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Energy Strategy
November 2023

ABERFELDY VILLAGE MASTERPLAN

Aberfeldy Village Masterplan

Energy Assessment Report

Updated Planning Issue

Issue P8 – 06 November 2023

ABERFELDY VILLAGE MASTERPLAN

ENERGY ASSESSMENT REPORT

UPDATED PLANNING ISSUE

Quality Assurance Page

Issue	Date	Prepared By	Checked By	Approved By	Remarks
P1	21/9/2021	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Draft Issue
P2	14/10/2021	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Planning Issue
P3	25/8/2022	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Planning Issue
P4	21/10/2022	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Planning Issue
P5	21/08/2023	Mr W. Newall	Mr R. Denteh	Mr R. Wilkes	Draft Updated Planning Issue
P6	12/09/2023	Mr W. Newall	Mr R. Denteh	Mr R. Wilkes	Draft Updated Planning Issue
P7	21/09/2023	Mr W. Newall	Mr R. Denteh	Mr R. Wilkes	Updated Planning Issue
P8	06/11/2023	Mr R. Wilkes			Updated Planning Issue

Figure 1: 3D aerial sketch of the illustrative Masterplan

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1 Executive Summary

1.1 Introduction

This Energy Assessment Report has been prepared by Meinhardt (UK) Ltd and is submitted in support of an updated hybrid planning application to the Mayor of London for the Aberfeldy Village Masterplan seeking detailed planning permission for Phase A and Outline planning permission for future phases, comprising:

Outline planning permission (all matters reserved) for the demolition of all existing structures and redevelopment to include a number of buildings (up to 100m AOD) and up to 140,591 (GEA) of floorspace comprising the following mix of uses: Residential (Class C3); Retail, workspace, food and drink uses (Class E); Car and cycle parking; Formation of new pedestrian route through the conversion and repurposing of the Abbott Road vehicular underpass for pedestrians and cyclists connecting to Jolly's Green; Landscaping including open spaces and public realm; and New means of access, associated infrastructure and highway works.

In Full, for residential (Class C3), retail, food and drink uses and a temporary marketing suite (Class E and Sui Generis), together with access, car and cycle parking, associated landscaping and new public realm, and open space. This application is accompanied by an Environmental Statement.

The purpose of this Energy Assessment report is to demonstrate how the climate change mitigation measures proposed for the Aberfeldy Village Masterplan address the relevant local, regional and national planning policies. It also demonstrates that energy is an integral part of the proposed development's design.

This report supersedes the Energy Assessment Report Revision P4 dated 21st October 2022 previously submitted in support of the Hybrid Application (LBTH Ref: PA/21/02377/A1 and GLA Ref: 2023/0300/S3) and should therefore be read on a standalone basis.

Following a resolution to refuse planning permission by the SDC in February 2023, and the subsequent direction that the Mayor of London will act as the local planning authority for the purposes of determining the planning application, further amendments have been made to the design of the scheme to accommodate second staircases in all buildings over 18m in height.

For the sake of completeness only it should be noted that the above referenced amendments follow previous amendments to the Hybrid Application, made prior to its consideration by the LBTH SDC, the assessments of which were set out within previous revisions of this Energy Assessment Report. In summary the previously assessed charges were: the incorporation of Jolly's Green within the red line boundary, the removal of the previously proposed Block A3 and associated increase in open space and play space, an increase in the number of affordable rented family homes, and the inclusion of second staircases in Plots F & I.

Further information is set out within the accompanying Covering Letter (as prepared by DP9 Ltd, dated November 2023) and the updated Planning Statement (as prepared by DP9 Ltd, dated November 2023).

This Energy Assessment Report has been updated to reflect the revised Building Regulations 2021 and GLA planning policy introduced since submission of the application to LBTH. Refer to Section 4.

In response to the revised Building Regulations 2021 and updated planning policy, a number of improvements have been made to the scheme to lower energy usage and carbon dioxide emissions including the following;-

- **Waste water heat recovery included to residential dwellings in the detailed part of the application;**
- **Triple glazing included to retail and office space in the detailed part of the application (Blocks F and H);**
- **Improved air tightness to retail and office space in the detailed part of the application (Blocks F and H);**
- **Reduced thermal bridging;**
- **Higher efficiency residential MVHR unit included;**
- **Lower carbon of heat from the existing heat network achieved (through a higher CHP fraction);**
- **Additional photovoltaic panels included;**
- **Efficiency of all photovoltaic panels increased; and**
- **Efficiency of Block I heat pumps increased.**

Using the latest Part L 2021 methodology, this report demonstrates the following improvements since the previous submission (Revision P4 dated 21st October 2022) to LBTH;-

- **34% lower residential fabric energy demand (efficiency) for the detailed part of the application;**
- **8% lower total annual carbon dioxide emissions for the detailed part of the application; and**
- **47.5% lower total annual carbon dioxide emissions for the outline part of the application.**

1.2 Carbon Reduction Policy and Targets

National Policy

The UK Government has made a commitment to bring all greenhouse gas emissions in the UK to net zero by 2050. Further commitments have been made to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

Building Regulations

An updated Building Regulations Part L Conservation of Fuel and Power and a new Part O Overheating were introduced in June 2022. The updated Part L is expected to deliver a 30% improvement on 2013 standards for domestic buildings.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough's carbon offset fund, or off-site provided that an alternative proposal is identified, and delivery is certain.

Carbon emissions from any other part of the development i.e. unregulated emissions, should be calculated and minimised.

Energy Assessment Guidance (2022)

Updated planning guidance has been published by the GLA (in June 2022) which explains how London Plan policies apply now that Part L 2021 has taken effect.

Residential developments are expected to be able to exceed the 35 per cent minimum improvement over Building Regulations Part L 2021 requirements and should aim to achieve at least a 50 per cent improvement.

1.3 Detailed Part of the Application (Phase A)

1.3.1 Carbon Reduction Strategy

The energy strategy for the detailed part of the application follows the London Plan's updated energy hierarchy approach of 'Be Lean', 'Be Clean', 'Be Green', and 'Be Seen' as detailed in policy SI2.

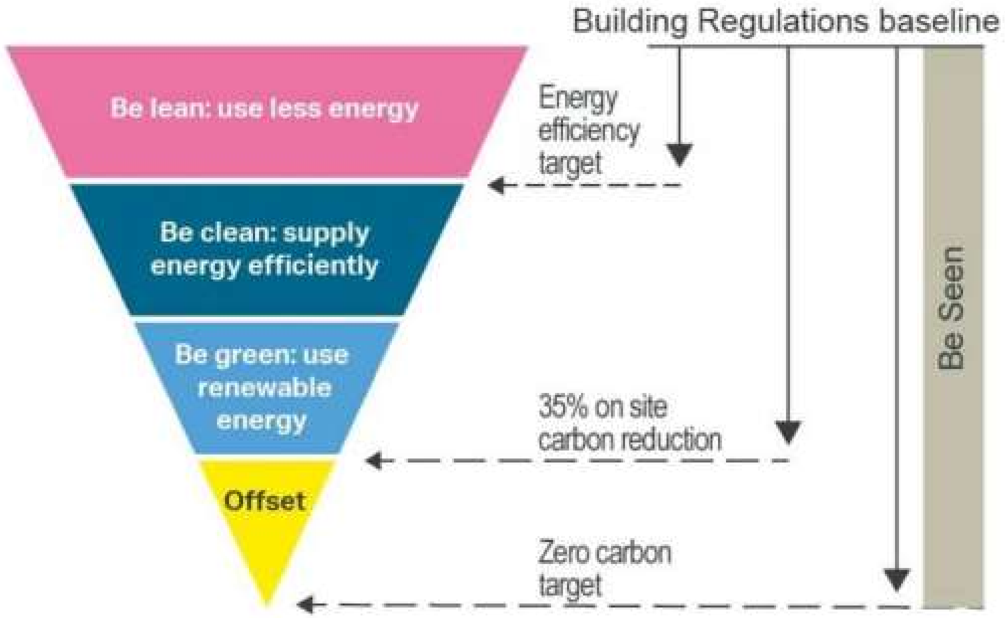


Figure 2: The energy hierarchy and associated targets

The proposed development has been assessed using Elmhurst Design SAP10.2 modelling software and IES dynamic thermal modelling software (SBEM) to demonstrate compliance with Part L 2021.

1.3.2 Carbon Reductions

Domestic Carbon Emissions and Savings (Detailed part of the application)

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential element of the detailed part of the application.

The graph below demonstrates that the residential element of the detailed part of the application achieves an overall on-site reduction of 28% in regulated carbon dioxide emissions over Part L 2021. It is not possible to meet the London Plan target of 35% due to the carbon content of heat delivered to Blocks F & H by the existing heat network.

In accordance with GLA Energy Assessment Guidance 2022 (see Section 1.3.4 below) Blocks F and H must prioritise a connection to the existing heat network which is currently fed from gas fired CHP and boilers. The heat network operator EON has provided a decarbonisation plan to the GLA which will see the carbon content of heat delivered by the existing network lowered considerably over the forthcoming years.

Energy demand in the residential areas has been significantly reduced, exceeding the GLA target of 10%, achieving a reduction of 15% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

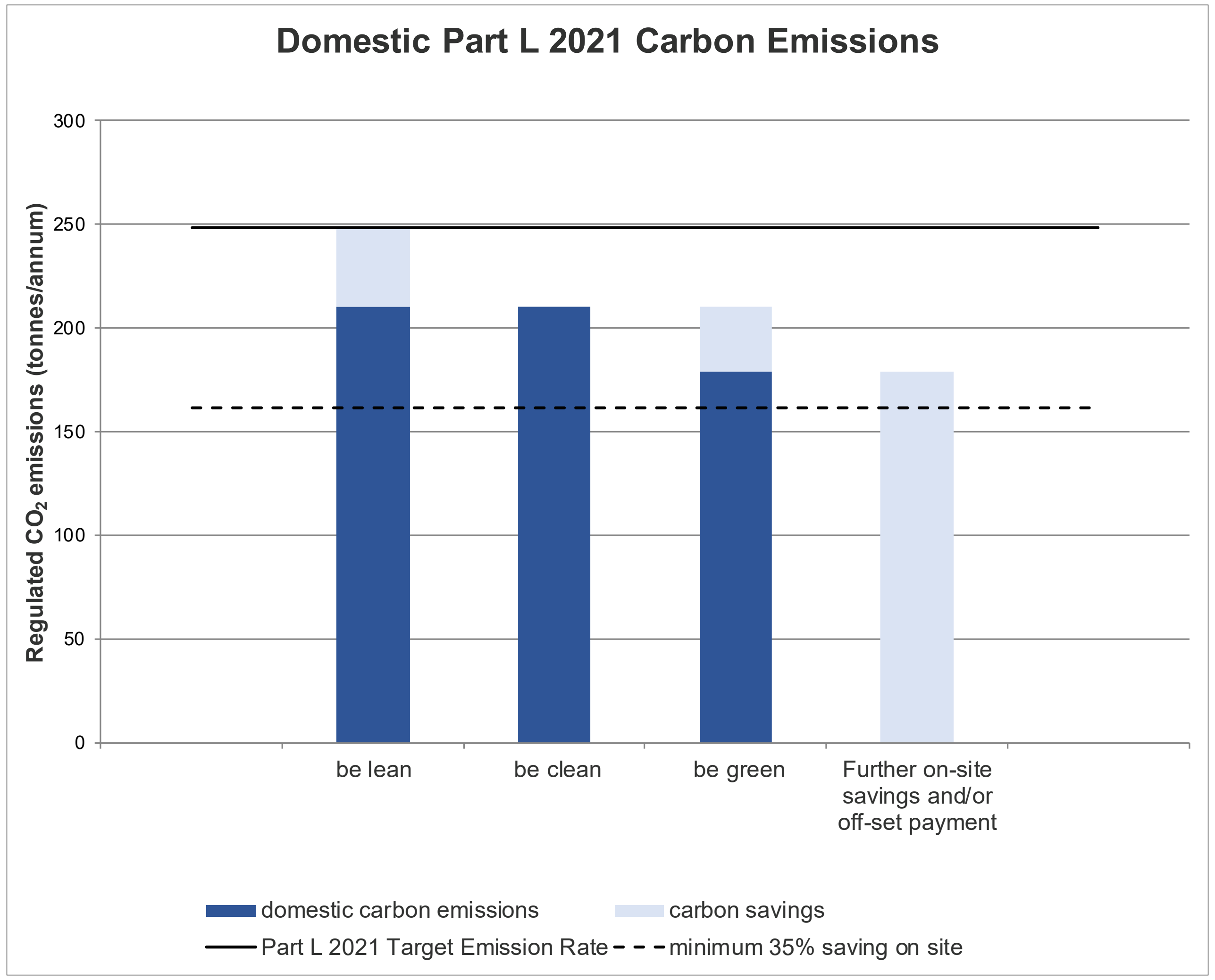


Figure 3: Domestic energy hierarchy and targets for the detailed part of the application

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the domestic elements.

	Regulated carbon dioxide emissions for domestic buildings (Tonnes CO_2 per annum)		
	Block F and H (Existing heat network)	**Blocks I and J (Heat pumps)**	**Total domestic emissions for detailed part of the application**
Baseline: Part L 2021	180.8	67.4	**248.2**
Be Lean	157.1	52.8	**209.8**
Be Clean	157.1	52.8	**209.8**
Be Green	163.5	15.6	**179.1**

Table 1: Carbon dioxide emissions after each stage of the energy hierarchy for domestic elements of the detailed part of the application

	Regulated domestic carbon dioxide savings					
	Block F and H (Existing heat network)		Block I and J (Heat pumps)		Total for detailed part of the application	
	Tonnes CO_2 per	%	Tonnes CO_2 per	%	Tonnes CO_2 per annum	%
Be lean	23.8	13%	14.6	22%	**38.4**	**15%**
Be clean	0	0%	0.0	0%	**0**	**0%**
Be green	-6.4	-4%	37.2	55%	**30.7**	**12%**
Cumulative on site	17.3	10%	51.8	77%	**69.1**	**28%**
Carbon shortfall	163.5		15.6		**179.1**	
					Tonnes CO_2	
Cumulative savings for off-set payment					**5,373**	
Cash-in-lieu contribution					**£510,397**	

Table 2: Regulated carbon dioxide savings from each stage of the energy hierarchy for domestic elements of the detailed part of the application

Non-Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the non-residential element of the detailed part of the application.

The graph below demonstrates that the non-residential element of the detailed part of the application achieves an overall reduction of 30% in regulated carbon dioxide emissions over Part L 2021.

The non-residential elements of the detailed part of the application are primarily located within Blocks F and H, and as with the residential above, it is not possible to meet the London Plan target of 35% due to the carbon content of heat delivered by the existing heat network.

Energy demand in the non-residential areas has been significantly reduced, exceeding the GLA target of 15%, achieving a reduction of 25% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

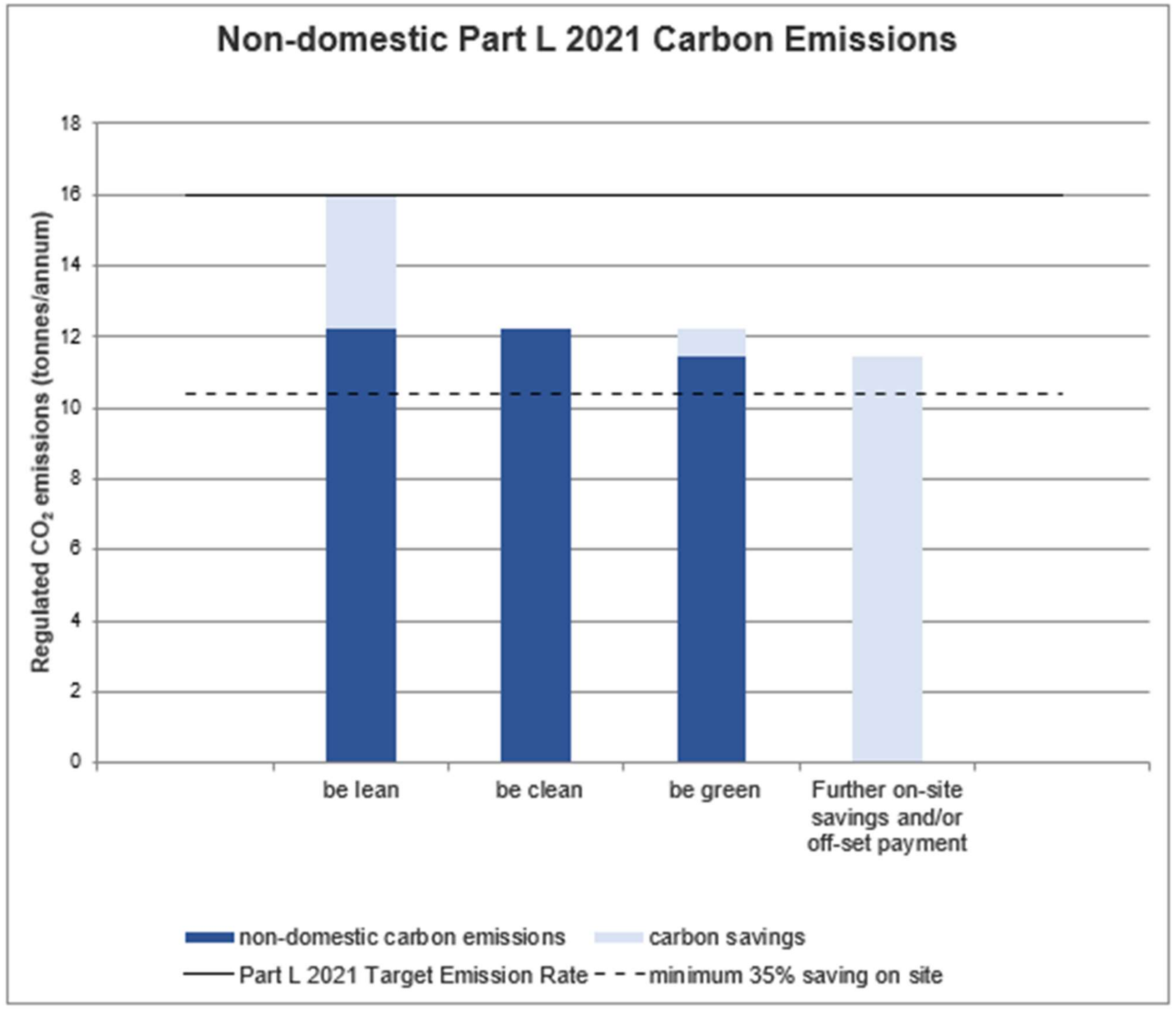


Figure 4: Non-domestic energy hierarchy and targets for the detailed part of the application

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the non-domestic elements.

	Regulated carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)
Baseline: Part L 2021	16.1
Be Lean	12.0
Be Clean	12.0
Be Green	11.2

Table 3: Carbon dioxide emissions after each stage of the energy hierarchy for non-domestic elements of the detailed part of the application

	Regulated non-domestic carbon dioxide savings	
	Tonnes CO_2 per annum	%
Be lean	4.1	25%
Be clean	0.0	0%
Be green	0.8	5%
Cumulative on site savings	4.8	30%
Carbon shortfall	11.2	-
	Tonnes CO_2	
Cumulative savings for off-set payment	**337**	
Cash-in-lieu contribution	**£32,058**	

Table 4: Regulated carbon dioxide savings from each stage of the energy hierarchy for non-domestic elements of the detailed part of the application

Total Carbon Emissions and Savings

The table below details the overall carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the detailed part of the application.

	Total regulated emissions (Tonnes CO_2/year)	CO_2 savings (Tonnes CO_2/year)	Percentage saving (%)
Part L 2021 baseline	264.3		
Be Lean	221.9	42.4	16%
Be Clean	221.9	0.0	0%
Be Green	190.3	31.5	12%
Cumulative on site savings	-	74.0	28%
		CO_2 savings off-set (Tonnes CO_2)	
Off-set		5,710.0	

Table 5: Total regulated carbon dioxide emissions and savings for the detailed part of the application

The table above demonstrates that the detailed part of the application as a whole achieves an on-site reduction of 28% in regulated carbon dioxide emissions over Part L 2021.

The table above demonstrates that the total regulated carbon dioxide emissions (using Part L 2021) for the detailed part of the application (190.3 Tonnes/year) are 8% lower than the 206.6 Tonnes/year calculated for the previous submission to LBTH.

1.3.3 Demand Reduction (Be Lean)

Energy demand will be significantly reduced beyond Part L requirements, achieving an overall 16% reduction over Part L 2021 through passive design and energy efficiency measures alone.

The reduction will be achieved by a combination of measures, which shall include the following. Please refer to Section 6 for further details.

- Significantly improved fabric 'U' values (including the addition of triple glazing to the commercial / retail spaces since the previous submission to LBTH)
- Minimised thermal bridging (further improved since the previous submission to LBTH)
- Improved air tightness (further improved in commercial / retail spaces since the previous submission to LBTH)
- Optimised g-value of the glazing – to provide a balance between minimising heat gain in summer (to reduce overheating), maximising useful heat gain in winter (to reduce heating energy) and maximising natural daylight (to reduce lighting energy)
- Waste water heat recovery (WWHR) for the residential (included since the previous submission to LBTH)
- Communal heating systems
- High efficiency ventilation systems (Residential MVHR efficiency further improved since the previous submission to LBTH)
- Minimised heat loss from hot water systems
- Low energy lighting
- Controls systems to monitor and operate the plant and equipment as efficiently as possible.
- Smart meters.

Fabric Energy Efficiency

The table below details the total Part L Fabric Energy Efficiency Standard (FEES) for the residential elements of the detailed part of the application.

	Part L Fabric Energy Efficiency Standard (FEES)		
	Target Fabric Energy Efficiency (kWh/m²)	Design Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Detailed part of the application	26.21	25.61	2%

Table 6: Part L Fabric Energy Efficiency Standard (FEES) for the residential elements of the detailed part of the application

Energy Use Intensity (EUI) and Space Heating Demand

The table below details the Energy Use Intensity (EUI) and space heating demand for the residential element of the detailed part of the application.

Building type	EUI (kWh/m²/yr)	Space heating demand (kWh/m²/yr)	Methodology used	Explanatory notes
Residential Blocks F and H	79.3	8.9	SAP 10.2	Heat supply from the existing heat network.
Residential Blocks I and J	34.8	14.9	SAP 10.2	Heat supply from heat pumps
Residential Detailed part of the application overall	66.8	10.6	SAP 10.2	Overall EUI is higher than the GLA target as the heat supply to Blocks F & H is from the existing heat network

Table 7: EUI and space heating demand for the residential elements of the detailed part of the application

The table above demonstrates the following;-

- EUI in Blocks F and H residential is above the GLA target of 35 kWh/m²/year as the heat supply is from the existing heat network.
- EUI in Blocks I and J residential is below the GLA target of 35 kWh/m²/year.
- Space heating demand is below the GLA target of 15 kWh/m²/year for all residential areas of the detailed part of the application.

The table below details the Energy Use Intensity (EUI) and space heating demand for the non-residential elements of the detailed part of the application.

Building type	EUI (kWh/m²/yr)	Space heating demand (kWh/m²/yr)	Methodology used	Explanatory notes
Non-residential Blocks F and H	60.5	36.2	CIBSE TM54	Mainly commercial / retail space. Heat supply from the existing heat network.
Non-residential Block I	40	8.2	CIBSE TM54	Residential entrance and amenity space only. Heat supply from heat pumps.
Non-residential Detailed part of the application overall	57.5	32.1	CIBSE TM54	

Table 8: EUI and space heating demand for the non-residential elements of the detailed part of the application

The table above demonstrates the following;-

- EUI in Blocks F and H non-residential is slightly above the GLA target of 55 kWh/m²/year as the heat supply is from the existing heat network.
- EUI in Blocks I and J non-residential is below the GLA target of 55 kWh/m²/year.
- Space heating demand in Blocks F and H non-residential is above the GLA target of 15 kWh/m²/year. A combination of measures have been used to minimise the heating demand, including triple glazing. However, small commercial and retail spaces such as these inherently have a higher form factor (when assessed separately from the rest of the building) and a higher glazing to wall ratio.
- Space heating demand in Blocks I non-residential is below the GLA target of 15 kWh/m²/year.

