34%	Risk criteria not met
B08 8.TY.11 4B Bedroom 4	3.65%	1.22%	Risk criteria not met
B08 8.TY.11 4B Bedroom 3	3.57%	1.28%	Risk criteria not met
B08 8.TY.12 2B Bedroom 1	3.00%	1.43%	Risk criteria not met
B08 8.TY.12 2B Bedroom 2	3.51%	1.40%	Risk criteria not met
B08 8.TY.13 3B Bedroom	3.73%	1.34%	Risk criteria not met
B08 8.TY.13 3B Bedroom 2	3.89%	1.25%	Risk criteria not met
B08 8.TY.13 3B Bedroom 3	4.22%	1.16%	Risk criteria not met
B08 8.TY.4 3B Bedroom 3	3.79%	1.34%	Risk criteria not met
B08 8.TY.4 3B Bedroom 2	3.65%	1.25%	Risk criteria not met
B08 8.TY.4 3B Bedroom 1	3.62%	1.34%	Risk criteria not met
B08 8.TY.2 3B Bedroom 2	3.79%	1.31%	Risk criteria not met
B08 8.TY.2 3B Bedroom 1	3.59%	1.31%	Risk criteria not met
B08 8.TY.1 3B Bedroom 3	3.73%	1.31%	Risk criteria not met
B08 8.TY.1 3B Bedroom 2	3.87%	1.31%	Risk criteria not met
B08 8.TY.1 3B Bedroom 1	3.79%	1.31%	Risk criteria not met
B08 8.TY.5 1B Bedroom	4.98%	3.44%	Risk criteria not met
B08 8.TY.3 1B Bedroom	5.56%	3.17%	Risk criteria not met
B08 8.TY.11 4B Bedroom	3.65%	2.89%	Risk criteria not met
B08 8.TY.11 4B Bedroom	3.79%	2.95%	Risk criteria not met
B08 8.TY.10 2B Bedroom	4.52%	2.98%	Risk criteria not met
B08 8.TY.2 3B Bedroom	3.73%	1.31%	Risk criteria not met
B08 8.TY.10 2B () Living Area	6.89%		Risk criteria not met
B08 8.TY.9 2B Living Area	7.94%		Risk criteria not met
B08 8.TY.8 2B Living Area	8.90%		Risk criteria not met
B08 8.TY.7 2B Living Area	8.25%		Risk criteria not met
B08 8.TY.6 2B Living Area	7.64%		Risk criteria not met
B08 8.TY.11 4B () Living Area	6.59%		Risk criteria not met
B08 8.TY.12 2B Living Area	6.84%		Risk criteria not met
B08 8.TY.4 3B Living Area	5.98%		Risk criteria not met
B08 8.TY.3 1B living Area	8.14%		Risk criteria not met
B08 8.TY.1 3B Living Area	7.24%		Risk criteria not met
B08 8.TY.13 Living Area	7.29%		Risk criteria not met
B08 8.TY.5 1B living Area	8.60%		Risk criteria not met
B08 8.TY.2 3B Living Area	6.94%		Risk criteria not met

Iteration 2 – Natural ventilation with improved parameters

Table 54: Iteration 2 - Overheating risk results on a room by room basis (DSY3).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	3.54%	1.31%	Risk criteria not met
B08 8.TY.9 2B Bedroom 2	3.79%	1.34%	Risk criteria not met
B08 8.TY.9 2B Bedroom 1	3.81%	1.25%	Risk criteria not met
B08 8.TY.8 2B Bedroom 1	3.76%	1.31%	Risk criteria not met
B08 8.TY.8 2B Bedroom 2	3.57%	1.31%	Risk criteria not met
B08 8.TY.7 2B Bedroom 2	3.65%	1.31%	Risk criteria not met
B08 8.TY.7 2B Bedroom 1	3.70%	1.28%	Risk criteria not met
B08 8.TY.6 2B Bedroom	3.43%	0.94%	Risk criteria not met
B08 8.TY.6 2B Bedroom2	3.49%	1.34%	Risk criteria not met
B08 8.TY.11 4B Bedroom 4	3.62%	1.19%	Risk criteria not met
B08 8.TY.11 4B Bedroom 3	3.40%	1.25%	Risk criteria not met
B08 8.TY.12 2B Bedroom 1	2.86%	1.37%	Risk criteria not met
B08 8.TY.12 2B Bedroom 2	3.27%	1.37%	Risk criteria not met
B08 8.TY.13 3B Bedroom	3.43%	1.31%	Risk criteria not met
B08 8.TY.13 3B Bedroom 2	3.68%	1.22%	Risk criteria not met

