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engineering sustainable buildings

Energy Statement
Ref: Z70633 RevA

13 No. Apartments Dwellings

at

101 Queens Road,
Cheetham Hill,
M8 8UT

for

Create It Studios





DESIGNER CERTIFIED PASSIVE HOUSE DESIGNER

BREEAM ACCREDITED PROFESSIONAL

LOW CARBON ENERGY ASSESSORS

CIBSE Certification Ltd

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Executive Summary

This Energy Statement has been developed in support of the planning application for the proposed 13 No. new build apartments 101 Queens Road, Cheetham Hill. This Energy Statement will evaluate the technical and economic feasibility of using both passive and low and zero carbon technologies and will assess the practical levels of CO_2 reduction possible for this development to comply with the following Manchester City Council's planning requirements:

- National Planning Policy Framework (2025)
- Manchester City Council's Core Strategy Development plan (2012-2027)
- Places for Everyone Joint Development Plan (2024)

The following low and zero carbon technologies have been evaluated:

- Biomass
- Wind
- Biogas
- Air Source Heat Pumps & Exhaust Air Heat Pumps
- Geothermal
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photovoltaic

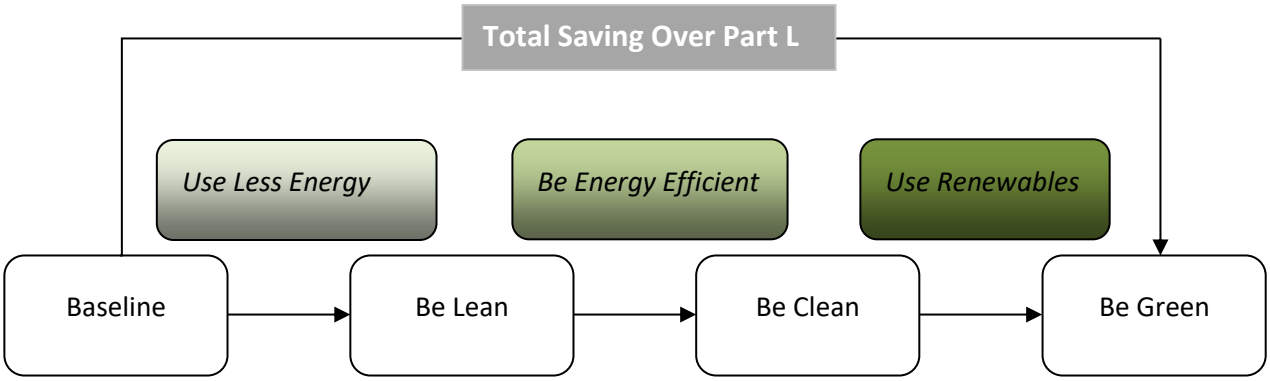
The approach for the development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Enhanced building fabric to meet Building Regulation ADL1A 2021.
2. Enhanced air tightness and thermal bridging
3. Highly efficient mechanical ventilation with heat recovery system to all dwellings
4. Heating will be provided by highly efficient electric panel heaters
5. Hot water will be provided by highly efficient hot water heat pumps
6. Efficient lighting strategy primarily using LED type fittings.
7. 18kW PV Array mounted on the roof to benefit the building

For the purpose of the assessment, we have evaluated the dwelling types in ADL1A 2021 (Standard Assessment Procedure SAP 10) to provide an accurate estimate of predicted energy consumption/CO_2 emissions.

Summary

The development has been provided with energy savings through the use of passive improvement measures such as improved energy efficiency. This passive approach to compliance will complement the integrated approach to the sustainable energy objectives of the national and local policies.



The principles of a Be Lean, Be Clean, Be Green design philosophy have been applied, which results in a 77.18% improvement and a 47.86% primary energy improvement over Building Regulations Part L1A 2021, as indicated in Table 1. A full design specification that confirms inputs used within the SAP calculations is provided within the Appendices of this report.

Table 1 - Proposed development emissions against Building Regulations Part L1A 2021

	Total CO_2 Emissions ($kgCO_2/yr$)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	**11,983**	**63,827**
Proposed Dwelling Performance	**2,735**	**33,280**
Total Reduction	**9,248**	**30,547**
Percentage Improvement (above ADL1 2021)	**77.18%**	**47.86%**

1. Introduction

The proposed new build development is for 13 No. apartments at 101 Queens Road, Cheetham Hill. The dwellings will be assessed under Building Regulations Approved Document Part L1A (2021).

Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

- National Planning Policy Framework (2025)
- Manchester City Council's Core Strategy Development plan (2012-2027)
- Places for Everyone Joint Development Plan (2024)

Throughout this report, passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the 'Be Lean, Be Clean, Be Green' philosophy of relevant planning documents and the Energy Hierarchy.

An assessment of CO_2 emissions will be made based on the calculation methodology dictated by the Standard Assessment Procedure (SAP) and in line with the requirements of Places for Everyone Joint Development Plan (2024).

1.1. Location

The area of land for the proposed development at 101 Queens Road, Cheetham Mill is highlighted by the red line boundary shown in the image below.

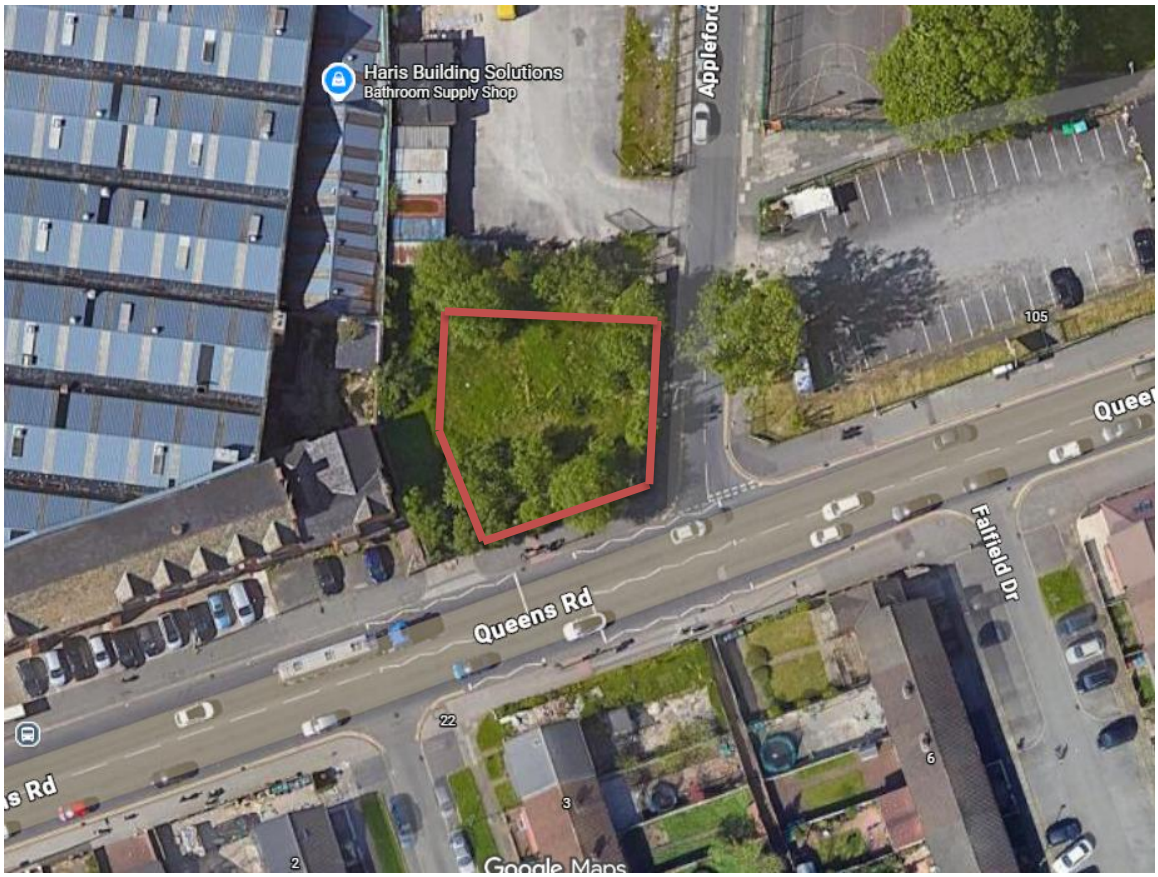


Figure 1 - Location and surrounding area of proposed residential development

The site will be accessed from Queens Road in Cheetham Hill. The surrounding area is predominantly suburban, with the Manchester Coach Station located to the West and residential properties bordering the remainder of the development.