1.3.4 Heating Infrastructure (Be Clean)

Blocks F, H1/H2, and H3

The energy strategy (AV011) submitted as part of the original masterplan for the Aberfeldy Estate, proposed a site wide heat network served from a new energy centre sized to provide heat to all six phases of the original development.

Phases 1, 2, 3a and 3b of the original masterplan have been completed and are now occupied. The energy centre was constructed in Phase 3a and includes gas fired CHP and boilers with the capacity to serve a further 300 residential units. This has been confirmed by the operator of the network EON.

Blocks F, H1/H2, and H3 of the detailed part of the application comprise 206 residential units, and are located adjacent to Phase 3b within the area designated as phases 4 and 5 of the original masterplan.

A valved and capped connection to the existing site wide heat network has been provided at the north of Phase 3b onto Blair Street to facilitate the connection and extension to Blocks F, H1/H2, and H3 of the detailed part of the application.

GLA Energy Assessment Guidance 2022 confirms that a connection to an existing heat network must be prioritised where the CO2 emission and primary energy factors are within Part L 2021, and where the operator has agreed a decarbonisation strategy with the GLA.

Since the planning submission in October 2021, regular meetings have been held between the applicant, Meinhardt and EON (the heat network operator).

In July 2023, EON provided confirmation of the expected carbon content and primary energy factor of the heat that will be delivered to Blocks F and H using the latest SAP 10.2 carbon emission factors.

The carbon content of the heat delivered by the heat network will be 0.273 kg CO2 per kWh and the primary energy factor 1.356 kWh/kWh based on SAP10.2 carbon emission factors.

As these parameters are below the limits set out in Part L 2021 (0.350 kg CO2 per kWh for carbon content and 1.450 kWh/kWh for primary energy) and as EON have submitted a decarbonisation plan to the GLA, in accordance with GLA Energy Assessment Guidance 2022 it is therefore proposed that Blocks F and H will connect to the existing heat network.

Block I

Block I is a small block of apartments located at the very east of the application site, close to Phase 1 of the original masterplan. A future connection has not been provided to allow connection into the existing site heat network serving the original masterplan.

Due to the significant distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat from a block energy centre comprising air-to-water heat pumps.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

Block J

Block J is a row of individual terraced houses and maisonettes located at the very north of the application site.

Due to the significant distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat to the houses from individual air-to-water heat pumps supplemented by solar thermal, and to the maisonettes from individual MVHR heat pumps.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

1.3.5 Renewable Energy Systems (Be Green)

An assessment of the feasibility of including on-site renewable energy has been carried out, and the results are shown in Section 8.

Blocks F, H1/H2, and H3

It is proposed to install a total of 156 No. photovoltaic panels on the roofs with a total peak output of 59.3 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 5,248 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% and an additional 70 No. photovoltaic panels have been included, thereby increasing the peak output from 29kW to 59.3kW since the previous submission to LBTH.

Block I

As stated above, air-to-water heat pumps are appropriate as the main heat source for Block I. The heat pumps are expected to provide a total saving of approximately 27,148 kg CO2 per year in regulated carbon dioxide emissions.

It is also proposed to install photovoltaic panels with a total peak output of 6.5 kW on the roof (based on 17 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 537 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% thereby increasing the peak output from 5.8kW to 6.5kW since the previous submission to LBTH.

Block J

As stated above, individual air-to-water heat pumps (supplemented by solar thermal) are appropriate as the main heat source for the houses in Block J.

It is proposed to use solar thermal panels in conjunction with the local heat pumps in each house as they can generate high temperature heat suitable for domestic hot water, thereby maximising the efficiency of the heat pumps (which are best operating at lower temperature). A collector of 1.1m² area will be provided on the roof of each house.

Individual MVHR heat pumps are appropriate as the main heat source for the maisonettes in Block J.

The heat pumps and solar thermal panels are expected to provide a total saving of approximately 16,044 kg CO2 per year in regulated carbon dioxide emissions.

It is also proposed to install photovoltaic panels with a total peak output of 16 kW on the roofs (based on 42 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 1,327 kg CO2 per year in regulated carbon dioxide emissions.

1.3.6 Energy Monitoring (Be Seen)

The applicant confirms a commitment to monitor and report its energy performance post-construction in accordance with the ‘Be Seen’ guidance.

An updated ‘planning stage’ submission will be made via the GLA ‘Be Seen’ web-form immediately after the planning submission.

1.3.7 Carbon Offset

The remaining regulated carbon dioxide emissions (to 100%) over 30 years for the detailed part of the application (5,710 Tonnes CO_2) will off-set through a cash in lieu contribution of £542,455 (based on £95/Tonne) to the local planning authority, to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

1.3.8 Unregulated Energy

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking, appliances, equipment) have been estimated using the following;-

- Residential – UK Government Household Electrical Survey (2014).
- Non-residential – CIBSE Guide F.

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

It is expected that the detailed part of the application will provide a 14.5% reduction in unregulated carbon dioxide emissions over the baseline. Refer to Section 9.

1.3.9 Overheating and Cooling

The detailed part of the application has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O, in order to reduce overheating and minimise the use of air conditioning. Refer to Section 10.

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.7.

The assessment includes dynamic thermal modelling of the redevelopment, using IES modelling software, to assess the risk of overheating. The results are summarised below.

1.3.9.1 Residential

The residential assessment includes dynamic thermal modelling on a representative sample of dwellings to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3 weather data.

Building Regulations Part O requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB. The overheating risk categories assessment provided in Annex 14 of the Environment Statement Appendix: Noise and Vibration demonstrates that for most of the detailed part of the application the ambient noise levels are below 40 dB at night (identified as negligible or low risk).

The strategy will therefore generally allow for windows to be open at night in the detailed part of the application .

The overheating risk categories assessment shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) so two overheating assessments have been completed (one with windows open at night, and one with windows closed at night) to demonstrate that the passive design has been maximised.

Natural Ventilation via Openable Windows (All Blocks)

All residential dwellings tested have been modelled with natural ventilation via openable windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised. The results are summarised below;-

- The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.

- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.

The GLA Energy Assessment Guidance 2022 expects that the CIBSE compliance criteria is met for the DSY1 weather scenario. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

The assessment with natural ventilation demonstrates that the risk of overheating has been reduced as far as practical, with all available passive measures explored.

Closed Windows (Block J, Parts of Blocks F and H1/H2)

The overheating risk categories assessment (see Annex 14 of the Environment Statement Appendix: Noise and Vibration) shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) and therefore exceed the limit prescribed in Building Regulations Part O.

Additional modelling has been carried out for the appropriate sampled dwellings in Blocks J, F and H1/H2 with the windows closed at night but with the increased mechanical ventilation in operation. The results are summarised below;-

- The CIBSE compliance criteria cannot be met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds with closed windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria cannot be met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds with closed windows/doors and increased mechanical ventilation.

The MVHR heat pumps proposed for the maisonettes in Block J have the capability to lower the temperature of the supply air when in operation to assist in reducing the impact of high summer temperatures.

In the Block J houses and in the affected apartments in Blocks F and H1/H2, an additional cooling module would be fitted to the MVHR unit to provide the same functionality.

This would provide the occupants with an alternative method of sufficiently reducing the risk of overheating without opening the windows.

This is not considered as active cooling due to the following;-

- It would only ‘temper’ the supply air, reducing the temperature by a few degrees.
- It would have limited cooling capacity due to the size of heat pump / cooling module, and the low air volume of the residential ventilation system.
- It would not ‘control’ space temperature – it would only be used if required by the occupant and would only operate when external temperature exceeds 26 ºC at night and 28ºC during the day to achieve compliance with the CIBSE overheating criteria.
- No additional fan would be required in the apartment.

Mitigation Measures

The proposed overheating mitigation measures are summarised below;-

- In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.
- In Block J and parts of Blocks F and H1/H2 where the occupants may choose to keep their windows closed at night, an alternative method of reducing the risk of overheating will be available through the use of the MVHR heat pump or a MVHR cooling module.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following;-
    - Using portable fans to increase airflow
    - Minimising internal heat gains
    - Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home in line with the cooling hierarchy.

Non-Residential

The non-residential assessment includes dynamic thermal modelling of the non-residential space in the detailed part of the application to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM52 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3 weather data.

The results of the dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria cannot be met in the non-residential space (for the 2020s DSY1, 2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

The proposed overheating mitigation measures are summarised below;-

- For the retail, commercial, marketing suite and other appropriate areas active cooling is proposed.

1.4 Outline Part of the Application (Phases B, C and D)

1.4.1 Carbon Reduction Strategy

The energy strategy for the outline part of the application follows the London Plan’s updated energy hierarchy approach of ‘Be Lean’, ‘Be Clean’, ‘Be Green’, and ‘Be Seen’ as detailed in policy SI2.

The carbon emissions from the residential element of the outline part of the application have been estimated using the SAP calculation results from Block I of the detailed part of the application. These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using a combination of air-to-water and water-to-water heat pumps) and then increased to reflect the maximum number of dwellings and the mix of dwelling types in the proposed outline development.

The carbon emissions from the non-residential element of the outline part of the application have been estimated using the SBEM calculation results from Blocks F and H of the detailed part of the application. These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using heat pumps) and then increased pro-rata to reflect the maximum non-residential area in the proposed outline development.

1.4.2 Carbon Reductions

Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential element of the outline part of the application.

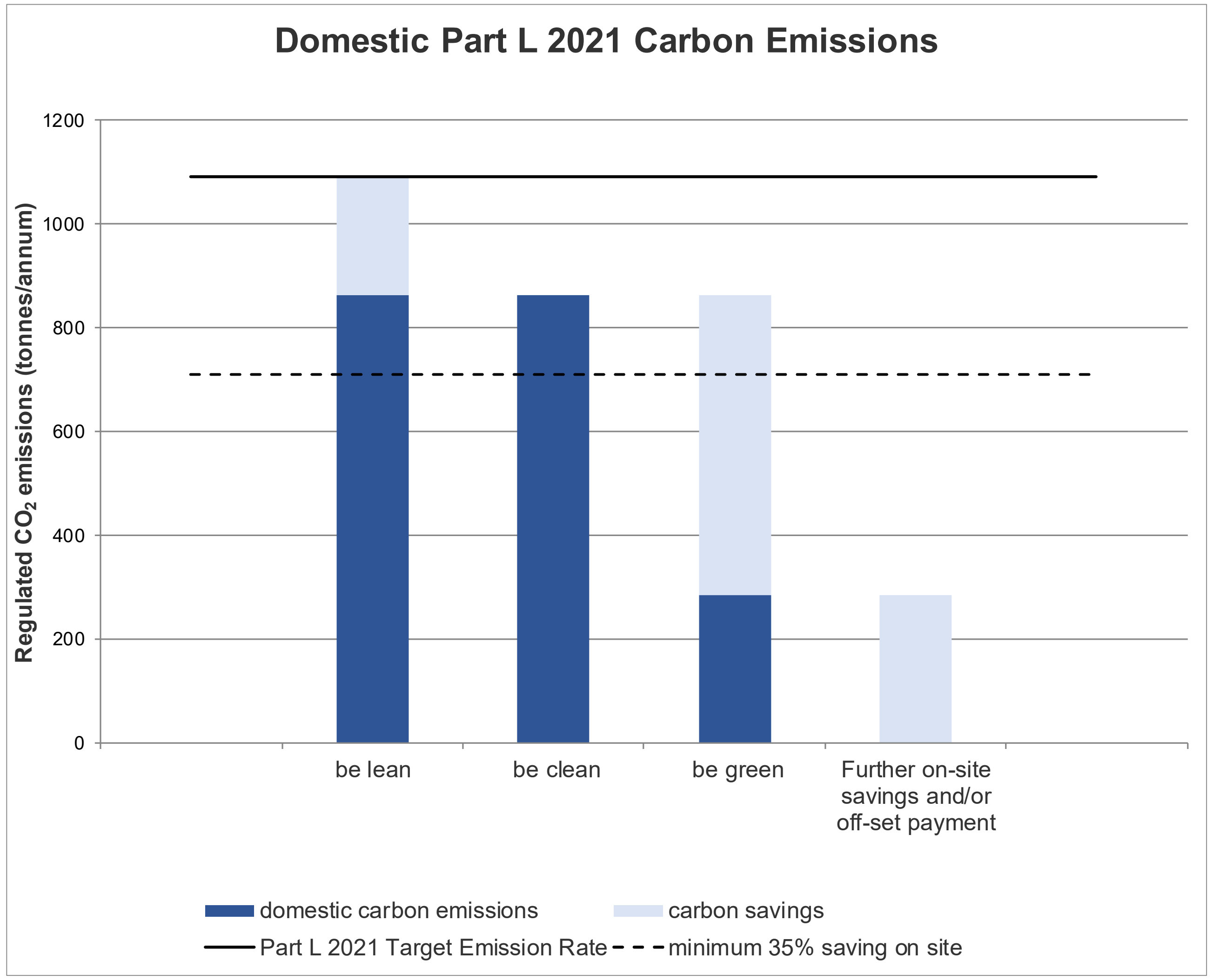


Figure 5: Domestic energy hierarchy and targets for the outline part of the application

The graph above demonstrates that the residential element of the outline part of the application is expected to significantly exceed the London Plan minimum target of 35% and GLA benchmark target of 50%, achieving an overall on-site reduction of around 74% in regulated carbon dioxide emissions over Part L 2021.

Energy demand in the residential areas will be significantly reduced, expected to exceed the GLA target of 10%, achieving a reduction of around 21% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the domestic elements.

	Regulated carbon dioxide emissions for domestic buildings (Tonnes CO₂ per annum)
Baseline: Part L 2021 Compliant	1,103.5
Be Lean	871.2
Be Clean	871.2
Be Green	286.0

Table 9: Carbon dioxide emissions after each stage of the energy hierarchy for domestic elements of the outline part of the application

	Regulated domestic carbon dioxide savings	
	Tonnes CO₂ per annum	%
Be lean	232.3	21%
Be clean	0.0	0%
Be green	585.2	53%
Cumulative on site savings	**817.5**	**74%**
Carbon shortfall	286.0	-
	Tonnes CO₂	
Cumulative savings for off-set payment	**8,581**	
Cash-in-lieu contribution	**815,201**	

Table 10: Regulated carbon dioxide savings from each stage of the energy hierarchy for domestic elements of the outline part of the application

Non-Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the non-residential element of the outline part of the application.

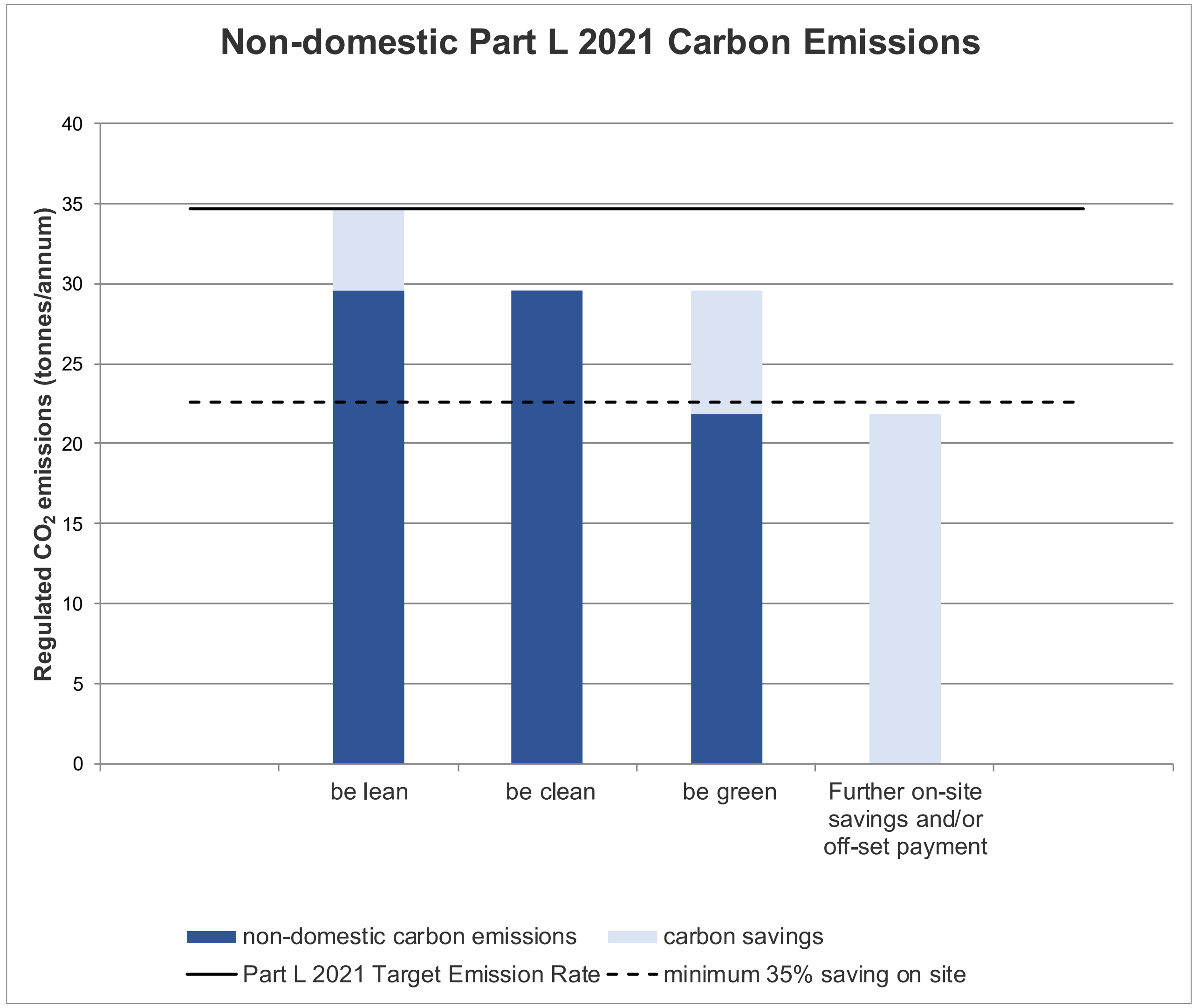


Figure 6: Non-domestic energy hierarchy and targets for the outline part of the application

The graph above demonstrates that the non-residential element of the outline part of the application is expected to exceed the London Plan minimum target of 35%, achieving an overall on-site reduction of around 37% in regulated carbon dioxide emissions over Part L 2021.

Energy demand in the non-residential areas will be significantly reduced, expected to meet the GLA target, achieving a reduction of around 15% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the non-domestic elements.

	Regulated carbon dioxide emissions for non-domestic buildings (Tonnes CO₂ per annum)
Baseline: Part L 2021 Compliant	35.3
Be Lean	30.1
Be Clean	30.1
Be Green	22.2

Table 11: Carbon dioxide emissions after each stage of the energy hierarchy for non-domestic elements of the outline part of the application

	Regulated domestic carbon dioxide savings	
	Tonnes CO₂ per annum	**%**
Be lean	5.1	15%
Be clean	0.0	0%
Be green	8.0	23%
Cumulative on site savings	**13.1**	**37%**
Carbon shortfall	22.2	-
	Tonnes CO₂	
Cumulative savings for off-set payment	**665**	
Cash-in-lieu contribution	**63,150**	

Table 12: Regulated carbon dioxide savings from each stage of the energy hierarchy for non-domestic elements of the outline part of the application

Total Carbon Emissions and Savings

The table below details the overall carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the outline part of the application. These are calculated using SAP 10 carbon emission factors.

The table below demonstrates that the outline part of the application as a whole is expected to achieve an on-site reduction of 73% in regulated carbon dioxide emissions over Part L 2021.

	Total regulated emissions (Tonnes CO₂/year)	**CO₂ savings (Tonnes CO₂/year)**	**Percentage saving (%)**
Part L 2021 baseline	1,138.7		
Be Lean	901.4	237.4	21%
Be Clean	901.4	0.0	0%
Be Green	308.2	593.2	52%

Cumulative	-	830.5	73%
		CO_2 savings off-set (Tonnes CO_2)	
Off-set		9,245.8	

Table 13: Total regulated carbon dioxide emissions and savings for the outline part of the application

The table above demonstrates that the outline part of the application as a whole achieves an on-site reduction of 73% in regulated carbon dioxide emissions over Part L 2021.

The table above demonstrates that the total regulated carbon dioxide emissions (using Part L 2021) for the outline part of the application (308.2 Tonnes/year) are 47.5% lower than the 587.0 Tonnes/year calculated for the previous submission to LBTH.

1.4.3 Demand Reduction (Be Lean)

As detailed above, energy demand will be significantly reduced beyond Part L requirements, achieving a 21% reduction in overall carbon emissions over Part L 2021 for the outline part of the application, through passive design and energy efficiency measures alone.

The reduction is expected to be achieved by a combination of measures, which shall include the following;

- Significantly improved fabric 'U' values (including the addition of triple glazing to the commercial / retail spaces since the previous submission to LBTH);
- Minimised cold bridging (further improved since the previous submission to LBTH);
- Improved air tightness (further improved in commercial / retail spaces since the previous submission to LBTH);
- Optimised g-value of the glazing – to provide a balance between minimising heat gain in summer (to reduce overheating), maximising useful heat gain in winter (to reduce heating energy) and maximising natural daylight (to reduce lighting energy);
- Waste Water Heat Recovery (WWHR) for the residential (included since the previous submission to LBTH);
- Communal heating system to the outline development blocks;
- High efficiency ventilation systems (Residential MVHR efficiency further improved since the previous submission to LBTH);
- Minimised heat loss from heating and hot water systems;
- Low energy lighting;
- Controls systems to monitor and operate the plant and equipment as efficiently as possible; and
- Smart meters.

1.4.4 Heating Infrastructure (Be Clean)

The existing site heat network serving the original masterplan does not have capacity to serve the whole of the new Masterplan. Investigations have confirmed that there are no other district heating networks in the vicinity of this site and none planned for the near future.

It is therefore proposed to provide a new site heat network serving the heat demand of the outline part of the application (Phases B, C and D).

EON have identified potential sources of waste heat from data centres to the south of the outline part of the application, and are currently developing plans for a low temperature network that could potentially serve the outline part of the application in the future, and also be used to de-carbonise the existing heat network serving the original masterplan area.

It is therefore proposed that the site heat network serving the outline part of the application will be a low temperature network compatible with the future network being developed by EON.

As EON's plans are at an early stage, this assessment is based on the primary network for the outline part of the application being fed from central air-to-water heat pumps which will generate low temperature heat at around 20-30ºC for distribution around the development.

When available, waste heat from the EON district network could directly serve the primary network to further de-carbonise the network.

Each block will be provided with its own water-to-water heat pumps and thermal store which is used to raise the temperature to around 55°C for distribution within the block. Heat interface units will be provided per dwelling, providing instantaneous heating and hot water.

An annual heating (and cooling) load profile assessment has been carried out for the development in conjunction with a heat pump manufacturer, with demand calculated hourly using the London TRY weather data, and the results are provided in Appendix A.6. This has been used to confirm the system seasonal efficiency.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

1.4.5 Renewable Energy Systems (Be Green)

As stated above, air-to-water and water-to-water heat pumps are appropriate as the main heat source for the outline part of the application. The heat pumps are expected to provide a total saving of approximately 649,474 kg CO2 per year in regulated carbon dioxide emissions.

It is also proposed that photovoltaic panels will be installed on the roofs of the residential blocks in the outline part of the application.