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.13 3B Bedroom 3	3.92%	1.16%	Risk criteria not met
B08 8.TY.4 3B Bedroom 3	3.46%	1.34%	Risk criteria not met
B08 8.TY.4 3B Bedroom 2	3.46%	1.25%	Risk criteria not met
B08 8.TY.4 3B Bedroom 1	3.46%	1.31%	Risk criteria not met
B08 8.TY.2 3B Bedroom 2	3.49%	1.28%	Risk criteria not met
B08 8.TY.2 3B Bedroom 1	3.40%	1.28%	Risk criteria not met
B08 8.TY.1 3B Bedroom 3	3.43%	1.28%	Risk criteria not met
B08 8.TY.1 3B Bedroom 2	3.59%	1.28%	Risk criteria not met
B08 8.TY.1 3B Bedroom 1	3.46%	1.28%	Risk criteria not met
B08 8.TY.5 1B Bedroom	3.30%	3.11%	Risk criteria not met
B08 8.TY.3 1B Bedroom	3.59%	2.83%	Risk criteria not met
B08 8.TY.11 4B Bedroom	2.59%	2.59%	Risk criteria not met
B08 8.TY.11 4B Bedroom	2.75%	2.80%	Risk criteria not met
B08 8.TY.10 2B Bedroom	3.30%	2.80%	Risk criteria not met
B08 8.TY.2 3B Bedroom	3.46%	1.28%	Risk criteria not met
B08 8.TY.10 2B () Living Area	6.59%		Risk criteria not met
B08 8.TY.9 2B Living Area	6.54%		Risk criteria not met
B08 8.TY.8 2B Living Area	7.09%		Risk criteria not met
B08 8.TY.7 2B Living Area	6.69%		Risk criteria not met
B08 8.TY.6 2B Living Area	6.89%		Risk criteria not met
B08 8.TY.11 4B () Living Area	5.98%		Risk criteria not met
B08 8.TY.12 2B Living Area	5.98%		Risk criteria not met
B08 8.TY.4 3B Living Area	5.33%		Risk criteria not met
B08 8.TY.3 1B living Area	4.98%		Risk criteria not met
B08 8.TY.1 3B Living Area	6.08%		Risk criteria not met
B08 8.TY.13 Living Area	5.68%		Risk criteria not met
B08 8.TY.5 1B living Area	6.28%		Risk criteria not met
B08 8.TY.2 3B Living Area	5.83%		Risk criteria not met

Iteration 3 – Hybrid ventilation with improved parameters

Table 55: Iteration 3 - Overheating risk results on a room by room basis (DSY3).