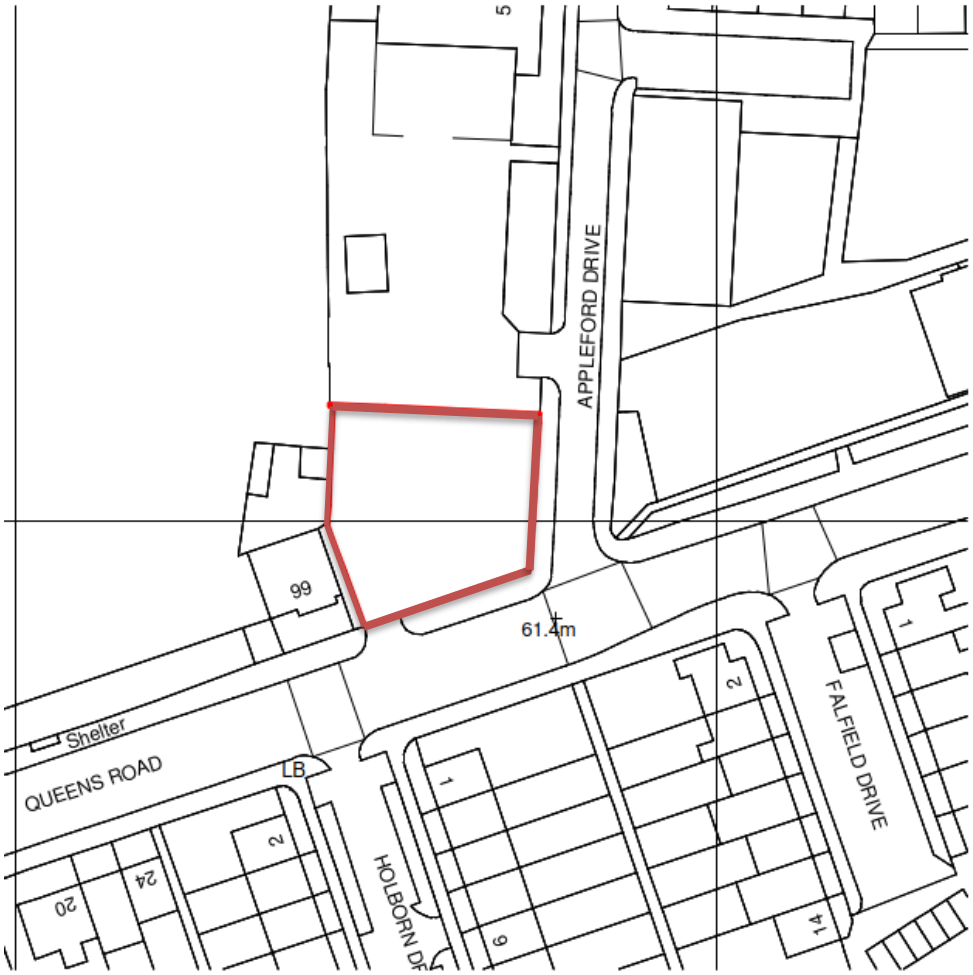


Figure 2 - Site Plan for Proposed development

The proposed development is as shown within the red line boundary defined in figure 2 above.