Although the exact numbers cannot be determined at this stage, it is expected that a minimum of 420 No. photovoltaic panels will be installed on the roofs, based on a pro-rata increase from Block I. The panels will have a total peak output of 159.6 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 13,287 kg CO2 per year in regulated carbon dioxide emissions.

In accordance with GLA Energy Assessment Guidance 2022, PV provision will be maximised when the design for the Reserved Matters application(s) is developed.

1.4.6 Energy Monitoring (Be Seen)

The applicant confirms a commitment to monitor and report its energy performance post-construction in accordance with the 'Be Seen' guidance.

1.4.7 Carbon Offset

The remaining regulated carbon dioxide emissions (to 100%) over 30 years for the outline part of the application (around 9,245.8 Tonnes CO_2) will off-set through a cash in lieu contribution of approximately £878,350 (based on £95/Tonne) to the local planning authority, to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

1.4.8 Overheating and Cooling

An initial early stage assessment has been carried out for the outline part of the application in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan and the latest Energy Assessment Guidance, in order to reduce overheating and minimise the use of air conditioning.

Residential

Although dynamic thermal modelling is not a requirement for the outline part of the application, as part of the early stage design modelling has been carried out on a sample of apartments to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3.

This modelling has been completed for a sample of west facing apartments at differing levels between the 2nd and 20th floor with both recessed and projecting balconies.

The results of this early stage dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria are met in almost all rooms modelled (for the 2020s DSY1 weather scenario) for both recessed and projecting balconies, without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.

The results demonstrate that the outline design provides a suitable reduction in the risk of overheating at this stage of design.

As the design is developed for the later Reserved Matters application(s), further work will be done to explore all available passive measures with the aim of reducing the risk further.

Non-Residential

The design of the outline part of the application is not sufficiently progressed to allow dynamic thermal modelling for the non-residential areas.

As the design is developed for the later Reserved Matters application(s), an assessment will be carried out to reduce overheating and minimise the use of air conditioning in the non-residential areas.

2 Introduction

2.1 This Application

This Energy Assessment Report has been prepared by Meinhardt (UK) Ltd and is submitted in support of an updated hybrid planning application to the Mayor of London for the Aberfeldy Village Masterplan seeking detailed planning permission for Phase A and Outline planning permission for future phases, comprising:

Outline planning permission (all matters reserved) for the demolition of all existing structures and redevelopment to include a number of buildings (up to 100m AOD) and up to 140,591 (GEA) of floorspace comprising the following mix of uses: Residential (Class C3); Retail, workspace, food and drink uses (Class E); Car and cycle parking; Formation of new pedestrian route through the conversion and repurposing of the Abbott Road vehicular underpass for pedestrians and cyclists connecting to Jolly's Green; Landscaping including open spaces and public realm; and New means of access, associated infrastructure and highway works.

In Full, for residential (Class C3), retail, food and drink uses and a temporary marketing suite (Class E and Sui Generis), together with access, car and cycle parking, associated landscaping and new public realm, and open space. This application is accompanied by an Environmental Statement.

2.2 Extant Outline Planning Permission

An Outline Permission (ref: PA/11/02716/P0) was granted in June 2012 and the following has been delivered to date:

- Phases 1, 2, 3a and 3b built out
- 901 new homes
- 29% affordable homes by habitable room or 9.18% affordable homes by habitable room on the uplift
- New larger Community Centre with improved facilities
- Larger modern Health Centre
- New retail floorspace
- New energy centre
- New and enhanced high quality open space including play-space and a linear park
- Heights: 2 to 10 storeys
- Parking ratio: 0.2 spaces

2.3 This Energy Assessment

The purpose of this Energy Assessment report is to demonstrate how the climate change mitigation measures proposed for the Aberfeldy Village Masterplan address the relevant local, regional and national planning policies. It also demonstrates that energy is an integral part of the proposed development's design.

This report supersedes the Energy Assessment Report Revision P4 dated 21st October 2022 previously submitted in support of the Hybrid Application (LBTH Ref: PA/21/02377/A1 and GLA Ref: 2023/0300/S3) and should therefore be read on a standalone basis.

Following a resolution to refuse planning permission by the SDC in February 2023, and the subsequent direction that the Mayor of London will act as the local planning authority for the purposes of determining the planning application, further amendments have been made to the design of the scheme to accommodate second staircases in all buildings over 18m in height.

For the sake of completeness only it should be noted that the above referenced amendments follow previous amendments to the Hybrid Application, made prior to its consideration by the LBTH SDC, the assessments of which were set out within previous revisions of this Energy Assessment Report. In summary the previously assessed charges were: the incorporation of Jolly's Green within the red line boundary, the removal of the previously proposed Block A3 and associated increase in open space and play space, an increase in the number of affordable rented family homes, and the inclusion of second staircases in Plots F & I.

Further information is set out within the accompanying Covering Letter (as prepared by DP9 Ltd, dated November 2023) and the updated Planning Statement (as prepared by DP9 Ltd, dated November 2023).

This Energy Assessment Report has been updated to reflect the revised Building Regulations 2021 and GLA planning policy introduced since submission of the application to LBTH. Refer to Section 4.

In response to the revised Building Regulations 2021 and updated planning policy, a number of improvements have been made to the scheme to lower energy usage and carbon dioxide emissions.

2.4 Other Documents

This report should be read in conjunction with the other documents which form part of the hybrid planning application.

2.5 Project Team

Client:	EcoWorld and Poplar HARCA
Planning Consultant:	DP9
Masterplan Architect:	Levitt Bernstein
Phase A Architect:	Morris and Company
Structural, Civils, MEP, and Energy:	Meinhardt (UK) Ltd
Access Consultant:	Lord Consultants
Air Quality and Acoustics Consultant:	Entran
Arboriculture Consultant:	Arbeco
Archaeology Consultant:	Thames Valley Archaeology Services
Communications and PR:	Lowick
Cost Consultant:	Circle
Cycling Consultant:	Cycling Score
Daylight and Sunlight Consultant:	GIA
Ecology and Sustainability Consultant:	Greengage
Education Consultant:	Quod
EIA Consultant:	Trium
Fire Consultant:	Elementa
Flood Risk Consultant:	Parmabrook
Heritage Consultant:	KM Heritage
Landscape Architect:	LDA Design
Legal:	Pinsent Masons
Play and Recreation:	ZCD Architects
Principal Designer:	Baily Garner
Retail and Commercial Consultant:	AND

Rights of Light Consultant:	Anstey Horne
Socio-Economic Consultant:	Hatch
Townscape Consultant:	Peter Stewart Consultancy
Transport Consultant:	Velocity
Viability Consultant:	DS2
Visual Impact Assessment:	Miller Hare
Visualisation:	Black Point Design
Wind Consultant:	RWDI

3 Scheme Overview

3.1 Site and Surroundings

The Site is located in Poplar, within the administrative boundary of the London Borough of Tower Hamlets. The Site is 9.08 hectares in total and comprises:

- Abbott Road;
- Aberfeldy Street;
- Balmore Close;
- Blairegowrie House;
- Heather House;
- Jura House;
- Tartan House;
- Thistle House;
- Kilbrennan House;
- Blairgowrie House;
- Nos. 33-35 Findhorn Street;
- 2a Ettrick Street;
- Lochnager Street;
- Aberfeldy Neighbourhood Centre;
- Nairn Street Estate; and
- Leven Road Open Space, Jolly's Green and Braithwaite Park.

Figure 7: Aerial view of the existing site

3.2 Proposed Development

An outline planning approval was granted for the Aberfeldy Estate masterplan in 2012. Phases 1, 2, 3a and 3b of the original masterplan have been completed on site and are now occupied.

The New Aberfeldy Masterplan includes the residual phases of the original masterplan (phase 4-6), the Nairn Street Estate to the north, Abbott Road, the properties and land around Balmore Close and the existing green space along Abbott Road: Millennium Green, Jolly's Green, Braithwaite Park and the Leven Road green amenity space.

The proposed scheme will include the phased demolition of all existing buildings and structures, site preparation works and the construction of a new mixed use redevelopment, including the following;-

- Residential
- Retail
- Workspace/ employment space
- Resident facilities
- Temporary marketing suite

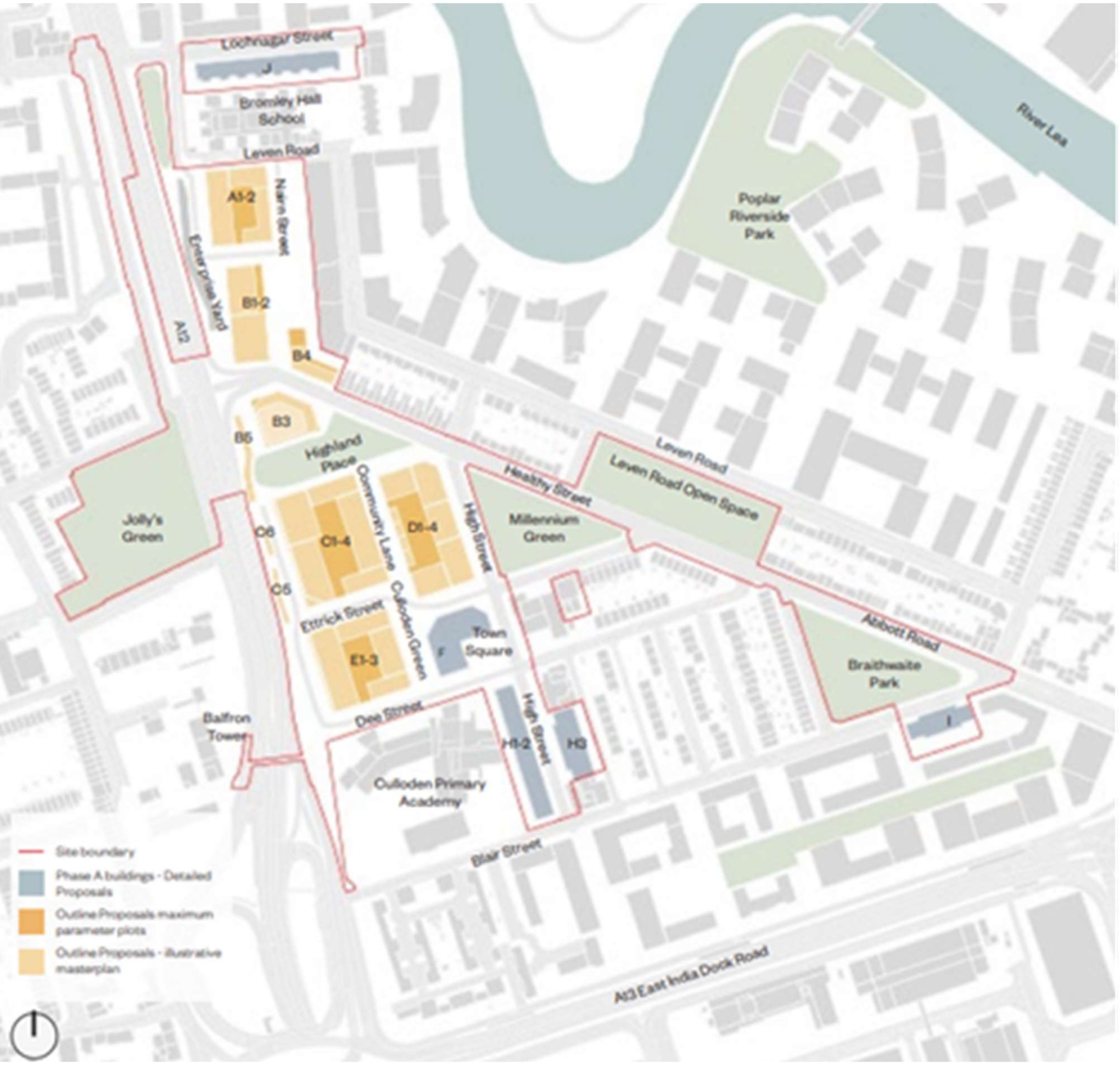


Figure 8: Plan view of the illustrative Aberfeldy Village Masterplan

The detailed part of the application comprises Phase A of the proposed development located in the areas shown in grey below, and includes Blocks F, H1/H2, H3, I and J.

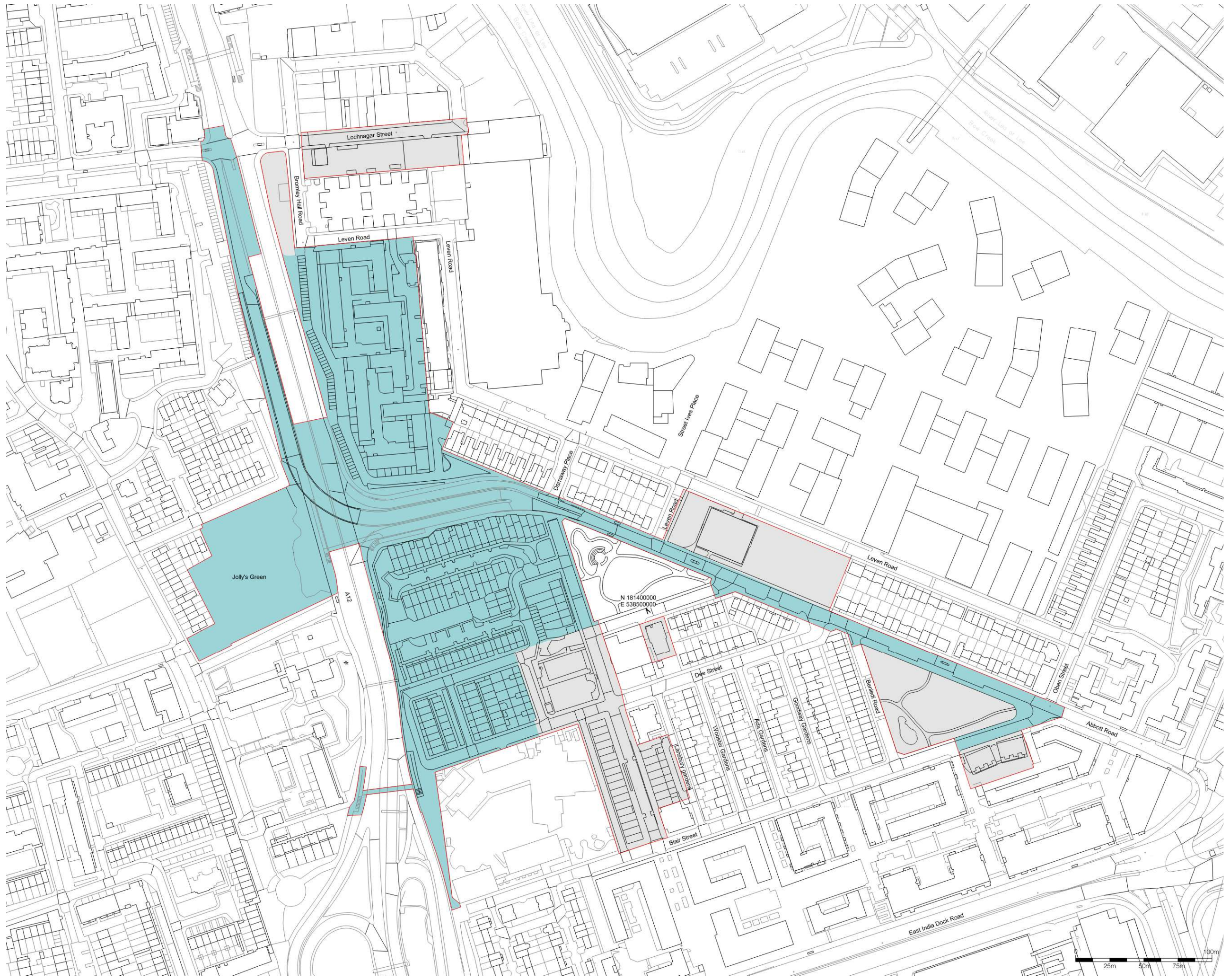


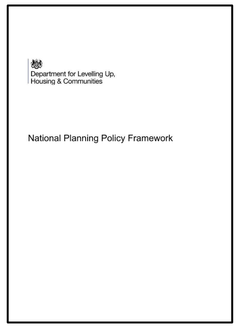
Figure 9: Detailed part of the application Phase A location plan

The remainder of the Aberfeldy Village Masterplan forms the outline part of the application and is expected to be constructed in a further three phases (B, C and D) as shown on Figure 8 above.

4 Planning Policy

4.1 National

4.1.1 National Planning Policy Framework (2023)



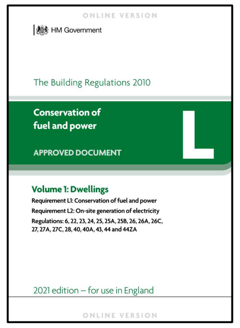
Department for Levelling Up, Housing & Communities

National Planning Policy Framework

The National Planning Policy Framework (NPPF) set out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

The current version was issued in September 2023.

4.1.2 Building Regulations



ONLINE VERSION

HM Government

The Building Regulations 2010

Conservation of fuel and power

APPROVED DOCUMENT

L

Volume 1: Dwellings

Requirement L1: Conservation of fuel and power

Requirement L2: On-site generation of electricity

Regulations: 6, 22, 23, 24, 25, 25A, 25B, 26, 26A, 26C, 27, 27A, 27C, 28, 40, 40A, 43, 44 and 44ZA

2021 edition – for use in England

ONLINE VERSION

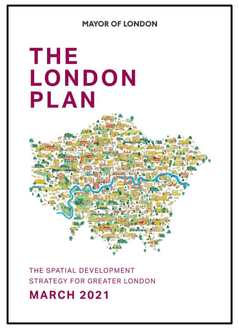
The Building Regulations set out the statutory standards that developments are to meet. These standards cover measures including energy efficiency, water efficiency, sound resistance and ventilation.

Part L of the Building Regulations covers energy efficiency requirements.

The current version of Part L was issued in 2021 (with minor amendments in 2023).

4.2 Regional

4.2.1 The London Plan (2021)



MAYOR OF LONDON

THE LONDON PLAN

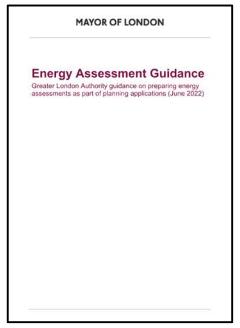
THE SPATIAL DEVELOPMENT STRATEGY FOR GREATER LONDON

MARCH 2021

The London Plan 2021 is the Spatial Development Strategy for Greater London. It sets out a framework for how London will develop over the next 20-25 years and the Mayor's vision for Good Growth.

The Plan is part of the statutory development plan for London, meaning that the policies in the Plan should inform decisions on planning applications across the capital. Borough's Local Plans must be in 'general conformity' with the London Plan, ensuring that the planning system for London operates in a joined-up way and reflects the overall strategy for how London can develop sustainably.

4.2.2 Energy Assessment Guidance (2022)



MAYOR OF LONDON

Energy Assessment Guidance

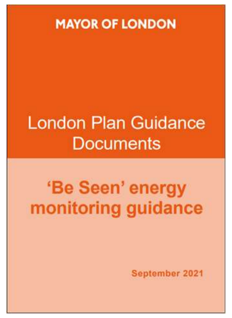
Greater London Authority guidance on preparing energy assessments as part of planning applications (June 2022)

This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor.

The purpose of an energy assessment is to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy.

An updated version was published in June 2022 which explains how London Plan policies apply now that Part L 2021 has taken effect.

4.2.3 'Be Seen' Energy Monitoring Guidance (2021)



MAYOR OF LONDON

London Plan Guidance Documents

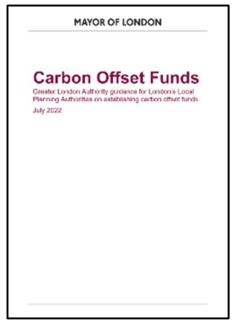
'Be Seen' energy monitoring guidance

September 2021

This guidance explains the process that needs to be followed to comply with the 'Be Seen' post-construction monitoring requirement of Policy SI 2 of the new London Plan.

The collected data will help the GLA and local authorities better understand how London Plan policies are being applied to new developments, it will provide useful insights to the performance gap and will drive improved building performance.

4.2.4 Carbon Offset Funds (2022)



MAYOR OF LONDON

Carbon Offset Funds

Greater London Authority guidance for London's Local Planning Authorities on establishing carbon offset funds

July 2022

This guidance document provides further detail for London's LPAs on setting up carbon offset funds and identifying suitable projects to best utilise that funding. It aims to encourage a consistent approach across London but one that allows for flexibility according to an LPA's local context and priorities

5 Establishing Energy Demand and Emissions

5.1 Carbon Reduction Targets

5.1.1 National Policy

The UK Government has made a commitment to bring all greenhouse gas emissions in the UK to net zero by 2050. Further commitments have been made to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

5.1.2 Building Regulations

An updated Building Regulations Part L Conservation of Fuel and Power and a new Part O Overheating were introduced in June 2022. The updated Part L is expected to deliver a 30% improvement on 2013 standards for domestic buildings.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

5.1.3 London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough’s carbon offset fund, or off-site provided that an alternative proposal is identified and delivery is certain.

Carbon emissions from any other part of the development i.e. unregulated emissions, should be calculated and minimised.

5.1.4 Energy Assessment Guidance (2022)

Updated planning guidance has been published by the GLA (in June 2022) which explains how London Plan policies apply now that Part L 2021 has taken effect.

Residential developments are expected to be able to exceed the 35 per cent minimum improvement over Building Regulations Part L 2021 requirements and should aim to achieve at least a 50 per cent improvement.

5.2 Detailed Part of the Application

5.2.1 Residential

5.2.1.1 Methodology

Building Regulations Part L1 2021 SAP calculations have been undertaken, using Elmhurst Design SAP10.2 software for a sample of residential dwellings in each block.

The calculations include apartments at the lowest level, intermediate and top floors.

The results of the residential SAP calculations (Compliance and TER/DER worksheets) are provided in Appendix A.1 for the ‘Be Lean’ stage of the hierarchy and in Appendix A.2 and for the ‘Be Green’ stage.

5.2.1.2 Baseline Emissions

In accordance with GLA Energy Assessment Guidance 2022, to determine the CO_2 emissions baseline the Target Emission Rate (TER) has been used from the final proposed building specification ie the ‘Be Green’ stage of the hierarchy.

The SAP 10.2 TER includes an area of photovoltaic panels in accordance with the dwelling floor area and the number of storeys in the block (for flats).

The GLA Carbon Emissions Reporting spreadsheet also includes the carbon savings generated by the notional PV panels for the actual building, at both the ‘Be Lean’ and ‘Be Clean’ stages of the hierarchy (but not at the ‘Be Green’ stage) to ensure that passive design and energy efficiency savings are suitably demonstrated.

Blocks F and H

As the final proposed building specification includes a connection to an existing heat network, SAP 10.2 calculates the TER using a heat network with the same carbon emission and primary energy factors as used in calculating the DER for the actual building.

Blocks I and J

As the final proposed building specification includes heat pumps, SAP 10.2 calculates the TER using a gas fired boiler with an efficiency of 89.5% for space heating and hot water.

5.2.2 Commercial

5.2.2.1 Methodology

Building Regulations Part L2 2021 modelling has been undertaken for the commercial area using IES dynamic thermal modelling software (SBEM) in line with the relevant National Calculation Methodology (NCM) guidance.

The BRUKL output sheets are provided in Appendix A.3 for the ‘Be Lean’ stage of the hierarchy and in Appendix A.4 and for the ‘Be Green’ stage.

5.2.2.2 Baseline Emissions

In accordance with GLA Energy Assessment Guidance 2022, to determine the CO_2 emissions baseline the Target Emission Rate (TER) has been used from the final proposed building specification ie the ‘Be Green’ stage of the hierarchy.

The SBEM TER normally includes an area of photovoltaic panels in accordance with the building area and arrangement, but for this development it is proposed to supply 100% of the space heating and hot water demand from heat pumps so the area of PV in the TER is reduced to zero.