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.10 2B () Bedroom 2	3.65%	1.28%	Risk criteria not met
B08 8.TY.9 2B Bedroom 2	3.73%	1.28%	Risk criteria not met
B08 8.TY.9 2B Bedroom 1	3.98%	1.19%	Risk criteria not met
B08 8.TY.8 2B Bedroom 1	3.81%	1.22%	Risk criteria not met
B08 8.TY.8 2B Bedroom 2	3.65%	1.25%	Risk criteria not met
B08 8.TY.7 2B Bedroom 2	3.73%	1.25%	Risk criteria not met
B08 8.TY.7 2B Bedroom 1	3.79%	1.22%	Risk criteria not met
B08 8.TY.6 2B Bedroom	3.49%	0.94%	Risk criteria not met
B08 8.TY.6 2B Bedroom2	3.62%	1.31%	Risk criteria not met
B08 8.TY.11 4B Bedroom 4	3.68%	1.10%	Risk criteria not met
B08 8.TY.11 4B Bedroom 3	3.57%	1.22%	Risk criteria not met
B08 8.TY.12 2B Bedroom 1	2.97%	1.34%	Risk criteria not met
B08 8.TY.12 2B Bedroom 2	3.43%	1.31%	Risk criteria not met
B08 8.TY.13 3B Bedroom	3.62%	1.28%	Risk criteria not met
B08 8.TY.13 3B Bedroom 2	3.76%	1.16%	Risk criteria not met
B08 8.TY.13 3B Bedroom 3	4.11%	1.16%	Risk criteria not met
B08 8.TY.4 3B Bedroom 3	3.62%	1.25%	Risk criteria not met
B08 8.TY.4 3B Bedroom 2	3.65%	1.22%	Risk criteria not met
B08 8.TY.4 3B Bedroom 1	3.51%	1.25%	Risk criteria not met
B08 8.TY.2 3B Bedroom 2	3.68%	1.25%	Risk criteria not met
B08 8.TY.2 3B Bedroom 1	3.46%	1.22%	Risk criteria not met
B08 8.TY.1 3B Bedroom 3	3.65%	1.25%	Risk criteria not met
B08 8.TY.1 3B Bedroom 2	3.70%	1.25%	Risk criteria not met
B08 8.TY.1 3B Bedroom 1	3.59%	1.25%	Risk criteria not met
B08 8.TY.5 1B Bedroom	3.19%	2.19%	Risk criteria not met
B08 8.TY.3 1B Bedroom	3.76%	2.01%	Risk criteria not met
B08 8.TY.11 4B Bedroom	2.89%	2.01%	Risk criteria not met
B08 8.TY.11 4B Bedroom	3.00%	2.13%	Risk criteria not met
B08 8.TY.10 2B Bedroom	3.57%	2.07%	Risk criteria not met
B08 8.TY.2 3B Bedroom	3.65%	1.25%	Risk criteria not met
B08 8.TY.10 2B () Living Area	6.18%		Risk criteria not met

Room Name	TM52 Criterion 1	% Hours >26°C (bedrooms only)	Result
B08 8.TY.9 2B Living Area	5.78%		Risk criteria not met
B08 8.TY.8 2B Living Area	6.18%		Risk criteria not met
B08 8.TY.7 2B Living Area	6.08%		Risk criteria not met
B08 8.TY.6 2B Living Area	6.44%		Risk criteria not met
B08 8.TY.11 4B () Living Area	5.78%		Risk criteria not met
B08 8.TY.12 2B Living Area	5.63%		Risk criteria not met
B08 8.TY.4 3B Living Area	4.07%		Risk criteria not met
B08 8.TY.3 1B living Area	4.63%		Risk criteria not met
B08 8.TY.1 3B Living Area	5.83%		Risk criteria not met
B08 8.TY.13 Living Area	5.18%		Risk criteria not met
B08 8.TY.5 1B living Area	5.03%		Risk criteria not met
B08 8.TY.2 3B Living Area	5.53%		Risk criteria not met

Appendix H: Indicative Roof areas suitable for PV.

	Area (square metres)	Area as percentage
Available roof space	4,475	N/A
Green roof allocation	2,164	48%
Brown roof allocation	360	8%
Total allocated	2,524	56%

Figure 19: Site wide PV areas (brown roofs)

Appendix I: BRUKL and SAP Output documents.

Provided in separate attachment.

Appendix J: Discussions with GLA.

The original energy stratgey was discussed in detail with GLA and agreed upon. The Energy Strategy addendum and communications with GLA are summarised in the following reporting.

HOARE LEA

RICHARD HARPER

HOARELEA.COM

155 Aztec West
Almondsbury
Bristol
BS32 4UB
England