1.2. Floor Plans

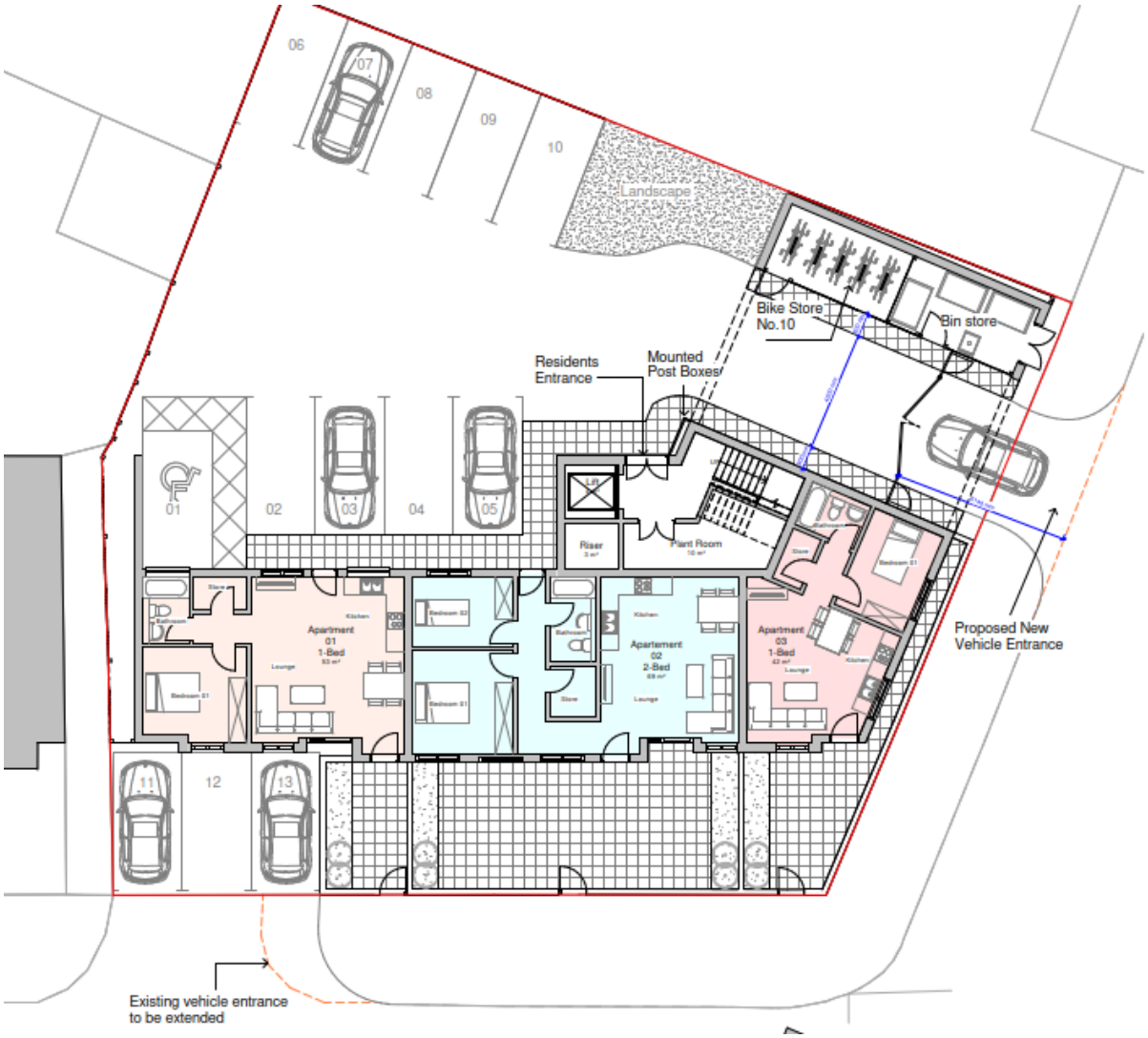
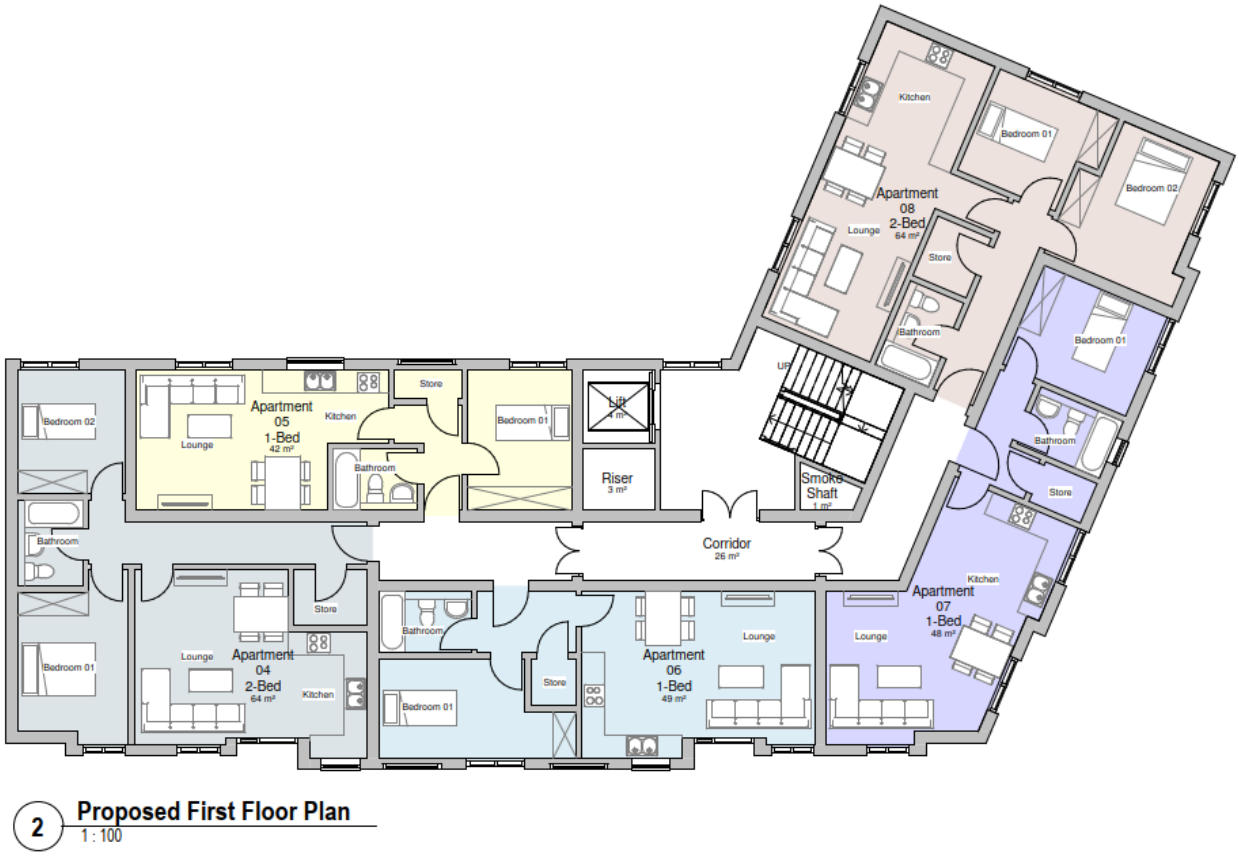