The GLA Carbon Emissions Reporting spreadsheet also includes the carbon savings generated by the notional PV panels for the actual building, at both the ‘Be Lean’ and ‘Be Clean’ stages of the hierarchy (but not at the ‘Be Green’ stage)

Blocks F and H

As the final proposed building specification includes a connection to an existing heat network, SBEM calculates the TER using a heat network with the same carbon emission and primary energy factors as used in calculating the BER for the actual building.

Blocks I

As the final proposed building specification includes heat pumps, SBEM calculates the TER using a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water.

5.3 Outline Part of the Application

5.3.1 Residential

The carbon emissions from the residential element of the outline part of the application have been estimated using the SAP calculation results from Block I of the detailed part of the application.

These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using a combination of air-to-water and water-to-water heat pumps) and then increased to reflect the maximum number of dwellings and the mix of dwelling types in the proposed outline development.

5.3.2 Non-Residential

The carbon emissions from the non-residential element of the outline part of the application have been estimated using the SBEM calculation results from Blocks F and H of the detailed part of the application.

These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using heat pumps) and then increased pro-rata to reflect the maximum non-residential area in the proposed outline development.

6 Demand Reduction (Be Lean)

6.1 Detailed Part of the Application

Energy demand will be significantly reduced beyond Part L requirements, achieving a 16% reduction in overall carbon emissions over Part L 2021 for the detailed part of the application, through passive design and energy efficiency measures alone.

The demand reduction will be achieved by a combination of the measures including those detailed below;-

6.1.1 Building Fabric Insulation

The thermal performance of the building fabric will be significantly improved over Part L 2021 minimum requirements as below;-

Fabric Element	Blocks F, H and I Residential ‘U’ Values (W/m^2 K)	Block J Residential ‘U’ Values (W/m^2 K)	Non-Residential ‘U’ Values (W/m^2 K)
External Walls	0.14	0.13	0.14
Floor	0.10	0.08	0.10
Roof	0.10	0.10	0.10
Windows	1.3	0.80	0.8 (Block F and H retail and Office areas), 1.40

Table 14: Proposed fabric ‘U’ values for the detailed part of the application

The window U value has been further improved in the commercial / retail space, from 1.4 W/m² K used in the previous submission to LBTH, through the incorporation of triple glazing.

6.1.2 Cold Bridging

Thermal bridging will be minimised to reduce the loss of heat and to prevent the development of cold spots which can lead to mould.

At this early stage of design, detailed construction joint drawings are not available, so each junction type has been assessed and a target improved psi-value has been set as detailed below.

These targets have been benchmarked against calculations from other similar junctions and reputable sources such as the LABC, to ensure they are deliverable.

At the appropriate stages of design and construction, the thermal bridges will be demonstrated to the Building Control Body in accordance with the requirements of Building Regulations Part L 2021.

Residential

The target improved psi-values have been set using the reference values detailed in Table R2 of the SAP 10.2 Procedure, except for window junctions (E2, E3 and E4) which have used an improved psi value of 0.03. The y-value is calculated individually for each dwelling in the SAP software using the measured junction lengths.

Commercial

IES VE software calculates thermal bridge heat losses for the actual building using default y-values that are 25% of the construction element ‘U’ values, in accordance with the NCM Modelling Guide.

The target improved y-values have been set at 10% of the construction element ‘U’ values, in accordance with the notional building in the NCM Modelling Guide.

6.1.3 Air Tightness

The target air permeability has been set at 2.5 $m^3/(h\ m^2)$ in non-residential areas and 3 $m^3/(h\ m^2)$ in the residential dwellings, as compared to the Part L minimum requirement of 8 $m^3/(h\ m^2)$ to reduce heat loss in winter.

The air permeability has been further improved in the commercial / retail space from 3 $m^3/(h\ m^2)$ used in the previous submission to LBTH.

6.1.4 Natural Daylight

Natural daylight has been maximised wherever possible in the residential accommodation by arranging the living rooms and bedrooms as shallow spaces on the perimeter, by providing dual aspect glazing where possible, and by ensuring ceiling voids are as small as possible (particularly at the perimeter) to maintain the maximum floor to ceiling heights.

Increased floor to ceiling heights with full height glazing are generally provided to the ground floor commercial units and residential entrances.

6.1.5 Solar Gain

The size and g-value of the glazing has been optimised using the SAP calculations, SBEM calculations and the dynamic thermal modelling for the overheating assessment, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy.

This has resulted in the g-value of the glazing being set as detailed below;-.

Space type	Glazing g-value
Blocks F, H and I	0.33
Block J	0.50
Non-residential	0.33

Table 15: Glazing g-values for the detailed part of the application

6.1.6 Shading

Balconies are provided to most of the proposed development which will provide a shading effect to the residential apartments to minimise peak solar gain.

6.1.7 Waste Water Heat Recovery (WWHR)

WWHR will be included for the showers in the residential dwellings, based on a utilisation factor of 0.902. This has been included since the previous submission to LBTH.

6.1.8 Heating Systems

In Section 7.9 entitled “Heating and hot water assumptions” the GLA Energy Assessment Guidance 2022 states “*For the purposes of demonstrating CO2 emission improvements in the ‘be lean’ stage of the energy hierarchy, applicants should use the notional building system type and performance values specified in the Part L 2021 baseline as determined by the final proposed building specification*”.

Blocks F and H – Residential and Non-Residential

In SAP 10.2 and SBEM where a connection to an existing heat network is proposed as the final specification, the notional building uses a heat network with the same carbon emission and primary energy factors as used in calculating the DER/BER for the actual building.

In July 2023, EON confirmed that the carbon content of the heat delivered by the heat network will be 0.273 kg CO2 per kWh and the primary energy factor 1.356 kWh/kWh based on SAP10.2 carbon emission factors, so this has also been used for the actual building in the Block F and H non-residential SBEM calculations at 'Be Lean' stage.

The residential SAP calculations for Blocks F and H use the following input parameters at 'Be Lean' stage to reflect the confirmed carbon content of the heat network;-

Input parameter	Value
CHP heat efficiency	49.9%
CHP electrical efficiency	32.0%
CHP fraction	55.8%
Boiler efficiency	93.9%
Boiler fraction	44.2%
Distribution loss factor	1.25

Table 16: SAP heating system input parameters for Blocks F and H

Blocks I and J – Residential

In SAP 10.2 where heat pumps are proposed as the final specification, the notional building uses a gas fired boiler with an efficiency of 89.5% for space heating and hot water, so this has also been assumed for the actual building at 'Be Lean' stage for Blocks I and J residential dwellings.

Block I – Non-Residential

In SBEM where heat pumps are proposed as the final specification, the notional building uses a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water, so this has also been assumed for the actual building at 'Be Lean' stage for Block I non-residential areas.

6.1.9 Pipework Heat Losses

The site heating systems will be designed to minimise heat losses in accordance with the recommendations of CIBSE CP1, including measures such as minimising pipework lengths and installing high level of insulation (in excess of British Standards).

6.1.10 Cooling

Residential

Active mechanical cooling is not proposed for the residential dwellings.

The use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.

In Block J, where the occupants may choose to keep their windows closed at night, an alternative method of reducing the risk of overheating will be available through the use of the MVHR heat pump or a MVHR cooling module.

Non-Residential

For the retail units, marketing suite, and other appropriate areas active cooling is proposed via cooling only split or multi-split heat pump systems which will achieve a seasonal efficiency of 3.92.

6.1.11 Ventilation Systems

Residential

Ventilation to the residential apartments to provide fresh air and extract moisture/pollutants in accordance with Building Regulations Part F will be via individual Mechanical Ventilation with Heat Recovery (MHVR) units. Each unit will achieve a Specific Fan Power of up to 0.47 W/(l/s) and a heat recovery efficiency of up to 91%, depending on the number of wet rooms.

This has been further improved from 0.52 W/(l/s) and 90% efficiency used in the previous submission to LBTH, through the selection of an alternative newer model.

The communal corridors shall have a dual purpose mechanical extract system that can operate to assist the natural ventilation when necessary in maintaining air movement in corridors and prevent stagnant air and odour build up in winter.

Non-Residential

It is expected that the retail units, marketing suite, and other appropriate areas will be provided with local commercial MVHR units that will achieve a Specific Fan Power of less than 1.1 W/(l/s) and a heat recovery efficiency of at least 85%.

6.1.12 Lighting

Energy efficient LED lighting will be used throughout the proposed development. Occupancy and daylight sensors will be used where appropriate.

6.1.13 Smart Controls / Metering

It is expected that residential apartments will be provided with an individual, programmable, zoned, control system, together with smart energy meters.

This will allow the display of energy use within individual units, assisting occupants to understand the way in which they consume energy and how much it costs, and encouraging them to turn off non-essential equipment or run some equipment at a lower capacity during times of peak demand.

A central Building Management System (BMS) will be provided to operate the 'Landlord' plant and systems in the most energy efficient manner.

6.1.14 Appliances

Where appliances are provided by the developer they will be of an energy efficient type, which generally generate less heat and can help minimise the build-up of heat within the buildings. Where appliances are not provided by the developer, owners/tenants will be encouraged to supply energy efficient equipment.

6.2 Outline Part of the Application

Detailed energy assessments will be carried out as part of the Reserved Matters application(s) to determine the most appropriate demand reduction measures.

The below sections outline the measures incorporated in the outline part of the application, which should form the minimum standards expected to be achieved for all areas within the masterplan.

6.2.1 Building Fabric Insulation

The thermal performance of the building fabric should achieve at least the following;-

Fabric Element	Residential 'U' Values (W/m² K)	Non-Residential 'U' Values (W/m² K)
External Walls	0.14	0.14
Floor	0.10	0.10
Roof	0.10	0.10
Windows	1.30	0.8 in retail and office areas, 1.40 elsewhere

Table 17: Proposed maximum fabric 'U' values for the outline part of the application

The window U value has been further improved in the commercial / retail space, from 1.4 W/m² K used in the previous submission to LBTH, through the incorporation of triple glazing.

6.2.2 Cold Bridging

Cold bridging should be minimised to prevent the loss of heat and to prevent the development of cold spots, which can lead to mould. Suitable construction details should be developed to ensure insulation continuity and to meet the air tightness targets detailed below.

6.2.3 Air Tightness

The target air permeability should be set at a maximum of 2.5 $m^3/(h\ m^2)$ in non-residential areas and 3 $m^3/(h\ m^2)$ in the residential dwellings.

The air permeability has been further improved in the commercial / retail space from 3 $m^3/(h\ m^2)$ used in the previous submission to LBTH.

6.2.4 Daylight and Solar Gain

The size and g-value of the glazing should be optimised using SAP calculations, SBEM calculations and dynamic overheating modelling, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy.

6.2.5 Shading

External shading should be considered as appropriate to reduce peak solar gain.

6.2.6 Waste Water Heat Recovery (WWHR)

WWHR should be included for the showers in the residential dwellings, with a minimum utilisation factor of 0.902. This has been included since the previous submission to LBTH.

6.2.7 Heating and Hot Water System

Residential

In SAP 10.2 where heat pumps are proposed as the final specification, the notional building uses a gas fired boiler with an efficiency of 89.5% for space heating and hot water, so this should also be assumed for the actual building at 'Be Lean' stage.

Non-Residential

In SBEM where heat pumps are proposed as the final specification, the notional building uses a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water, so this should also be assumed for the actual building at 'Be Lean' stage.

6.2.8 Pipework Heat Losses

The site heating systems should be designed to minimise heat losses in accordance with the recommendations of CIBSE CP1, including measures such as minimising pipework lengths and installing high level of insulation (in excess of British Standards).

6.2.9 Cooling

Residential

Active mechanical cooling should not be proposed for the residential dwellings.

The use of natural ventilation via openable windows/doors and increased mechanical ventilation should generally sufficiently reduce the risk of overheating.

Where the occupants may choose to keep their windows closed at night due to higher external noise levels, an alternative method of reducing the risk of overheating should be made available through the use of MVHR heat pumps or a MVHR cooling module.

Non-Residential

For the workspace and retail units cooling is expected to be provided via VRF, split or multi-split heat pump systems which should achieve a seasonal efficiency of at least 3.92.

6.2.10 Ventilation Systems

Residential

Ventilation to the residential apartments should be via individual Mechanical Ventilation with Heat Recovery (MHVR) units. Each unit should achieve a Specific Fan Power of up to 0.47 W/(l/s) and a heat recovery efficiency of up to 91%, depending on the number of wet rooms.

This has been further improved from 0.52 W/(l/s) and 90% efficiency used in the previous submission to LBTH, through the selection of an alternative newer model.

The communal corridors shall have a dual purpose mechanical extract system that can operate to assist the natural ventilation when necessary in maintaining air movement in corridors and prevent stagnant air and odour build up in winter.

Non-Residential

It is expected that the workspace and retail units will be provided with local commercial MVHR units that should achieve a Specific Fan Power of less than 1.1 W/(l/s) and a heat recovery efficiency of at least 85%.

6.2.11 Lighting

Energy efficient LED lighting should be used throughout the proposed development. Occupancy and daylight sensors should be used where appropriate.

6.2.12 Smart Controls / Metering

It is expected that residential apartments will be provided with an individual, programmable, zoned, control system, together with smart energy meters.

A central Building Management System (BMS) should be provided to operate the ‘Landlord’ plant and systems in the most energy efficient manner.

6.2.13 Appliances

Where appliances are provided by the developer they should be of an energy efficient type, and where they are not provided by the developer, owners/tenants will be encouraged to supply energy efficient equipment.

7 Heating Infrastructure (Be Clean)

7.1 Detailed Part of the Application

7.1.1 Blocks F, H1/H2, and H3

Overview

The energy strategy (AV011) submitted as part of the original masterplan for the Aberfeldy Estate, proposed a site wide heat network served from a new energy centre sized to provide heat to all six phases of the development.

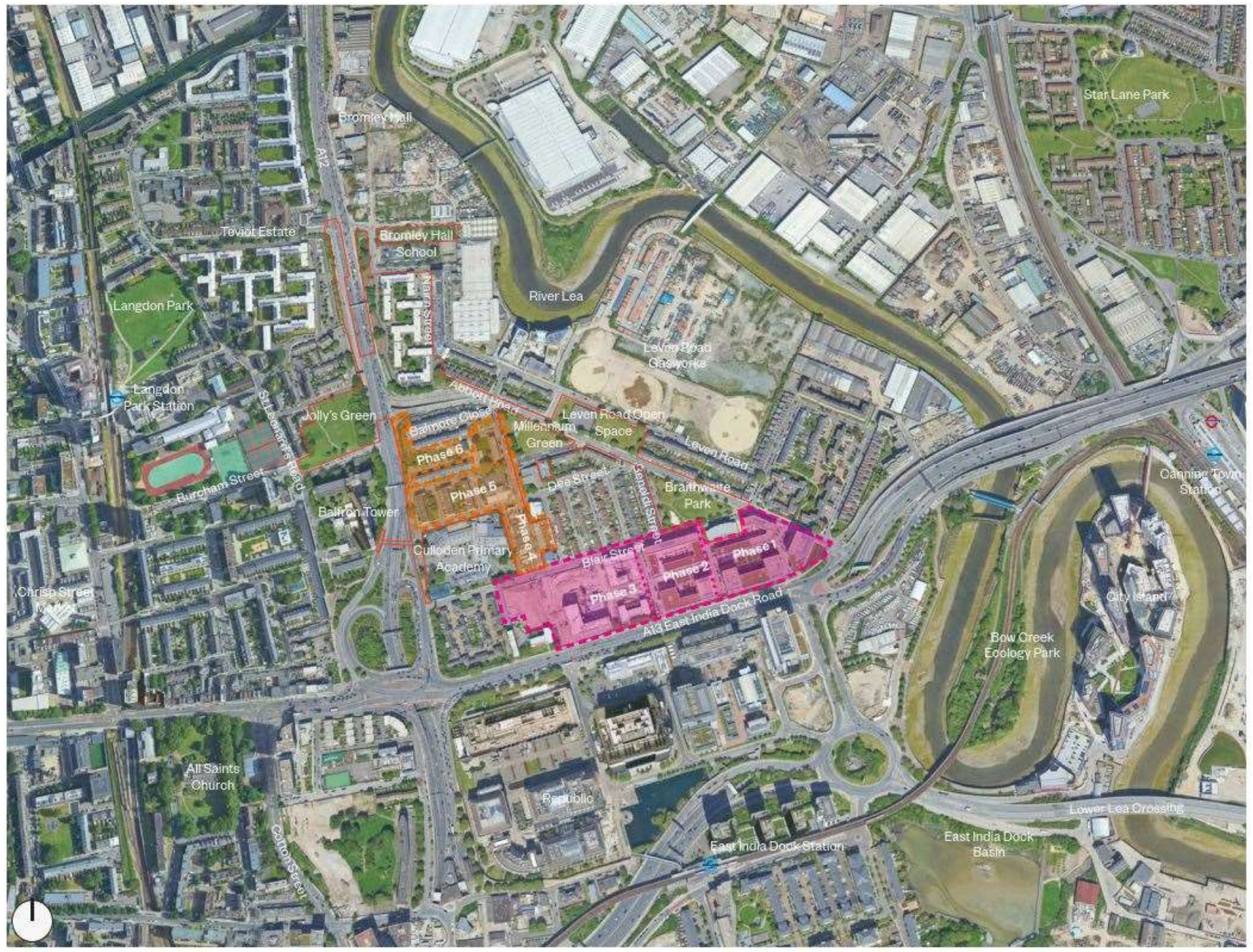


Figure 10: Aerial view of the original masterplan phases and the new masterplan boundary

Phases 1, 2, 3a and 3b of the original masterplan have been completed on site and are now occupied. The energy centre was constructed in Phase 3a and includes gas fired CHP and boilers with the capacity to serve a further 300 residential units. This has been confirmed by the operator of the network Eon.

Blocks F, H1/H2, and H3 of the detailed part of the application comprise 206 residential units, and are located adjacent to Phase 3b within the area designated as phases 4 and 5 of the original masterplan.

A valved and capped connection to the existing site wide heat network has been provided at the north of Phase 3b onto Blair Street to facilitate the connection and extension to Blocks F, H1/H2, and H3 of the detailed part of the application.

GLA Energy Assessment Guidance 2022 confirms that a connection to an existing heat network must be prioritised where the CO2 emission and primary energy factors are within Part L 2021, and where the operator has agreed a decarbonisation strategy with the GLA.

Since the planning submission in October 2021, regular meetings have been held between the applicant, Meinhardt and EON (the heat network operator).

In July 2023, EON provided confirmation of the expected carbon content and primary energy factor of the heat that will be delivered to Blocks F and H using the latest SAP 10.2 carbon emission factors. The carbon content of the heat delivered by the heat network will be 0.273 kg CO2 per kWh and the primary energy factor 1.356 kWh/kWh based on SAP10.2 carbon emission factors.

As these parameters are below the limits set out in Part L 2021 (0.350 kg CO2 per kWh for carbon content and 1.450 kWh/kWh for primary energy) and as EON have submitted a decarbonisation plan to the GLA, in accordance with GLA policy it is therefore proposed that Blocks F and H will connect to the existing heat network.

Connection to the Network

The primary pipework will be extended from the valved and capped connection in Blair Street to heat substations in Blocks F and H3, which will act as a hydraulic break between the primary network and the secondary heating system that distributes heat throughout the building.

Each substation will consist of two equally sized heat exchangers providing 60% of the heat demand. The substation will operate with both heat exchangers operating in parallel at all times unless a fault in one requires isolation.

Existing Energy Centre

The existing energy centre has been constructed on the ground floor level of Block H and includes a low NOx gas fired "base thermal" load Combined Heat and Power CHP unit operating in conjunction with a supplementary gas fired boiler plant and thermal storage.

The CHP unit has the following specification;-

Heat output	357kW	49.9% gross efficiency
Electrical output	229kW	32.0% gross efficiency
Gas input (gross)	716kW	

The gas fired boilers have a total output of 5020 kW and a gross seasonal efficiency of 93.9%. The centralised thermal storage vessels have a total capacity of approximately 40,000 litres at 85°C storage temperature.

In July 2023, EON confirmed the CHP fraction at 55.8%, which is improved from 51% used in the previous submission to LBTH.

For the SAP calculations a distribution loss factor of 1.25 has been used to reflect the carbon content of 0.273 kg CO2 per kWh confirmed by EON.

7.1.2 Block I

Block I is a small block of apartments located at the very east of the application site, close to Phase 1 of the original masterplan. A future connection has not been provided to allow connection into the existing site heat network serving the original masterplan.

Due to the significant distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat from a block energy centre comprising air-to-water heat pumps and water-to-water heat pumps.

A load assessment has been carried out for Block I by a heat pump manufacturer, which confirms a seasonal efficiency of 310% is achievable for the block heat pumps with appropriate thermal storage. This is improved from the 257% used in the previous submission to LBTH. Please refer to Appendix A.5.

For the SAP calculations a distribution loss factor of 1.1 has been used, as it is a small building wide system.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

7.1.3 Block J

Block J is a row of individual terraced houses and maisonettes located at the very north of the application site.

Due to the distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat to the houses from individual air-to-water heat pumps supplemented by solar thermal, and to the maisonettes from individual MVHR heat pumps.

Houses

Each system will comprise of an inverter driven outdoor unit and a wall mounted indoor unit, together with a hot water storage vessel.

It is proposed to use solar thermal panels in conjunction with the local heat pumps in each house as they can generate high temperature heat suitable for domestic hot water, thereby maximising the efficiency of the heat pumps (which are best operating at lower temperature).

When selected in the SAP Database, the proposed unit for the houses (Mitsubishi Ecodan PUZ-WMA5VAA) achieves a space heating efficiency of up to 100%, and a domestic hot water efficiency of 267%.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

Maisonettes

Each individual MVHR heat pump comprises an electric heat pump, hot water vessel and MVHR unit with counterflow heat exchanger.

The unit provides the following;-

- Supply and extract ventilation to the dwelling, with heat recovery via the integral counterflow heat exchanger
- Domestic hot water via the integral hot water storage vessel
- Space heating via the ventilation supply air
- Cooling (tempering) of the ventilation supply air

It is proposed to use the Nilan Compact P heat pump for the maisonettes, which is a Passivhaus Certified product. However, when selected in the SAP Database, the Elmhurst software is unable to calculate, so a seasonal efficiency of 310% has been assumed.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

7.2 Outline Part of the Application

The existing site heat network serving the original masterplan does not have capacity to serve the whole of the new Masterplan. Investigations have confirmed that there are no other district heating networks in the vicinity of this site and none planned for the near future.

It is therefore proposed to provide a new site heat network serving the heat demand of the outline part of the application (Phases B, C and D).

EON have identified potential sources of waste heat from data centres to the south of the outline part of the application, and are currently developing plans for a low temperature network that could potentially serve the outline part of the application in the future, and also be used to de-carbonise the existing heat network serving the original masterplan area.

It is therefore proposed that the site heat network serving the outline part of the application will be a low temperature network compatible with the future network being developed by EON.

As EON's plans are at an early stage, this assessment is based on the primary network for the outline part of the application being fed from central air-to-water heat pumps which will generate low temperature heat at around 20-30ºC for distribution around the development.

When available, waste heat from the EON district network could directly serve the primary network to further de-carbonise the network.

Each block will be provided with its own water-to-water heat pumps and thermal store which is used to raise the temperature to around 55°C for distribution within the block. Heat interface units will be provided per dwelling, providing instantaneous heating and hot water.

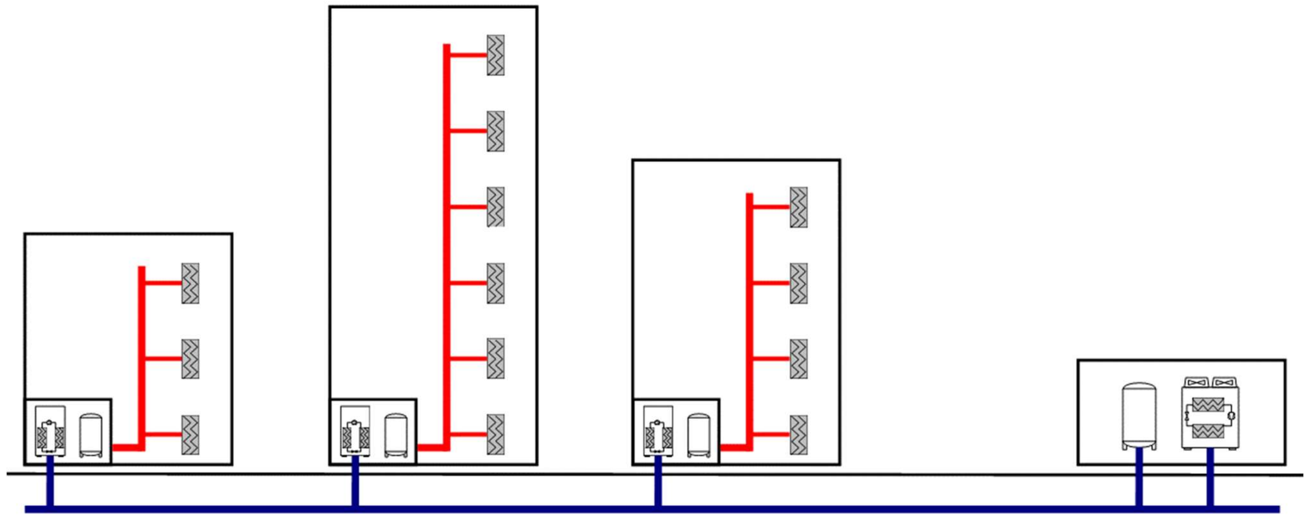


Figure 11: Diagrammatic of the proposed heat pump arrangement for the outline part of the application

An annual heating (and cooling) load profile assessment has been carried out for the development in conjunction with a heat pump manufacturer, with demand calculated hourly using the London TRY weather data, and the results are provided in Appendix A.6. This has been used to confirm the system seasonal efficiency.

The load profile assessment demonstrates an overall seasonal efficiency of 257% for the combination of the central and block heat pumps (in heating mode). For the SAP calculations a distribution loss factor of 1.2 has been assumed.

The site heat network within the development will be designed in accordance with CIBSE CP1 Heat Networks: Code of Practice.

The development has been arranged into several blocks, with the cores located centrally in each block to minimise lateral pipe runs and hence heat losses.

The system will operate with a variable volume and maximum temperature to satisfy the requirements of the tertiary system, which delivers the heat demand to the occupied spaces.

A high level of insulation (in excess of British Standards) will be provided to all parts of the systems, in accordance with the recommendations of CIBSE CP1.

The site heat network will have the following provisions to allow connection to either a future district heating network or a waste heat source (such as the data centre);-

- Space for future district heating interfacing heat exchanger, pumps, controls etc;
- Provision to allow future district heating connecting pipework to be routed through from outside; and
- Spare ways on local electrical distribution boards for future electrical supplies to pumps, controls etc.

8 Renewable Energy (Be Green)

8.1 Detailed Part of the Application

An appraisal of potential on-site renewable energy systems has been undertaken for the development with the following technologies considered:

- Biomass boilers;
- Photovoltaics (PVs);
- Solar thermal;
- Ground source heat pumps;
- Air source heat pumps; and
- Wind Turbines.

8.1.1 Biomass Boilers

Biomass boilers could provide a proportion of the space heating and hot water load, but would compete with the existing CHP serving the base load of the detailed part of the application.

Biomass boilers are better operating as the lead heat source (and not as top up) as they are not suited to operating with variable load.

Biomass boilers would also adversely impact on local air quality due to their emissions, and vehicular delivery of fuel would be required resulting in increased traffic movements.

Biomass boilers are therefore not proposed for the development.

8.1.2 Photovoltaics (PVs)

An assessment has been carried out and it has been determined that photovoltaic panels are appropriate for the detailed part of the application as detailed below.

Blocks F, H1/H2, and H3

It is proposed to install a total of 156 No. photovoltaic panels on the roofs with a total peak output of 59.3 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 5,248 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% and an additional 70 No. photovoltaic panels have been included, thereby increasing the peak output from 29kW to 59.3kW since the previous submission to LBTH.

Block I

It is proposed to install photovoltaic panels with a total peak output of 6.5 kW on the roof (based on 17 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 537 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% thereby increasing the peak output from 5.8kW to 6.5kW since the previous submission to LBTH.

Block J

It is proposed to install photovoltaic panels with a total peak output of 16 kW on the roofs (based on 42 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 1,327 kg CO2 per year in regulated carbon dioxide emissions.

Photovoltaics are therefore proposed for the development.

8.1.3 Solar Thermal

Blocks F, H1/H2, H3 and I

A solar thermal system could provide a proportion of the hot water load but would compete with the site heat network or air-to-water heat pumps serving the base load of the development. Greater carbon reductions are achieved by installing photovoltaics in the limited roof space available.

Solar thermal is therefore not proposed for Blocks F, H and I.

Block J

It is proposed to use solar thermal panels in conjunction with the local heat pumps in each house in Block J as they can generate high temperature heat suitable for domestic hot water, thereby maximising the efficiency of the heat pumps (which are best operating at lower temperature). A collector of 1.1 m² area will be provided on the roof of each dwelling.

The carbon savings generated by the solar thermal panels are reflected in the increased heat pump efficiency and are not reported separately.

Solar thermal is therefore proposed for Block J.

8.1.4 Ground Source Heat Pumps

The overall cooling load is low, resulting in a poor balance between heating and cooling demand, which would adversely impact on the potential yield from any ground source system.

Ground source heat pumps are therefore not proposed for the development.

8.1.5 Air / Water Source Heat Pumps

As described above, heat pumps are proposed for the detailed part of the application as detailed below.

Block I

Air-to-water heat pumps are appropriate as the main heat source for Block I. The heat pumps are expected to provide a total saving of approximately 27,148 kg CO2 per year in regulated carbon dioxide emissions.

Block J

Individual air-to-water heat pumps (supplemented by solar thermal) are appropriate as the main heat source for the houses in Block J.

Individual MVHR heat pumps are appropriate as the main heat source for the maisonettes in Block J.

The heat pumps and solar thermal panels are expected to provide a total saving of approximately 16,044 kg CO2 per year in regulated carbon dioxide emissions.

Air source heat pumps are therefore proposed for the development.

8.1.6 Wind Turbines

Wind turbines would be a complimentary technology to the proposed site heat network. However, they would have significant architectural and townscape implications, together with potential noise.

Wind turbines are therefore not proposed for the development.

8.2 Outline Part of the Application

8.2.1 Biomass Boilers

Biomass boilers are not appropriate for the outline part of the application due to their adverse impact on local air quality.

Biomass boilers are therefore not proposed for the development.

8.2.2 Photovoltaics (PVs)

It is proposed that photovoltaic panels will be installed on the roofs of the residential blocks in the outline part of the application.

Although the exact numbers cannot be determined at this stage, it is expected that a minimum of 420 No. photovoltaic panels will be installed on the roofs, based on a pro-rata increase from Block I. The panels will have a total peak output of 159.6 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 13,287 kg CO2 per year in regulated carbon dioxide emissions.

In accordance with GLA Energy Assessment Guidance 2022, PV provision will be maximised when the design for the Reserved Matters application(s) is developed.

Photovoltaics are therefore proposed for the development.

8.2.3 Solar Thermal

Solar thermal systems could provide a proportion of the hot water load, but would compete with the air-to-water heat pumps and potential waste heat source serving the base load of the development. Greater carbon reductions are achieved by installing photovoltaics in the limited roof space available.

Solar thermal is therefore not proposed for most of the development.

8.2.4 Ground Source Heat Pumps

The overall cooling load is low, resulting in a poor balance between heating and cooling demand, which would adversely impact on the potential yield from any ground source system.

Ground source heat pumps are therefore not proposed for the development.

8.2.5 Air / Water Source Heat Pumps

As stated above, air-to-water and water-to-water heat pumps are appropriate as the main heat source for the outline part of the application. The heat pumps are expected to provide a total saving of approximately 649,474 kg CO2 per year in regulated carbon dioxide emissions.

Air source heat pumps are therefore proposed for the development.

8.2.6 Wind Turbines

Wind turbines would be a complimentary technology to the proposed site heat network. However, they would have significant architectural and townscape implications, together with potential noise.

Wind turbines are therefore not proposed for the development.

9 Unregulated Energy

9.1 Detailed Part of the Application

This section outlines how non-regulated energy and carbon dioxide emissions will be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

9.1.1 Baseline

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking and appliances), have been estimated using the UK Government Household Electrical Survey (2014) for the residential elements and using data from CIBSE Guide F for non-residential.

The table below details the breakdown of baseline unregulated energy demand and associated CO_2 emissions for the detailed part of the application.

Energy Use	Residential		Non-Residential	
	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)
Residential cooking (electric)	101,936	13,863		
Residential appliances/equipment	174,621	23,748		
Non-residential cooking (electric)			3,862	525
Non-residential appliances/equipment			69,049	9,390
Total (Unregulated)	276,557	37,612	72,910	9,916

Table 18: Baseline unregulated energy demand and CO2 emissions for detailed part of the application

9.1.2 Demand Reduction (Be Lean)

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

The table below details the breakdown of unregulated energy demand and associated CO_2 emissions following demand reduction for the detailed part of the application.

Energy Use	Residential		Non-Residential	
	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO_2/year)
Residential cooking (electric)	82,262	11,188		
Residential appliances/equipment	142,086	19,324		
Non-residential cooking (electric)			3,439	468
Non-residential appliances/equipment			58,885	8,009
Total (Unregulated)	224,348	30,511	62,323	8,476

Table 19: Unregulated energy demand and CO2 emissions after demand reduction for detailed part of the application

It is expected that the detailed part of the application will provide a 14.5% reduction in unregulated carbon dioxide emissions over the baseline.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

9.1.2.1 Residential Cooking

The baseline energy demand and associated carbon dioxide emissions from BREDEM are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as ‘A’ rated electric ovens and ‘D’ rated cooker hood extract units.

More efficient appliances are easily available, and provision of ‘A+’ rated oven and a ‘C’ rated cooker hood extract units will be encouraged.

9.1.2.2 Residential Appliances/Equipment

The baseline energy demand and associated carbon dioxide emissions from BREDEM are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as ‘A+’ rated fridge/freezers, ‘A++’ rated washing machines, ‘A+’ rated dishwashers and ‘A’ rated televisions.

More efficient appliances are easily available, and purchasers/tenants will be encouraged to reduce energy demand by providing an ‘A++’ rated fridge/freezer, an ‘A+++’ rated washing machine, an ‘A++’ rated dishwasher and an ‘A+’ rated television.

Further reductions in unregulated energy can be achieved by owners/tenants of residential properties as detailed below. The potential savings are difficult to quantify as they are operational items. A reduction has not been included in this assessment, but owners/tenants will be encouraged to operate appliances as suggested.

Washing Machine and Dryer

Wash full loads rather than just a few items.

Use a temperature setting of 40°C or even 30°C where possible.

Reduce dryer use by using an outdoor line in summer and a drying rack in winter.

Use tumble dryer balls to reduce drying time.

Dishwasher

Fill the dishwasher before using.

Use the economy setting if available.

Kettle

Only boil the amount you need each time.

Oven

Limit the number of times the oven door is opened while cooking.

Hob

Use the smallest pot possible each time.

Use a lid.

Use stacked steamers.

General Appliances

Do not leave appliances on standby.

9.1.2.3 Non-residential Equipment/Small Power

Tenants will be encouraged to reduce energy demand and associated carbon dioxide emissions to achieve the CIBSE good practice benchmarks.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

Retail Space

- Optimisation of refrigeration storage temperatures.
- Specification of refrigeration equipment to include (where possible) automatic defrost, self-closing doors, fan assistance (with auto shut-off and energy efficient fans), high performance insulation, and door open alarms.
- Energy efficient glass and dishwashers to be used.
- Energy efficient desktop PCs, laptops, screens etc to be used.
- Energy efficient sound systems to be used.
- Encourage staff to switch off equipment when not in use.
- Energy efficient TVs, white goods and other equipment to be used.

10 Overheating and Cooling

10.1 Detailed Part of the Application

10.1.1 Cooling Hierarchy

The detailed part of the application has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O, in order to reduce overheating and minimise the use of air conditioning.

10.1.1.1 Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure

The heat entering the building will be reduced by a combination of measures including the following: -

- Significantly improved fabric ‘U’ values
- Improved air tightness
- Optimisation of glazing g-value
- Optimisation of glazing area
- External shading via projecting balconies and deep reveals
- Internal blinds

10.1.1.2 Minimise internal heat generation through energy efficient design

Internal heat generation will be minimised by a combination of measures including the following: -

- Minimising cold bridging
- Minimising heat loss from heating and hot water systems through reducing pipe lengths, pipework arrangements and high levels of insulation
- Low energy lighting
- Energy efficient desktop PCs, laptops, screens
- Energy efficient appliances

10.1.1.3 Manage the heat within the building through exposed internal thermal mass and high ceilings

- Floor to floor heights have been maximised in the proposed development.
- Purge ventilation can be achieved in residential dwellings through open windows
- Building structure is concrete providing thermal mass to absorb excess heat

10.1.1.4 Provide passive ventilation

Passive ventilation will be maximised by a combination of measures including the following: -

- Residential dwellings are designed with shallow floorplates
- Dual aspect dwellings where possible
- All residential dwellings are provided with natural ventilation via openable windows

10.1.1.5 Mechanical ventilation

Mechanical ventilation will assist in mitigating through the following measures;-

- Mechanical ventilation with high efficiency heat recovery (MVHR) will provide fresh air and extract moisture/pollutants in accordance with Building Regulations Part F.
- MVHR will have a bypass for summer mode operation
- MVHR will have a boost mode to increase ventilation rate and assist in reducing the risk of overheating when needed
- Dynamic modelling demonstrates that the risk of overheating is suitably reduced in residential dwellings through the use of natural ventilation via open windows and mechanical ventilation
- Dynamic modelling demonstrates that the risk of overheating cannot be suitably reduced through the use of mechanical ventilation alone, where windows need to remain closed at night due to higher external noise levels. This will be mitigated by temperaing the fresh air supply using the MVHR heat pump or additional cooling module.
- Dynamic modelling demonstrates that the risk of overheating cannot be suitably reduced in the commercial space through the use of natural ventilation via open windows and mechanical ventilation

10.1.1.6 Active Cooling Systems

- The use of active cooling has been minimised through the incorporation of the above passive measures
- It is proposed to provide active cooling to the retail, commercial and marketing spaces only. High efficiency air source heat pumps will be used.
- The module fitted to the MVHR units in the apartments affected by higher external noise levels is not considered as active cooling due to the following;-
  - It would only ‘temper’ the supply air, reducing the temperature by a few degrees.
  - It would have limited cooling capacity due to the size of heat pump / cooling module, and the low air volume of the residential ventilation system.
  - It would not ‘control’ space temperature – it would only be used if required by the occupant and would only operate when external temperature exceeds 26 ºC at night and 28ºC during the day to achieve compliance with the CIBSE overheating criteria.
  - No additional fan would be required in the apartment.

10.1.2 Early Stage Overheating Risk Tool

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.7.

10.1.3 Overheating Risk Assessment Methodology

10.1.3.1 Domestic

The residential assessment includes dynamic thermal modelling on a representative sample of dwellings to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance.

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

a) For living rooms, kitchens and bedrooms: the number of hours during which ∆T is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Building Regulations Part O requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB. The overheating risk categories assessment provided in Annex 14 of the Environment Statement Appendix: Noise and Vibration demonstrates that for most of the detailed part of the application the ambient noise levels are below 40 dB at night (identified as negligible or low risk).

The strategy will therefore generally allow for windows to be open at night in the detailed part of the application .

The overheating risk categories assessment shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) so two overheating assessments have been completed (one with windows open at night, and one with windows closed at night) to demonstrate that the passive design has been maximised.

10.1.3.2 Non-Domestic

The non-residential assessment includes dynamic thermal modelling of the non-residential space in the detailed part of the application to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM52 guidance.

A room or building that fails any two of the three criteria is classed as overheating.

- The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
- The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
- The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

10.1.3.3 Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The London Heathrow weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years;-

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

It is acknowledged in the GLA Energy Assessment Guidance 2022 that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, and compliance is therefore not expected.

10.1.4 Summary of Overheating Modelling Results

10.1.4.1 Domestic

Natural Ventilation via Openable Windows (All Blocks)

All residential dwellings tested have been modelled with natural ventilation via openable windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised. The results are summarised below;-

- The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.

The GLA Energy Assessment Guidance 2022 expects that the CIBSE compliance criteria is met for the DSY1 weather scenario. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

The assessment with natural ventilation demonstrates that the risk of overheating has been reduced as far as practical, with all available passive measures explored.

Closed Windows (Block J, Parts of Blocks F and H1/H2)

The overheating risk categories assessment (see Annex 14 of the Environment Statement Appendix: Noise and Vibration) shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) and therefore exceed the limit prescribed in Building Regulations Part O.

Additional modelling has been carried out for the appropriate sampled dwellings in Blocks J, F and H1/H2 with the windows closed at night but with the increased mechanical ventilation in operation. The results are summarised below;-

- The CIBSE compliance criteria cannot be met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds with closed windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria cannot be met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds with closed windows/doors and increased mechanical ventilation.

The MVHR heat pumps proposed for the maisonettes in Block J have the capability to lower the temperature of the supply air when in operation to assist in reducing the impact of high summer temperatures.

In the Block J houses and in the affected apartments in Blocks F and H1/H2, an additional cooling module would be fitted to the MVHR unit to provide the same functionality.

This would provide the occupants with an alternative method of sufficiently reducing the risk of overheating without opening the windows.

This is not considered as active cooling due to the following;-

- It would only ‘temper’ the supply air, reducing the temperature by a few degrees.

- It would have limited cooling capacity due to the size of heat pump / cooling module, and the low air volume of the residential ventilation system.
- It would not 'control' space temperature – it would only be used if required by the occupant and would only operate when external temperature exceeds 26 ºC at night and 28ºC during the day to achieve compliance with the CIBSE overheating criteria.
- No additional fan would be required in the apartment.

10.1.4.2 Non-Residential

The non-residential assessment includes dynamic thermal modelling of the non-residential space in the detailed part of the application to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM52 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3 weather data.

The results of the dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria cannot be met in the non-residential space (for the 2020s DSY1, 2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

The proposed overheating mitigation measures are summarised below;-

- For the retail, commercial, marketing suite and other appropriate areas active cooling is proposed.

10.1.5 Overheating Mitigation Measures

The proposed overheating mitigation measures are summarised below;-

- In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.
- In Block J and parts of Blocks F and H1/H2, where the occupants may choose to keep their windows closed at night, an alternative method of reducing the risk of overheating will be available through the use of the MVHR heat pump or a MVHR cooling module.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following;-
    - Using portable fans to increase airflow
    - Minimising internal heat gains
    - Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home in line with the cooling hierarchy.

10.2 Outline Part of the Application

Residential

Although dynamic thermal modelling is not a requirement for the outline part of the application, as part of the early stage design modelling has been carried out on a sample of apartments to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3.

This modelling has been completed for a sample of west facing apartments at differing levels between the 2nd and 20th floor with both recessed and projecting balconies.

The results of this early stage dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria are met in almost all rooms modelled (for the 2020s DSY1 weather scenario) for both recessed and projecting balconies, without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.

The results demonstrate that the outline design provides a suitable reduction in the risk of overheating at this stage of design.

As the design is developed for the later Reserved Matters application(s), further work will be done to explore all available passive measures with the aim of reducing the risk further.

Non-Residential

The design of the outline part of the application is not sufficiently progressed to allow dynamic thermal modelling for the non-residential areas.

As the design is developed for the later Reserved Matters application(s), an assessment will be carried out to reduce overheating and minimise the use of air conditioning in the non-residential areas.

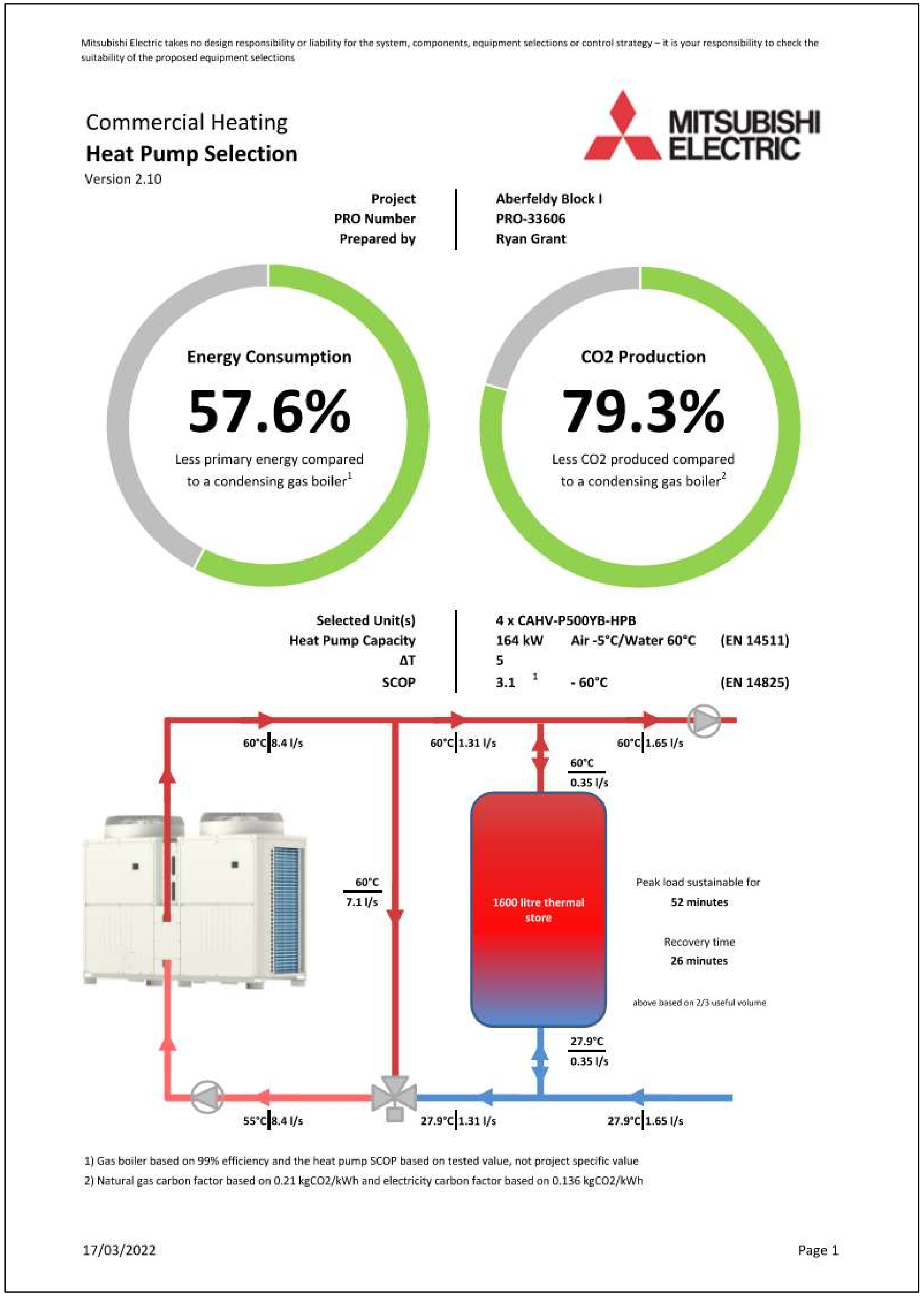
Appendix A.1 – SAP Calculations (Be Lean)

Appendix A.2 - SAP Calculations (Be Green)

Appendix A.3 – BRUKL Reports (Be Lean)

Appendix A.4 - BRUKL Reports (Be Green)

Appendix A.5 – Block I Heat Pump Selection



Commercial Heating

Heat Pump Selection

Version 2.10

Project	**Aberfeldy Block I**
PRO Number	**PRO-33606**
Prepared by	**Ryan Grant**

Energy Consumption

57.6%

Less primary energy compared to a condensing gas boiler[1]

CO2 Production

79.3%

Less CO2 produced compared to a condensing gas boiler[2]

Selected Unit(s)	**4 x CAHV-P500YB-HPB**		
Heat Pump Capacity	**164 kW**	**Air -5°C/Water 60°C**	**(EN 14511)**
ΔT	**5**		
SCOP	**3.1** [1]	**- 60°C**	**(EN 14825)**

Peak load sustainable for

52 minutes

Recovery time

26 minutes

above based on 2/3 useful volume

1) Gas boiler based on 99% efficiency and the heat pump SCOP based on tested value, not project specific value

2) Natural gas carbon factor based on 0.21 kgCO2/kWh and electricity carbon factor based on 0.136 kgCO2/kWh

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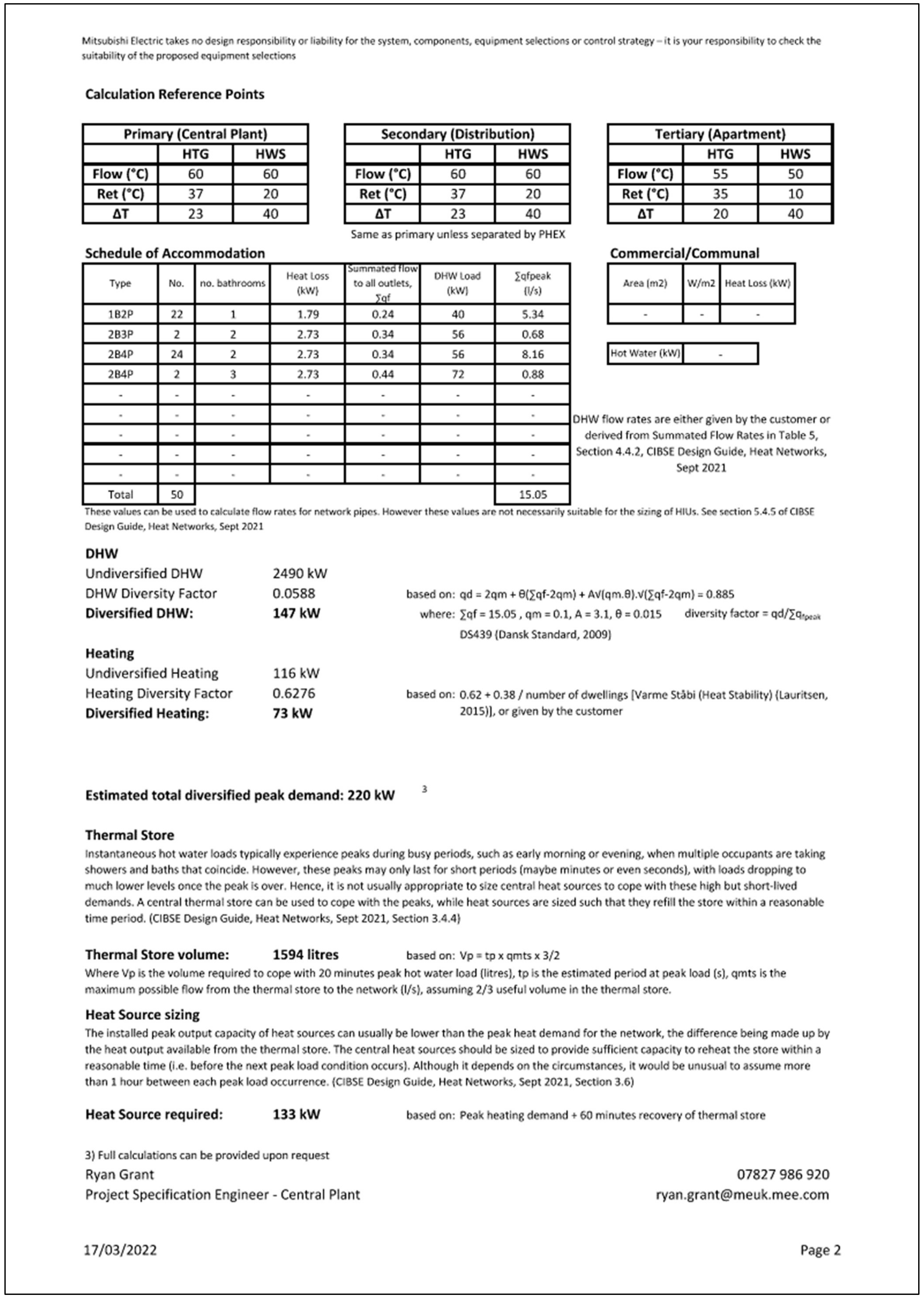

Calculation Reference Points

Primary (Central Plant)	HTG	HWS
Flow (°C)	60	60
Ret (°C)	37	20
ΔT	23	40

Secondary (Distribution)	HTG	HWS
Flow (°C)	60	60
Ret (°C)	37	20
ΔT	23	40

Same as primary unless separated by PHEX

Tertiary (Apartment)	HTG	HWS
Flow (°C)	55	50
Ret (°C)	35	10
ΔT	20	40

Schedule of Accommodation

Type	No.	no. bathrooms	Heat Loss (kW)	Summated flow to all outlets, Σqf	DHW Load (kW)	Σqfpeak (l/s)
1B2P	22	1	1.79	0.24	40	5.34
2B3P	2	2	2.73	0.34	56	0.68
2B4P	24	2	2.73	0.34	56	8.16
2B4P	2	3	2.73	0.44	72	0.88
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
Total	50					15.05

These values can be used to calculate flow rates for network pipes. However these values are not necessarily suitable for the sizing of HIUs. See section 5.4.5 of CIBSE Design Guide, Heat Networks, Sept 2021

Commercial/Communal

Area (m2)	W/m2	Heat Loss (kW)
-	-	-

Hot Water (kW)	-

DHW flow rates are either given by the customer or derived from Summated Flow Rates in Table 5, Section 4.4.2, CIBSE Design Guide, Heat Networks, Sept 2021

DHW

Undiversified DHW	2490 kW	
DHW Diversity Factor	0.0588	based on: $qd = 2qm + \theta(\sum qf-2qm) + A\sqrt{(qm.\theta)}.\sqrt{(\sum qf-2qm)} = 0.885$
Diversified DHW:	**147 kW**	where: $\sum qf = 15.05$, $qm = 0.1$, $A = 3.1$, $\theta = 0.015$ diversity factor = $qd/\sum q_{fpeak}$
		DS439 (Dansk Standard, 2009)

Heating

Undiversified Heating	116 kW	
Heating Diversity Factor	0.6276	based on: 0.62 + 0.38 / number of dwellings [Varme Ståbi (Heat Stability) (Lauritsen, 2015)], or given by the customer
Diversified Heating:	**73 kW**	

Estimated total diversified peak demand: 220 kW [3]

Thermal Store

Instantaneous hot water loads typically experience peaks during busy periods, such as early morning or evening, when multiple occupants are taking showers and baths that coincide. However, these peaks may only last for short periods (maybe minutes or even seconds), with loads dropping to much lower levels once the peak is over. Hence, it is not usually appropriate to size central heat sources to cope with these high but short-lived demands. A central thermal store can be used to cope with the peaks, while heat sources are sized such that they refill the store within a reasonable time period. (CIBSE Design Guide, Heat Networks, Sept 2021, Section 3.4.4)

Thermal Store volume: **1594 litres** based on: $Vp = tp \times qmts \times 3/2$

Where Vp is the volume required to cope with 20 minutes peak hot water load (litres), tp is the estimated period at peak load (s), qmts is the maximum possible flow from the thermal store to the network (l/s), assuming 2/3 useful volume in the thermal store.

Heat Source sizing

The installed peak output capacity of heat sources can usually be lower than the peak heat demand for the network, the difference being made up by the heat output available from the thermal store. The central heat sources should be sized to provide sufficient capacity to reheat the store within a reasonable time (i.e. before the next peak load condition occurs). Although it depends on the circumstances, it would be unusual to assume more than 1 hour between each peak load occurrence. (CIBSE Design Guide, Heat Networks, Sept 2021, Section 3.6)

Heat Source required: **133 kW** based on: Peak heating demand + 60 minutes recovery of thermal store

3) Full calculations can be provided upon request

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Appendix A.6 – Heating Load Profile Assessment

Energy Summary

Heating Energy	Residential	3,205,411	kWh
	Commercial	462,824	kWh
Cooling Energy	Residential	190,920	kWh
DHW Energy	Residential	2,563,721	kWh

Total Heating Energy	3,668,234	kWh
Total DHW Energy	2,563,721	kWh
Total Heating & DHW Energy	6,231,955	kWh
Total Cooling Energy	190,920	kWh

Water Source Heat Pump (WSHP)

WSHP Delivered Heating Energy	6,231,955	kWh
WSHP Consumed Energy	1,546,391	kWh
WSHP SCOP	4.03	
WSHP Heat Absorbed from Loop	4,685,565	kWh

Model	EW-HT /0612	
Condenser temps inlet/outlet	50/60	°C
Evaporator temps inlet/outlet	25/18	°C
WSHP Capacity	176.4	kW
Total no.	32	
Total output capacity	5644.8	kW

*selected at N+1

	4 x EW-HT 0612	5 x EW-HT 0612	5 x EW-HT 0612	8 x EW-HT 0612	5 x EW-HT 0612	5 x EW-HT 0612
	PHASE 4B HP A1/A2 WSHP SEC. STAGE | 60/50 COND. | 25/18 EVAP	PHASE 4B HP B1/B2 WSHP SEC. STAGE | 60/50 COND. | 25/18 EVAP	PHASE 4B HP B3 WSHP SEC. STAGE | 60/50 COND. | 25/18 EVAP	PHASE 4C HP BlockC WSHP SEC. STAGE | 60/50 COND. | 25/18 EVAP	PHASE 4C HP BlockE WSHP SEC. STAGE | 60/50 COND. | 25/18 EVAP	PHASE 4D HP D1/D2 WSHP SEC. STAGE | 60/50 COND. | 25/18 EVAP
Output per unit	176.4 kW	176.4 kW	176.4 kW	176.4 kW	176.4 kW	176.4 kW
Total output	705.6 kW	882 kW	882 kW	1411.2 kW	882 kW	882 kW
Load to serve	427 kW	629 kW	637 kW	1145 kW	567 kW	567 kW
Thermal Store volume	3000 litres	5000 litres	4000 litres	9000 litres	4000 litres	400C litres

Water Cooled Chiller (WCC)

WCC Delivered Cooling Energy	190,920	kWh
WCC Consumed Energy	29,453	kWh
WCC SEER	6.48	
WCC Heat Rejected to Loop	220,374	kWh

Model	NX-W /0122-0302	
Condenser temps inlet/outlet	25/31	°C
Evaporator temps inlet/outlet	18/12	°C
WCC Capacity	46.4 to 117.6	kW
Total no.	12	
Total output capacity	1035	kW

*selected at 2 at ~66%

	2 x NX-W 0182	2 x NX-W 0302	2 x NX-W 0252	2 NX-W 0302	2 x NX-W 0202	2 x NX-W 0122
	PHASE 4B HP A1/A2 WCC SEC. STAGE | 12/18 EVAP. | 25/31 COND.	PHASE 4B HP B1/B2 WCC SEC. STAGE | 12/18 EVAP. | 25/31 COND.	PHASE 4B HP B3 WCC SEC. STAGE | 12/18 EVAP. | 25/31 COND.	PHASE 4B HP BlockC WCC SEC. STAGE | 12/18 EVAP. | 25/31 COND.	PHASE 4B HP BlockE WCC SEC. STAGE | 12/18 EVAP. | 25/31 COND.	PHASE 4E HP D1/D2 WCC SEC. STAGE | 12/18 EVAP. | 25/31 COND.
Output per unit	68.3 kW	117.6 kW	88.3 kW	117.6 kW	79.3 kW	46.4 kW
Total output	136.6 kW	235.2 kW	176.6 kW	235.2 kW	158.6 kW	92.8 kW
Load to serve	102.7 kW	164.1 kW	134.0 kW	173.1 kW	107.2 kW	4.5 kW

*low load, suggest alternative system

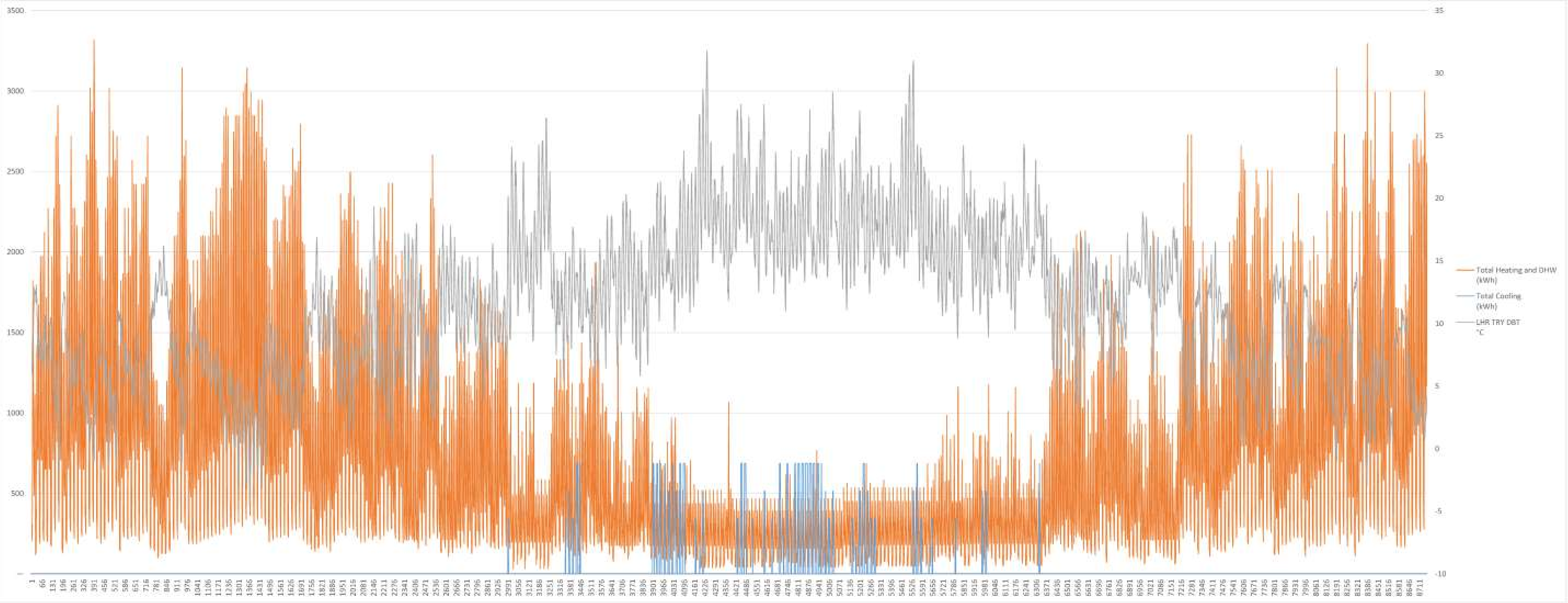
Heat Recovered in Loop due to simultaneous loads	78,171	kWh
Heat Recovered in primary thermal store due to deadband contro	TO DC	kWh

ASHP

ASHP Delivered Heating Energy	4,607,394	kWh
ASHP Delivered Cooling Energy	142,203	kWh
ASHP Consumed Energy for Heating	881,291	kWh
ASHP Consumed Energy for Cooling	30,430	kWh
ASHP SCOP	5.23	
ASHP SEER	4.67	

Model	NX2-N-G06 /A /0808		
Condenser temps inlet/outlet	19/25	°C	
Evaporator temps inlet/outlet	21/15	°C	
Heating Capacity @ -5°C	599.5	kW	
no. of in heating mode	6		N+1
ASHP Total Heating Capacity	3597	kW	
Cooling Capacity @+36°C	971.9	kW	
no. of in cooling mode	2		N+1
ASHP Total Cooling Capacity	1943.8	kW	
Total no units	6		

Combined Plant Efficiency		
Total Cooling SEER	3.19	
Total Heating SCOP	2.57	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3251
3316
3381
3446
3511
3576
3641
3706
3771
3836
3901
3966
4031
4096
4161
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4291
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4486
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4681
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4811
4876
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5006
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5201
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5331
5396
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5721
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5916
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6046
6111
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6241
6306
6371
6436
6501
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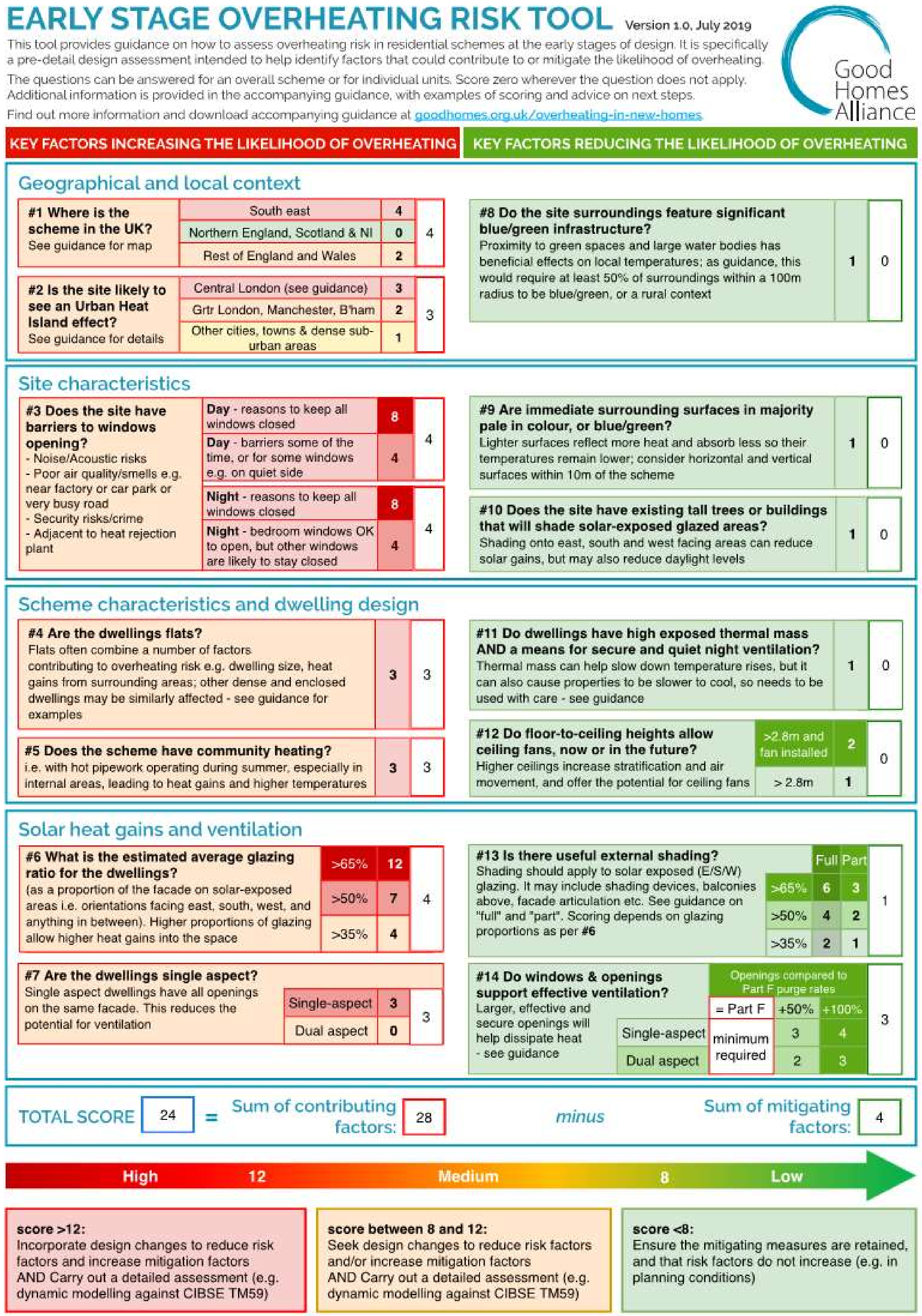
6631
6696
6761
6826
6891
6956
7021
7086
7151
7216
7281
7346
7411
7476
7541
7606
7671
7736
7801
7866
7931
7996
8061
8126
8191
8256
8321
8386
8451
8516
8581
8646
8711
Total Heating and DHW (kWh)
Total Cooling (kWh)
LHR TRY DBT °C

Appendix A.7 – Early Stage Overheating Risk Tool



EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

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

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

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

Good Homes Alliance

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

Geographical and local context

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

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

#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	**1**	0

Site characteristics

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

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	**1**	0
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	**1**	0

Scheme characteristics and dwelling design

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

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance	**1**	0

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	**2**	0
	> 2.8m	**1**	

Solar heat gains and ventilation

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

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

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

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

TOTAL SCORE 24 = Sum of contributing factors: 28 *minus* Sum of mitigating factors: 4

High 12 Medium 8 Low

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

Appendix A.8 - Overheating Assessment

A.8 Overheating Assessment

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.7.

Detailed Part of the Application

The detailed part of the application has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O, in order to reduce overheating and minimise the use of air conditioning.

The assessment includes dynamic thermal modelling of both the domestic and non-domestic elements of the proposed development to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49, TM52 and TM59.

Outline Part of the Application

An initial early stage assessment has also been carried out for the outline part of the application.

Although dynamic thermal modelling is not a requirement for the outline part of the application, as part of the early stage design modelling has been carried out on a sample of residential apartments to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3.

This modelling has been completed for apartments with both recessed and projecting balconies.

A.8.1 Overheating Risk Assessment Methodology

Domestic (Apartments)

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

a) For living rooms, kitchens and bedrooms: the number of hours during which ∆T is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).

b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Building Regulations Part O requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB.

Non-Domestic

The non-domestic overheating risk assessment has been made against the three criteria outlined in CIBSE TM52. A room or building that fails any two of the three criteria is classed as overheating.

- The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
- The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
- The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The London Heathrow weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years;-

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

It is acknowledged in the GLA Energy Assessment Guidance 2022 that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, and compliance is therefore not expected.

A.8.2 Domestic Model Input Data

This section summarises the input assumptions that have been used in the dynamic thermal modelling. The modelling has been carried out in accordance with CIBSE TM59: Design methodology for the assessment of overheating risk in home.

Fabric Performance

Refer to Section 6.

Solar Gain

For the residential apartments the size and g-value of the glazing has been optimised using the dynamic thermal modelling, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy. This has resulted in the g-value of the residential glazing being set at 0.33.

Blinds and Shading Devices

Internal blinds have not been included in the dwellings.

The balconies have been modelled to provide external shading for the apartments.

Mechanical Ventilation

Individual Mechanical Ventilation with Heat Recovery (MHVR) units are proposed to provide fresh air and extract ventilation for the residential dwellings.

These units will be equipped with a summer bypass mode and a boost mode that will enable the unit to achieve an increased total flow rate of up to 75l/s in the summer condition, exceeding the minimum ventilation requirement of Part F of the Building Regulations.

Natural Ventilation

A typical apartment has balcony doors which can be fully opened and side hung opening windows elsewhere to allow natural ventilation when required.

Window opening methodology is in accordance with Building Regulations Part O.

The overheating risk categories assessment provided in Annex 14 of the Environment Statement Appendix: Noise and Vibration demonstrates that for most of the detailed part of the application the ambient noise levels are below 40 dB at night (identified as negligible or low risk).

The strategy will therefore generally allow for windows to be open at night in the detailed part of the application .

The overheating risk categories assessment shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) so two overheating assessments have been completed (one with windows open at night, and one with windows closed at night) to demonstrate that the passive design has been maximised.

Infiltration

The target air permeability for the development is $3m^3/hr.m^2$@50Pa. An average infiltration air change of 0.25ACH has been assumed in the dynamic thermal modelling in accordance with Table 4.24 in CIBSE Guide A.

Air Speed Assumptions

Operative air speed in the apartments has been set at 0.1m/s and assumed elevated air speed of 0.8m/s used in the thermal modelling calculation in accordance with CIBSE TM59.

Thermal Comfort Category

This is a new build development, therefore Cat II building was selected as Normal Expectations.

Internal Gains

A thermal template has been created for each of the spaces within the sample apartments taking into account the internal gains. The internal heat gains consist of occupancy gains, equipment gains and lighting gains. CIBSE TM59 has been used in developing the internal gains profile.

Occupancy Gains

Occupancy heat gains and profiles were assumed in accordance with Table 2 in CIBSE TM59.

Occupancy gain has been set at 75 W/person sensible, 55 W/person latent.

Room Type	Profile/ Gain
Single Bedroom	1 person at 70% gains from 11pm -8am 1 person at full gains from 8am to 11pm
Double Bedroom	2 person at 70% gains from 11pm -8am 2 person at full gains from 8am to 9am and from 10pm to 11pm 1 person at full gains in the bedroom from 9am to 10pm
1 Bedroom (Living room/ kitchen)	1 person from 9am -10am, room is unoccupied for the rest the day
2 Bedroom (Living room/ kitchen)	2 person from 9am -10am, room is unoccupied for the rest the day
3 Bedroom (Living room/ kitchen)	3 person from 9am -10am, room is unoccupied for the rest the day

Table 20: Occupancy Gains

Equipment Gains

Equipment heat gains and profiles were assumed in accordance with Table 2 in CISBE TM59.

Room Type	Profile/ Gain
Living Room/ Kitchen	Peak load of 450W from 6pm-8pm 200W from 8pm- 10pm 110W from 9am to 6pm and from 10pm to 12pm Base load of 85W for the rest of the day
Single Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours
Double Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours

Table 21: Equipment Gains

Lighting Gains

Lighting gains of 2 W/m^2 have been assumed for each flat for the period of 6pm –11pm in accordance with CIBSE TM59. Lighting Gains of 8W/m2 have been assumed for the communal corridors.

A.8.3 Detailed Part of the Application Overheating Modelling Results

Domestic Dwellings

The results of the dynamic modelling overheating assessment are provided in Appendix A.8, and summarised below;-

Block	Windows	DSY1	DSY2 & 3
Block F	Open	100%	30%
Block H	Open	100%	47%
Block I	Open	100%	52%
Block J	Open	100%	48%
Block F	Closed (at night)	84%	38%
Block H	Closed (at night)	56%	19%
Block J	Closed (at night)	50%	19%

Table 22: TM59 Overheating Assessment results (Part O Compliant)

The results of the assessment of criteria (a) and (b) for the sample residential dwellings in the detailed part of the application are shown below.

2020	DSY1		DSY2		DSY3	
Block F windows openable at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
Dbl Bedroom L01.10	1.1	15	3.1	50	2.9	35
Dbl Bedroom L01.10	1.1	15	3.1	50	2.9	35
Dbl Bedroom L01.11	0.5	17	2.2	64	1.7	46
LDK L01.11	0.8	N/A	3.7	N/A	3	N/A
Dbl Bedroom L01.09	1.3	19	3.1	58	3.2	46
Dbl Bedroom L01.09	1.5	20	3.2	60	3.2	48
Dbl Bedroom L01.08	0.5	15	2	56	1.8	42
LDK L01.008	1.1	N/A	3.9	N/A	3.4	N/A
LDK L01.01	0.8	N/A	3.8	N/A	3.1	N/A
Dbl Bedroom L01.01	0.4	17	2	65	1.7	44
Dbl Bedroom L01.02	0.6	19	2.7	66	2.2	47
LDK L01.02	1	N/A	4	N/A	3.4	N/A
Dbl Bedroom L01.03	1.3	18	3.3	49	2.6	39
LDK L01.03	1.8	N/A	4.8	N/A	4.7	N/A
Dbl Bedroom L01.03	0.9	18	3	49	2.6	39
Dbl Bedroom L01.04	0.8	18	2.6	56	2.3	39
Dbl Bedroom L01.04	1	18	2.9	55	2.8	42
LDK L01.04	1.4	N/A	4.6	N/A	4.1	N/A
Dbl Bedroom L01.05	0.8	19	2.7	52	2.6	42
LDK L01.05	1.6	N/A	4.5	N/A	4.3	N/A
Dbl Bedroom L01.07	1.1	15	2.6	46	2.7	33
LDK L01.07	1.3	N/A	4.2	N/A	3.9	N/A
LDK L01.12	0.5	N/A	2.5	N/A	1.7	N/A
Dbl Bedroom L01.06	0.5	17	2.2	67	2	47
LDK L01.06	0.9	N/A	3.7	N/A	3.1	N/A
LDK L01.09	2.4	N/A	5.2	N/A	5.4	N/A
LDK L01.10	1.9	N/A	5.3	N/A	4.9	N/A
LDK L08.01	1.3	N/A	4.9	N/A	4.3	N/A
Dbl Bedroom L08.01	0.6	17	2.7	68	2.1	48
Dbl Bedroom L08.02	0.9	21	3.1	69	2.7	52
LDK L08.02	1.6	N/A	5	N/A	4.4	N/A
Dbl Bedroom L08.03	1.4	18	3.2	53	3.1	42
LDK L08.03	1.8	N/A	5	N/A	4.7	N/A
Dbl Bedroom L08.03	1.3	18	3.1	53	3.1	42
Dbl Bedroom L08.04	1	18	2.8	53	2.6	41
Dbl Bedroom L08.04	1.2	N/A	2.9	N/A	2.9	N/A
LDK L08.04	1.7	N/A	4.6	N/A	4.4	N/A
Dbl Bedroom L08.05	1	19	2.8	50	2.8	44
LDK L08.05	1.7	N/A	4.8	N/A	4.5	N/A
Single Bedroom L08.06	1.1	15	2.8	48	2.8	41
Dbl Bedroom L08.06	1.2	15	2.9	45	3	38
Single Bedroom L08.06	1.3	15	3.1	48	2.8	41
LDK L08.06	2.4	N/A	5.6	N/A	5.7	N/A

2020	DSY1		DSY2		DSY3	
Block F rooms with windows closed at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
Dbl Bedroom L01.10	1.1	20	1.9	43	3	55
Dbl Bedroom L01.10	1.1	20	1.9	43	3	55
Dbl Bedroom L01.09	0.5	35	2.1	69	3.3	98
Dbl Bedroom L01.09	0.8	35	2	68	3.3	99
Dbl Bedroom L01.08	1.3	23	1.3	59	1.9	78
LDK L01.008	1.5	N/A	2.8	N/A	4.3	N/A
LDK L01.01	0.5	N/A	2.6	N/A	3.4	N/A
Dbl Bedroom L01.01	1.1	23	1.4	59	1.7	77
Dbl Bedroom L01.02	0.8	25	1.5	63	2.1	84
LDK L01.02	0.4	N/A	2.6	N/A	3.5	N/A
Dbl Bedroom L01.03	0.6	28	2	62	2.8	79
Dbl Bedroom L01.03	1	28	1.8	62	2.8	79
LDK L01.07	1.3	N/A	2.8	N/A	4.3	N/A
LDK L01.09	1.8	N/A	3.9	N/A	6	N/A
LDK L01.10	0.9	N/A	3.7	N/A	5.3	N/A
LDK L08.01	0.8	N/A	3	N/A	5.1	N/A
Dbl Bedroom L08.01	1	36	1.5	74	2.3	107
Dbl Bedroom L08.02	1.4	42	1.8	81	3	115
LDK L08.02	0.8	N/A	3.1	N/A	5.1	N/A
Dbl Bedroom L08.03	1.6	39	2.1	75	3.4	107
Dbl Bedroom L08.03	1.1	39	2.2	75	3.4	107
Single Bedroom L08.06	1.3	26	2	58	3.1	87
LDK L08.06	0.5	N/A	3.8	N/A	6.1	N/A

2020	DSY1		DSY2		DSY3	
Block H windows openable at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
BH2 L02.05 Living room	2	N/A	3.3	N/A	2.7	N/A
BH2 L02.05 Kitchen	1.7	N/A	3.3	N/A	2.8	N/A
BH2 L02.04 Living room	1.9	N/A	3.2	N/A	2.5	N/A
BH2 L02.04 Kitchen	1.7	N/A	3.2	N/A	2.9	N/A
BH2 L02.03 LivingRm	0.9	N/A	2.3	N/A	2.7	N/A
BH2 L02.01 Dbl Bedroom	1.4	21	2	35	2.9	52
BH2 L02.01 DBl Bedroom	1.7	21	2	35	2.7	52
BH2 L02.02 Kitchen	2.4	N/A	3.7	N/A	2.5	N/A
BH2 L02.02 LivingRM	1.4	N/A	2.9	N/A	2.5	N/A
BH2 L02.02 F2 DBLBD2	0.8	N/A	1.8	N/A	1.8	N/A
BH2 L02.02 F2 SNGLBD	0.9	N/A	1.8	N/A	1.8	N/A
BH2 L02.02 DBLBD1	0.8	N/A	1.7	N/A	2.4	N/A
BH2 L02.03 Kitchen	0.9	N/A	2.6	N/A	2.5	N/A
BH2 L01.01 DBLBED2	1.4	24	2.1	36	2.7	56
BH2 L01.01 DBLBED1	1.6	24	2.2	38	2.6	56
BH2 L01.02 Kitchen diner	2.6	N/A	3.9	N/A	2.5	N/A

BH2 L01.02 Living room	1.7	N/A	3.2	N/A	2.5	N/A
BH2 L01.02 Dbl Bedroom	0.9	24	1.8	36	2.8	54
BH2 L01.01 Single Bed	1.2	23	1.9	30	2.5	50
BH2 L01.02 Dbl Bedroom	0.8	24	1.8	36	2.5	54
BH2 L03.01 Dbl Bedroom	1.3	24	2	36	2.4	57
BH2 L03.01 Dbl Bedroom	1.5	24	2	36	1.7	57
BH2 L03.01 Living/Dining	2	N/A	3.4	N/A	1.7	N/A
BH2 L03.02 Kitchen	2.6	N/A	3.9	N/A	2.4	N/A
BH2 L03.02 Kitchen	1.7	N/A	3.9	N/A	2.5	N/A
BH2 L03.02 Dbl Bedroom	1	24	1.9	36	2.8	55
BH2 L03.02 Single Bedroom	1.3	23	1.9	30	2.6	50
BH2 L03.02 Dbl Bedroom	0.8	24	1.9	36	2.6	55
BH2 L02.06 Kitchen	2.2	N/A	3.4	N/A	2.6	N/A
BH2 L02.06 Living room	2.6	N/A	3.9	N/A	2.6	N/A
BH2 L01.03 Twin Single Bed	0.9	15	1.6	25	5	41
BH2 L01.03 Dbl Bedroom	1.1	16	1.8	28	4.7	38
BH2 L01.03 Single Bedroom	1.1	20	1.9	31	4.9	48
BH2 L01.03 Dbl Bedroom	0.7	16	1.8	28	4.6	38
BH2 L01.04 Dbl Bedrrom	1.4	17	2.1	30	3.3	44
BH2 L01.04 Dbl Bedroom	1.4	20	2.1	32	3.2	48
BH2 L01.04 Single Bedroom	1.3	18	1.9	24	3.3	41
BH2 L01.04 Dbl Bedroom	1.1	20	2.1	32	5.4	48
BH2 L01.05 Dbl Bedroom	1.4	17	2.1	30	4.3	45
BH2 L01.05 Single Bedroom	1.3	17	2	26	3.3	39
BH2 L01.05 Single Bedroom	1.3	17	2	26	3.2	39
BH2 L01.05 Dbl Bedroom	1.2	17	2.1	30	3.4	45
BH2 L01.06 Twin Single Bedroom	0.5	23	1.3	33	5.7	48
BH2 L01.06 Twin Single Bedroom	0.5	23	1.3	33	4.7	48
BH2 L01.06 Dbl Bedroom	0.8	24	1.7	41	3	62
BH2 L01.06 Single Bedroom	0.6	39	1.7	56	3.1	75
BH2 L01.01 Living/Kitchen	2.3	N/A	3.5	N/A	3.3	N/A
BH1 L01.01 DBLBED2	1.3	25	2.2	35	4.9	58
BH1 L01.01 DBLBED1	1.5	25	2.3	35	5.8	58
BH1 L01.02 Living room	1.7	N/A	3.1	N/A	4.8	N/A
BH1 L01.02 Dbl Bedroom	1	24	1.8	36	3.2	53
BH1 L01.01 Single Bed	1.1	22	1.9	34	5.2	48
BH1 L01.02 Dbl Bedroom	0.8	24	1.8	36	5.6	53
BH1 L01.03 Twin Single Bed	0.9	15	1.6	24	2.8	41
BH1 L01.03 Dbl Bedroom	1	16	1.7	28	2.9	38
BH1 L01.03 Single Bedroom	1.1	20	1.9	32	3.2	48
BH1 L01.03 Dbl Bedroom	0.7	16	1.7	28	3.2	38
BH1 L01.04 Dbl Bedrrom	1.4	17	2.1	31	3	46
BH1 L01.04 Dbl Bedroom	1.4	20	2.2	32	2.9	48
BH1 L01.04 Single Bedroom	1.3	18	1.9	24	3.2	41
BH1 L01.04 Dbl Bedroom	1.1	20	2.2	32	2.9	48
BH1 L01.05 Dbl Bedroom	0.9	26	1.7	43	2.9	66

BH1 L01.05 Single Bedroom	0.8	20	1.7	33	2.9	51
BH1 L01.05 Single Bedroom	0.7	20	1.7	33	5.4	51
BH1 L01.05 Dbl Bedroom	0.7	26	1.7	43	3.3	66
BH1 L01.06 Twin Single Bedroom	0.5	19	1.3	28	3.4	44
BH1 L01.06 Twin Single Bedroom	0.5	19	1.3	28	5.5	44
BH1 L01.06 Dbl Bedroom	0.8	23	1.7	38	4.4	55
BH1 L01.06 Single Bedroom	0.9	20	1.8	33	2.8	50
BH1 L01.01 Living/Kitchen	2	N/A	3.4	N/A	2.7	N/A
BH2 L02.01 Living/Kitchen	2.3	N/A	3.7	N/A	2.9	N/A
BH1 L02.05 Living room	1.9	N/A	3.2	N/A	3.2	N/A
BH1 L02.05 Kitchen	1.7	N/A	3.1	N/A	3.2	N/A
BH1 L02.04 Living room	1.9	N/A	3.2	N/A	3	N/A
BH1 L02.04 Kitchen	1.7	N/A	3.1	N/A	2.9	N/A
BH1 L02.03 LivingRm	0.9	N/A	2.3	N/A	5.1	N/A
BH1 L02.01 Dbl Bedroom	1.3	21	2.1	30	5.1	54
BH1 L02.01 DBl Bedroom	1.6	21	2.1	30	4.8	54
BH1 L02.02 LivingRM	1.7	N/A	3.1	N/A	4.6	N/A
BH1 L02.02 F2 DBLBD2	1	N/A	1.9	N/A	4.9	N/A
BH1 L02.02 F2 SNGLBD	1.1	N/A	1.9	N/A	4.6	N/A
BH1 L02.02 DBLBD1	0.8	N/A	1.7	N/A	3.4	N/A
BH1 L02.03 Kitchen	0.9	N/A	2.5	N/A	3.3	N/A
BH1 L02.06 Kitchen	2.2	N/A	3.4	N/A	3.4	N/A
BH1 L02.06 Living room	2.8	N/A	4	N/A	5.5	N/A
BH1 L02.01 Living/Kitchen	1.9	N/A	3.3	N/A	4.4	N/A
BH2 L03.03 Kitchen	1.1	N/A	2.6	N/A	2.9	N/A
BH2 L03.03 Single Bedroom	0.9	16	1.7	25	3.3	38
BH2 L03.03 Dbl Bedroom	1	14	1.8	22	5.2	37
BH2 L03.03 Living room	1.2	N/A	2.6	N/A	5.8	N/A
BH2 L03.03 Dbl Bedroom	0.9	14	1.8	22	5	37
BH2 L03.04 Dbl Bedroom	1.1	22	1.9	29	3.6	46
BH2 L03.04 Living/Kitchen	1.6	N/A	3.1	N/A	2.6	N/A
BH2 L03.05 Single Bedroom	1.4	18	2	26	2.7	41
BH2 L03.05 Dbl Bedroom	1.4	20	2	27	3.8	44
BH2 L03.05 Living/Kitchen	2.6	N/A	3.9	N/A	2.8	N/A
BH1 L03.01 Dbl Bedroom	1.2	24	2.1	35	4.7	57
BH1 L03.01 Dbl Bedroom	1.4	24	2.1	35	3	57
BH1 L03.01 Living/Dining	1.6	N/A	3	N/A	3.1	N/A
BH1 L03.02 Kitchen	2.4	N/A	3.7	N/A	5.6	N/A
BH1 L03.02 Kitchen	1.8	N/A	3.7	N/A	3.1	N/A
BH1 L03.02 Dbl Bedroom	1.1	25	1.9	35	3.3	51
BH1 L03.02 Single Bedroom	1.2	24	2	33	4.8	46
BH1 L03.02 Dbl Bedroom	0.8	25	1.9	35	5.1	51
BH1 L03.03 Kitchen	1.1	N/A	2.5	N/A	4.4	N/A
BH1 L03.03 Single Bedroom	0.9	16	1.7	25	2.7	38
BH1 L03.03 Dbl Bedroom	1	14	1.8	22	2.9	37
BH1 L03.03 Living room	1.2	N/A	2.7	N/A	3.6	N/A

BH1 L03.03 Dbl Bedroom	1	14	1.8	22	2.6	37
BH1 L03.04 Dbl Bedroom	1.1	22	1.8	29	2.7	46
BH1 L03.04 Living/Kitchen	1.6	N/A	3	N/A	3.8	N/A
BH1 L03.05 Single Bedroom	1.4	18	2	26	2.8	41
BH1 L03.05 Dbl Bedroom	1.4	20	2	27	4.6	44
BH1 L03.05 Living/Kitchen	2.7	N/A	3.9	N/A	3	N/A
BH2 L03.01 Dbl Bedroom	1.5	24	2	36	3.1	57
BH2 L03.01 Dbl Bedroom	1.7	24	2	36	5.6	57
BH2 L03.01 Living/Dining	2.5	N/A	3.4	N/A	3.3	N/A
BH2 L03.02 Living	2.1	N/A	3.7	N/A	3.5	N/A
BH2 L03.02 Dbl Bedroom	1.2	24	1.9	36	5.8	55
BH2 L03.02 Single Bedroom	1.4	23	1.9	30	6.3	50
BH2 L03.02 Dbl Bedroom	1	24	1.9	36	5.4	55
BH2 L03.03 Kitchen	1.3	N/A	2.6	N/A	3	N/A
BH2 L03.03 Single Bedroom	1.5	16	1.7	25	3.1	38
BH2 L03.03 Dbl Bedroom	1.3	14	1.8	22	2.7	37
BH2 L03.03 Living room	1.4	N/A	2.6	N/A	4	N/A
BH2 L03.03 Dbl Bedroom	1.1	14	1.8	22	3.2	37
BH2 L03.04 Dbl Bedroom	1.4	22	1.9	29	3.1	46
BH2 L03.04 Living/Kitchen	2.4	N/A	3.1	N/A	4.5	N/A
BH1 L03.01 Dbl Bedroom	1.4	24	2.1	35	2.9	57
BH1 L03.01 Dbl Bedroom	1.6	24	2.1	35	3.1	57
BH1 L03.01 Living/Dining	2.3	N/A	3	N/A	5.3	N/A
BH1 L03.02 Kitchen	2	N/A	3.7	N/A	3.2	N/A
BH1 L03.02 Dbl Bedroom	1.2	25	1.9	35	3.2	51
BH1 L03.02 Single Bedroom	1.3	24	2	33	6.2	46
BH1 L03.02 Dbl Bedroom	1	25	1.9	35	3.4	51
BH1 L03.03 Kitchen	1.3	N/A	2.5	N/A	3.5	N/A
BH1 L03.03 Single Bedroom	1.5	16	1.7	25	5.5	38
BH1 L03.03 Dbl Bedroom	1.3	14	1.8	22	5.9	37
BH1 L03.03 Living room	1.4	N/A	2.7	N/A	4.7	N/A
BH1 L03.03 Dbl Bedroom	1.1	14	1.8	22	3	37
BH1 L03.04 Dbl Bedroom	1.4	22	1.8	29	3.1	46
BH1 L03.04 Living/Kitchen	2.4	N/A	3	N/A	2.7	N/A
BH1 L03.05 Single Bedroom	1.5	18	2	26	4	41
BH1 L03.05 Dbl Bedroom	1.5	20	2	27	3.2	44
BH1 L01.02 Kitchen diner	2.6	N/A	3.7	N/A	3.1	N/A
BH1 L02.02 Kitchen	2.6	N/A	3.7	N/A	4.5	N/A
BH2 L03.05 Single Bedroom	1.5	18	2	26	3.1	41
BH2 L03.05 Dbl Bedroom	1.5	20	2	27	5.3	44
BH2 L03.05 Living/Kitchen	3	N/A	3.9	N/A	3.2	N/A
BH1 L03.02 Kitchen	2.8	N/A	3.7	N/A	3.2	N/A
BH1 L03.05 Living/Kitchen	3	N/A	3.9	N/A	6.2	N/A

2020	DSY1		DSY2		DSY3	
Block H rooms with windows closed at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
BH2 L02.05 Kitchen	2.4	N/A	3.7	N/A	5.3	N/A
BH2 L02.04 Kitchen	2.5	N/A	3.7	N/A	5.3	N/A
BH2 L02.01 Dbl Bedroom	2	69	2.8	106	4.2	149
BH2 L02.01 DBl Bedroom	2	69	2.9	106	4.4	149
BH2 L01.01 DBLBED2	2.4	N/A	2.9	114	4.6	157
BH2 L01.01 DBLBED1	2.5	73	2.9	114	4.7	156
BH2 L03.01 Dbl Bedroom	1.9	71	2.9	105	4.2	153
BH2 L03.01 Dbl Bedroom	1.9	71	2.9	105	4.5	153
BH2 L03.01 Living/Dining	2.8	N/A	4.1	N/A	6.3	N/A
BH2 L02.06 Living room	3.1	N/A	4	N/A	6.1	N/A
BH2 L01.03 Dbl Bedroom	1.4	36	2.1	64	3.4	95
BH2 L01.04 Dbl Bedrrom	1.8	66	2.6	98	4	147
BH2 L01.04 Dbl Bedroom	1.8	62	2.5	95	3.9	136
BH2 L01.05 Dbl Bedroom	1.7	65	2.6	97	4	145
BH2 L01.05 Single Bedroom	1.7	58	2.5	92	3.8	133
BH2 L01.06 Dbl Bedroom	1.4	75	2.6	109	4	155
BH2 L01.06 Single Bedroom	1.7	85	3	112	4.7	161
BH2 L01.01 Living/Kitchen	3.3	N/A	4.4	N/A	6.6	N/A
BH1 L01.01 DBLBED2	2.2	72	2.8	108	4.4	158
BH1 L01.01 DBLBED1	2.2	71	2.8	107	4.3	157
BH1 L01.03 Dbl Bedroom	1.3	36	2.1	64	3.4	95
BH1 L01.04 Dbl Bedrrom	1.7	66	2.6	98	4	146
BH1 L01.04 Dbl Bedroom	1.8	63	2.5	96	3.9	138
BH1 L01.05 Dbl Bedroom	1.6	71	2.6	106	4	150
BH1 L01.05 Single Bedroom	1.3	61	2.5	96	3.7	140
BH1 L01.06 Dbl Bedroom	1.4	72	2.5	109	3.9	152
BH1 L01.06 Single Bedroom	1.5	62	2.6	101	3.9	141
BH1 L01.01 Living/Kitchen	2.9	N/A	4.1	N/A	6.3	N/A
BH2 L02.01 Living/Kitchen	3.1	N/A	4.2	N/A	6.5	N/A
BH1 L02.05 Kitchen	2.3	N/A	3.6	N/A	5.3	N/A
BH1 L02.04 Kitchen	2.5	N/A	3.7	N/A	5.3	N/A
BH1 L02.01 Dbl Bedroom	1.9	70	2.7	103	4.2	153
BH1 L02.01 DBl Bedroom	1.9	70	2.7	103	4.1	153
BH1 L02.06 Living room	3.2	N/A	4.1	N/A	6.3	N/A
BH1 L02.01 Living/Kitchen	2.8	N/A	4.1	N/A	6.1	N/A
BH2 L03.03 Single Bedroom	1.3	37	2.1	67	3.2	91
BH2 L03.03 Living room	1.4	N/A	3.1	N/A	4.6	N/A
BH2 L03.04 Living/Kitchen	2.1	N/A	3.5	N/A	5.1	N/A
BH2 L03.05 Living/Kitchen	3.1	N/A	4.2	N/A	6.4	N/A

2020	DSY1		DSY2		DSY3	
Block I	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
Double Bedroom 02.02	0.7	19	1.7	37	2.5	54
LDK 2bed 02.02	1.5	N/A	2.9	N/A	4.5	N/A
Double Bedroom 02.02	0.5	19	1.7	37	2.5	54
Dpuble Bedroom 02.05	0.5	23	1.5	39	2.1	60
LDK 2bed 02.05	1.6	N/A	2.9	N/A	4.3	N/A
LDK 1bed 07.02	2.4	N/A	3.6	N/A	5.8	N/A
Double Bedroom 07.03	1.3	17	2	28	3	45
LDK 2bed 07.03	2.3	N/A	3.6	N/A	5.2	N/A
Double Bedroom 07.04	1.3	14	2	21	3	38
LDK 1bed 07.04	2.2	N/A	3.8	N/A	5.6	N/A
LDK 1bed 07.01	2.1	N/A	3.6	N/A	5.4	N/A
Double Bedroom 07.01	1	17	1.8	27	2.8	42
Double Bedroom 02.01	1.1	19	1.8	29	2.8	44
Bathroom	1.9	N/A	2.9	N/A	4.5	N/A
LDK 1bed 02.01	1.7	N/A	3.1	N/A	4.7	N/A
Double Bedroom 02.06	1.1	17	1.8	27	2.8	43
LDK 1bed 02.06	1.4	N/A	3	N/A	4.6	N/A
Double Bedroom 02.05	0.7	22	1.6	38	2.5	55
Double Bedroom 07.04	1.8	14	2	21	3	38

2020	DSY1		DSY2		DSY3	
Block J windows openable at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
H15 Kitchen/Din	2.7	NA	4	NA	5.9	NA
GF H15 LivingRoom	0.8	NA	2.1	NA	3	NA
1F H15 SingleBed	0.9	19	1.7	35	2.5	45
2F H1 Kitchen/Din	2.2	NA	3.7	NA	5.4	NA
2F H1 LivingRoom	0.9	NA	2.6	NA	4.1	NA
3F H1 DoubleBed	0.9	19	1.9	29	2.7	39
3F H1 SingleBed	0.8	18	1.7	27	2.6	45
3F H1 DoubleBed	0.9	19	1.9	29	2.7	39
1F H15 DoubleBed	1	22	1.6	40	2.7	60
1F H15 DoubleBed	1	22	1.6	40	2.7	60
H6 Kitchen/Din	2.2	NA	3.7	NA	5.4	NA
GF H6 LivingRoom	0.7	NA	2.1	NA	2.7	NA
1F H6 SingleBed	0.7	16	1.5	27	2.6	47
1F H6 SingleBed	0.8	16	1.5	27	2.6	47
1F H6 DoubleBed	1	21	2	33	2.8	44
1F H6 DoubleBed	0.4	21	2	33	2.8	44
2F H6 DoubleBed	0.2	16	0.9	29	1.1	45
2F H6 SingleBed	0.5	16	1.4	27	2.1	43
1F H15 SingleBed	0.8	19	1.7	35	2.5	45

2020	DSY1		DSY2		DSY3	
Block J windows closed at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
H15 Kitchen/Din	3.8	NA	4.9	NA	7.1	NA
GF H15 LivingRoom	1.3	NA	3.1	NA	5.2	NA
1F H15 SingleBed	1.8	134	2.8	139	4.3	212
2F H1 Kitchen/Din	3.6	NA	5	NA	7.4	NA
2F H1 LivingRoom	2.1	NA	4.1	NA	6.5	NA
3F H1 DoubleBed	2.1	100	3.3	118	4.7	178
3F H1 SingleBed	1.9	110	3	134	4.5	196
3F H1 DoubleBed	2.1	100	3.1	118	4.7	178
1F H15 DoubleBed	1.7	80	2.5	116	4.2	168
1F H15 DoubleBed	1.7	80	2.9	116	4.3	168
H6 Kitchen/Din	3.3	NA	4.6	NA	6.9	NA
GF H6 LivingRoom	1	NA	2.7	NA	4	NA
1F H6 SingleBed	1.1	64	1.9	98	3.2	145
1F H6 SingleBed	1.1	64	2.3	98	3.6	145
1F H6 DoubleBed	1.7	75	2.7	106	3.9	152
1F H6 DoubleBed	1.7	75	2.2	106	3.5	152
2F H6 DoubleBed	1.4	104	3	127	4.7	186
2F H6 SingleBed	1.6	75	2.8	108	4.4	160
1F H15 SingleBed	1.8	134	2.6	139	3.9	212

Non-Domestic

The results of the assessment of the three criteria for the non-domestic elements of the detailed part of the application are shown below (using DSY 1).

Room Reference	Criterion 1: % Hours exceeding comfort range	Criterion 2: Maximum daily degree hours	Criterion 3: Maximum ΔT	Result
Target	**< 3**	**< 6**	**< 4**	
BF01 Retail	97.1	158	15	FAIL
BF02 Retail	98	159	17	FAIL
Marketing Suite 1 (2B4P)	75.9	121	14	FAIL
Marketing Suite 2 (Closing room)	9.6	17	3	FAIL
Marketing Suite 3 (BF04)	77.1	99	10	FAIL
Cafe	36.2	59	7	FAIL
BH1-01 Retail	97.2	126	14	FAIL
BH1-02 Retail	96.4	102	10	FAIL

Room Reference	Criterion 1: % Hours exceeding comfort range	Criterion 2: Maximum daily degree hours	Criterion 3: Maximum ΔT	Result
Target	**< 3**	**< 6**	**< 4**	
BH1-03 Retail	93.8	82	8	FAIL
BH1-04 Retail	87.0	61	6	FAIL
BH1-05 Retail	93.2	91	9	FAIL
BH1-06 Retail	92.6	81	8	FAIL
BH2-01 Retail	98.5	145	15	FAIL
BH2-02 Retail	97.3	106	11	FAIL
BH2-03 Retail	94.1	82	8	FAIL
BH2-04 Retail	83.6	53	5	FAIL
BH2-05 Retail	85.1	58	6	FAIL
BH2-06 Retail	88.9	62	6	FAIL
BH3-01 Retail	99.3	109	13	FAIL
BH3-02 Retail	86.7	76	10	FAIL
BH3-03 Retail	87.9	88	11	FAIL
BH3-04 Retail	89.6	94	12	FAIL

A.8.4 Outline Part of the Application Overheating Modelling Results

Domestic Dwellings – Recessed Balconies

The results of the assessment of criteria (a) and (b) for the sample residential dwellings in the outline part of the application using recessed balconies are shown below.

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	**DSY 2**	**DSY 3**	**DSY 1**	**DSY 2**	**DSY 3**
Target	**< 3**	**< 3**	**< 3**	**< 33**	**< 33**	**< 33**
E4.02.02 Living Kitchen	2.1	3.5	5.6	-	-	-
E4.02.02 Double Bed 1	0.4	1.2	1.6	11	21	35
E4.02.02 Double Bed 2	1.3	2.1	3.5	19	35	51
E4.08.02 Living Kitchen	2.9	3.8	6.2	-	-	-
E4.08.02 Double Bed 1	0.8	1.5	2.7	15	24	38
E4.08.02 Double Bed 2	2.5	2.9	4.2	22	37	56
E1.14.06 Living Kitchen	3.7	4.8	6.9	-	-	-
E1.14.06 Double Bed 1	0.7	1.8	2.6	16	31	40
E1.14.06 Double Bed 2	2.2	2.5	3.8	19	33	47
E1.20.06 Living Kitchen	3.7	4.8	6.9	-	-	-
E1.20.06 Double Bed 1	0.8	1.8	2.7	17	30	40
E1.20.06 Double Bed 2	2.2	2.6	3.9	20	33	46
E1.02.08 Living Kitchen	1.5	3.0	4.6	-	-	-
E1.02.08 Double Bed	1.1	1.6	3	16	25	40
E1.08.08 Living Kitchen	1.9	3.3	5.1	-	-	-
E1.08.08 Double Bed	1.6	2.2	3.5	17	28	42
E1.14.08 Living Kitchen	2.1	3.4	5.5	-	-	-
E1.14.08 Double Bed	1.9	2.3	3.6	18	32	47
E1.20.08 Living Kitchen	2.2	3.5	5.6	-	-	-
E1.20.08 Double Bed	2.0	2.3	3.7	19	33	46
E1.14.02 Living Kitchen	3.3	4.2	6.7	-	-	-
E1.14.02 Double Bed 1	0.5	1.4	2.1	15	26	38
E1.14.02 Double Bed 2	0.7	1.6	2.4	17	30	45
E1.20.02 Living Kitchen	3.4	4.2	6.6	-	-	-
E1.20.02 Double Bed 1	0.5	1.4	2.2	15	27	41
E1.20.02 Double Bed 2	0.7	1.6	2.5	17	28	44

Domestic Dwellings – Projecting Balconies

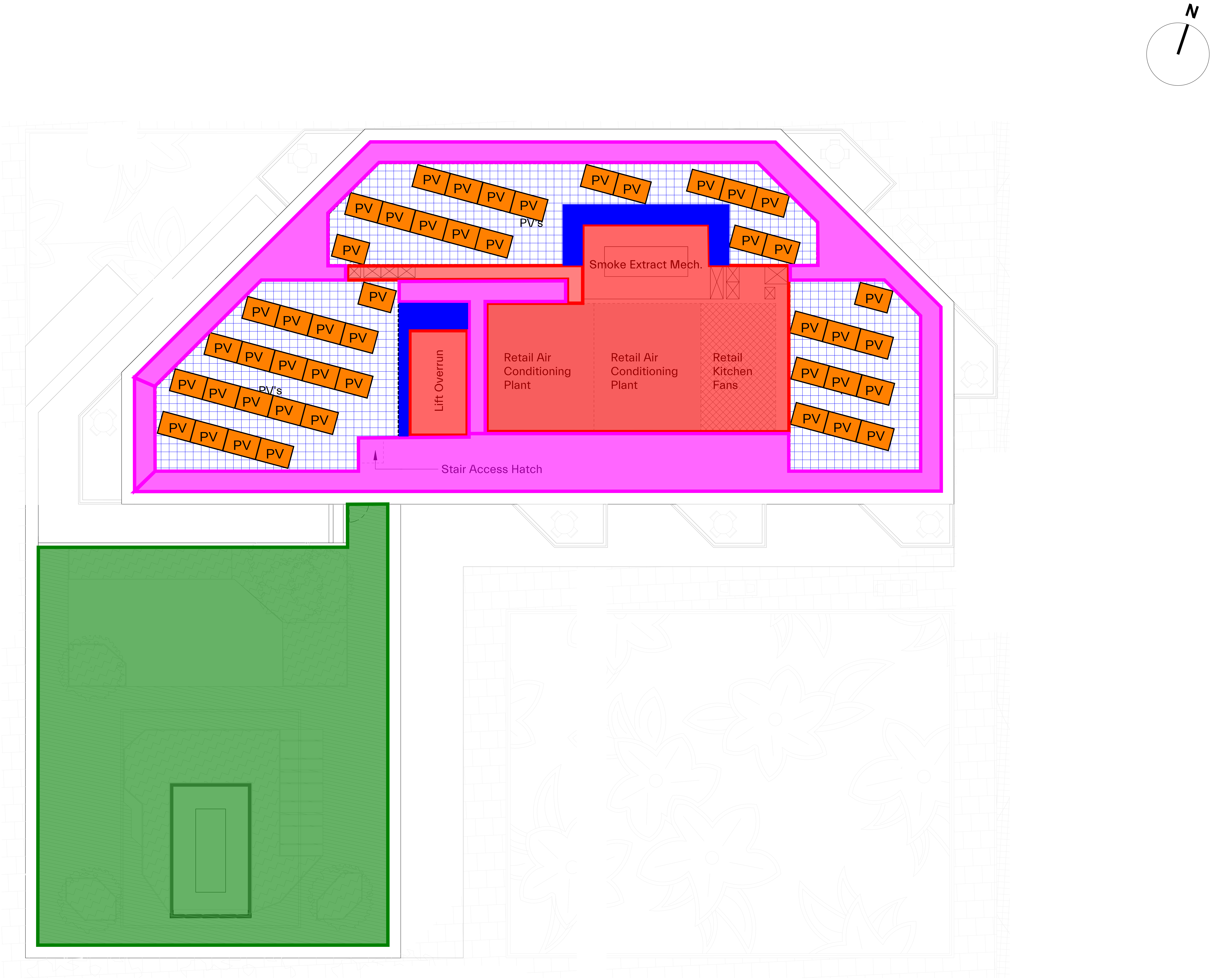
The results of the assessment of criteria (a) and (b) for the sample residential dwellings in the outline part of the application using projecting balconies are shown below.

Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperature (°C) - hours in range		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	**< 3**	**< 3**	**< 3**	**< 33**	**< 33**	**< 33**
E4.02.02 Living Kitchen	2.0	3.5	5.2	-	-	-
E4.02.02 Double Bed 1	0.4	1.3	1.7	11	23	32
E4.02.02 Double Bed 2	1.0	1.7	2.9	17	33	44
E4.08.02 Living Kitchen	3.7	4.5	6.8	-	-	-
E4.08.02 Double Bed 1	1.5	2.2	3.3	17	32	41
E4.08.02 Double Bed 2	3.1	3.2	4.6	24	38	57
E1.14.06 Living Kitchen	3.7	4.7	6.8	-	-	-
E1.14.06 Double Bed 1	0.9	1.8	2.7	17	27	38
E1.14.06 Double Bed 2	2.3	2.5	4	20	34	47
E1.20.06 Living Kitchen	4.3	5.2	7.6	-	-	-
E1.20.06 Double Bed 1	1.3	2.2	3.4	17	32	42
E1.20.06 Double Bed 2	2.7	3	4.4	22	35	52
E1.02.08 Living Kitchen	1.4	2.8	4.2	-	-	-
E1.02.08 Double Bed	0.9	1.4	2.6	12	23	31
E1.08.08 Living Kitchen	1.8	3.2	4.6	-	-	-
E1.08.08 Double Bed	1.3	2.0	3	13	23	32
E1.14.08 Living Kitchen	2.2	3.6	5.5	-	-	-
E1.14.08 Double Bed	1.8	2.2	3.5	17	27	38
E1.20.08 Living Kitchen	3.4	4.1	6.5	-	-	-
E1.20.08 Double Bed	2.3	2.5	3.8	18	30	42
E1.14.02 Living Kitchen	3.2	4.1	6.6	-	-	-
E1.14.02 Double Bed 1	0.7	1.6	2.4	17	32	43
E1.14.02 Double Bed 2	0.6	1.4	2.2	16	26	39
E1.20.02 Living Kitchen	3.5	4.2	6.7	-	-	-
E1.20.02 Double Bed 1	0.9	1.8	2.7	17	33	47
E1.20.02 Double Bed 2	0.8	1.5	2.5	17	29	41

Appendix A.9 - Drawings

ISO A1 841mm x 594mm

🟪	Maintenance Access Routes
🟦	Shaded Areas
▦	Areas Available for PV
🟩	Amenity Space
🟥	Plant Areas / Services Distribution Routes



FOR INFORMATION	PROJECT ABERFELDY VILLAGE MASTERPLAN	CLIENT ECOWORLD & POPLAR HARCA	DISCIPLINE MECHANICAL		DATE 08/10/21	SCALE @ A1 1:100
MEINHARDT 10 Aldersgate Street, London EC1A 4HJ. Telephone: +44 (0)20 7831 7969 www.meinhardt.co.uk		TITLE BLOCK F PV LAYOUT	DRAWN SF	DESIGNED RD	CHECKED RD	APPROVED RD
			DRAWING No 2812-SK-001			ISSUE P02

🟪	Maintenance Access Routes
🟦	Shaded Areas
▦	Areas Available for PV
🟪	Pitched Roofs - not suitable for PV due to north facing orientation
🟧	Pitched Roofs - not suitable for PV due to restricted access
🟥	Plant Areas / Services Distribution Routes
🟩	Amenity Space

FOR INFORMATION

MEINHARDT
10 Aldersgate Street, London EC1A 4HJ.
Telephone: +44 (0)20 7831 7969
www.meinhardt.co.uk

PROJECT
ABERFELDY VILLAGE
MASTERPLAN

CLIENT
ECOWORLD & POPLAR HARCA

TITLE
BLOCK H PV LAYOUT

DISCIPLINE
MECHANICAL

DATE
20/10/23

SCALE @ A1
1:100

DRAWN
WN

DESIGNED
RD

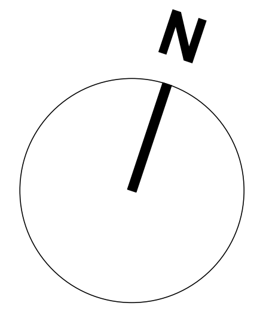
CHECKED
RD

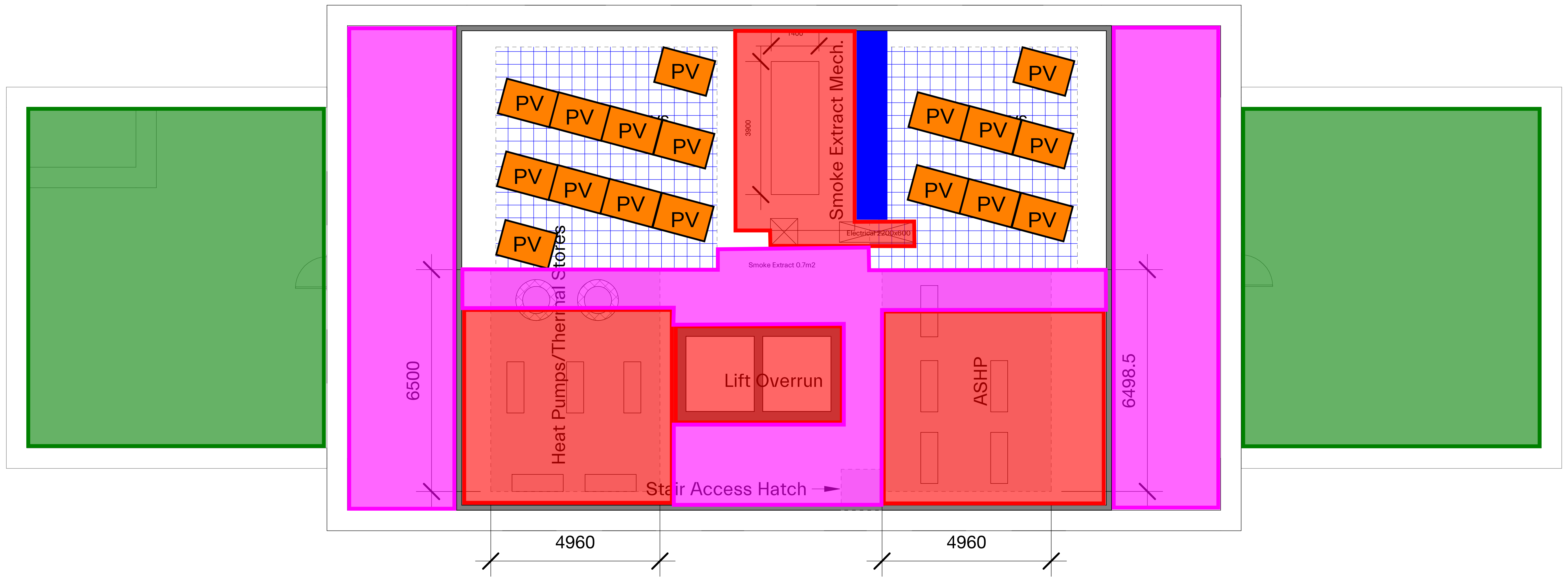
APPROVED
RD

DRAWING No
2812-SK-001

ISSUE
P04

ISO A1 841mm x 594mm

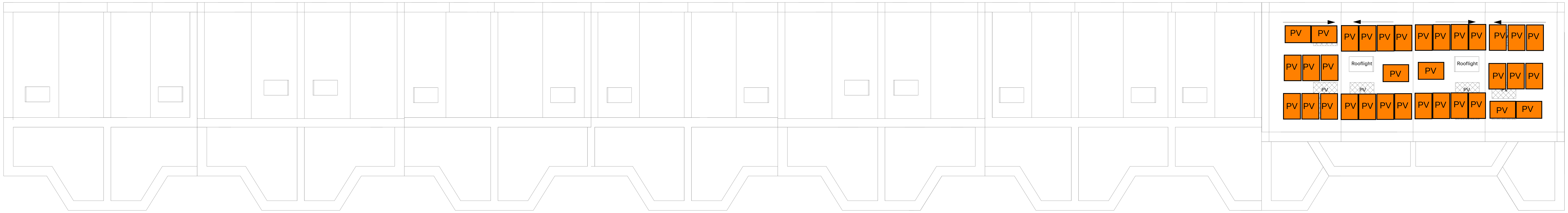




- 🟪 Maintenance Access Routes
- 🟦 Shaded Areas
- ▦ Areas Available for PV
- 🟩 Amenity Space
- 🟥 Plant Areas / Services Distribution Routes

FOR INFORMATION	PROJECT ABERFELDY VILLAGE MASTERPLAN	CLIENT ECOWORLD & POPLAR HARCA	DISCIPLINE MECHANICAL	DATE 08/10/21	SCALE @ A1 1:100
MEINHARDT 10 Aldersgate Street, London EC1A 4HJ. Telephone: +44 (0)20 7831 7969 www.meinhardt.co.uk		TITLE BLOCK I PV LAYOUT	DRAWN SF	DESIGNED RD	CHECKED RD
					APPROVED RD
			DRAWING No 2812-SK-003		ISSUE P02

ISO A1 841mm x 594mm



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PROJECT ABERFELDY VILLAGE MASTERPLAN	CLIENT ECOWORLD & POPLAR HARCA	DISCIPLINE MECHANICAL		DATE 08/10/21	SCALE @ A1 1:100
	TITLE BLOCK J1 PV LAYOUT	DRAWN SF	DESIGNED RD	CHECKED RD	APPROVED RD
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