Figure 3 - Ground Floor Plan



2 **Proposed First Floor Plan**
1 : 100

Figure 4 - 1st Floor plan

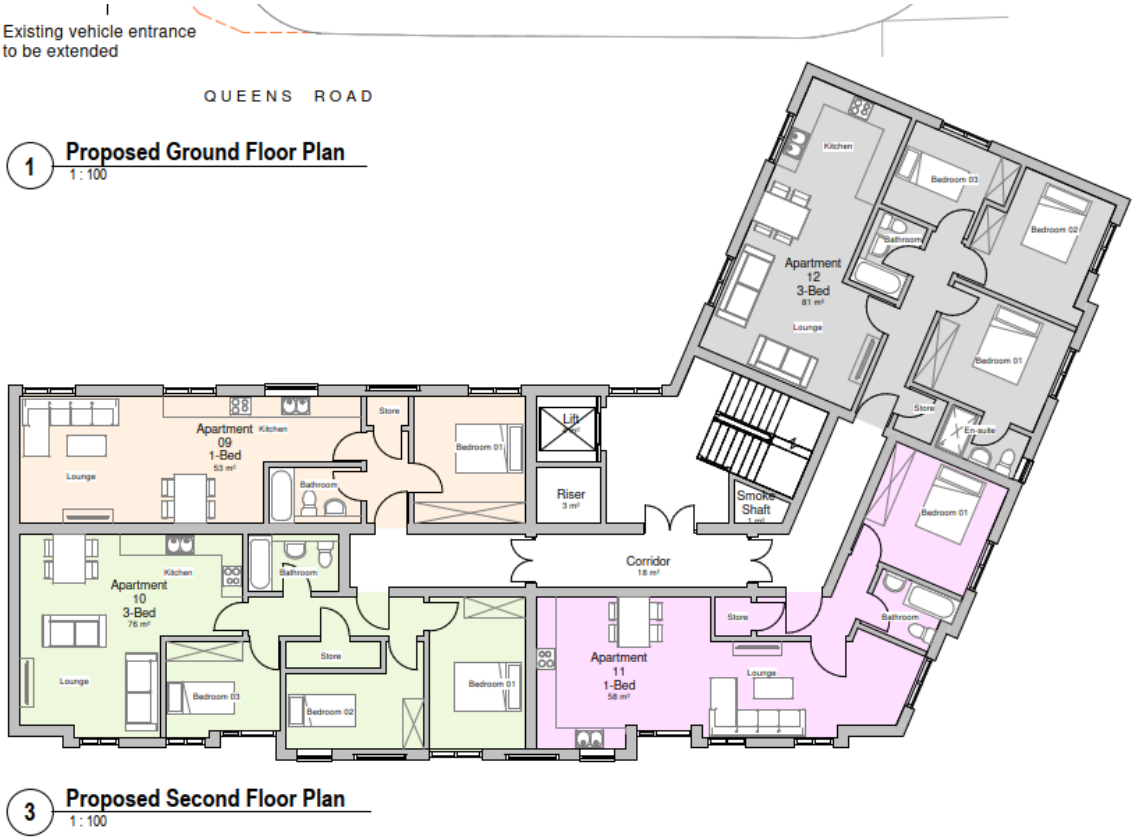


Figure 5 - 2nd Floor Plan

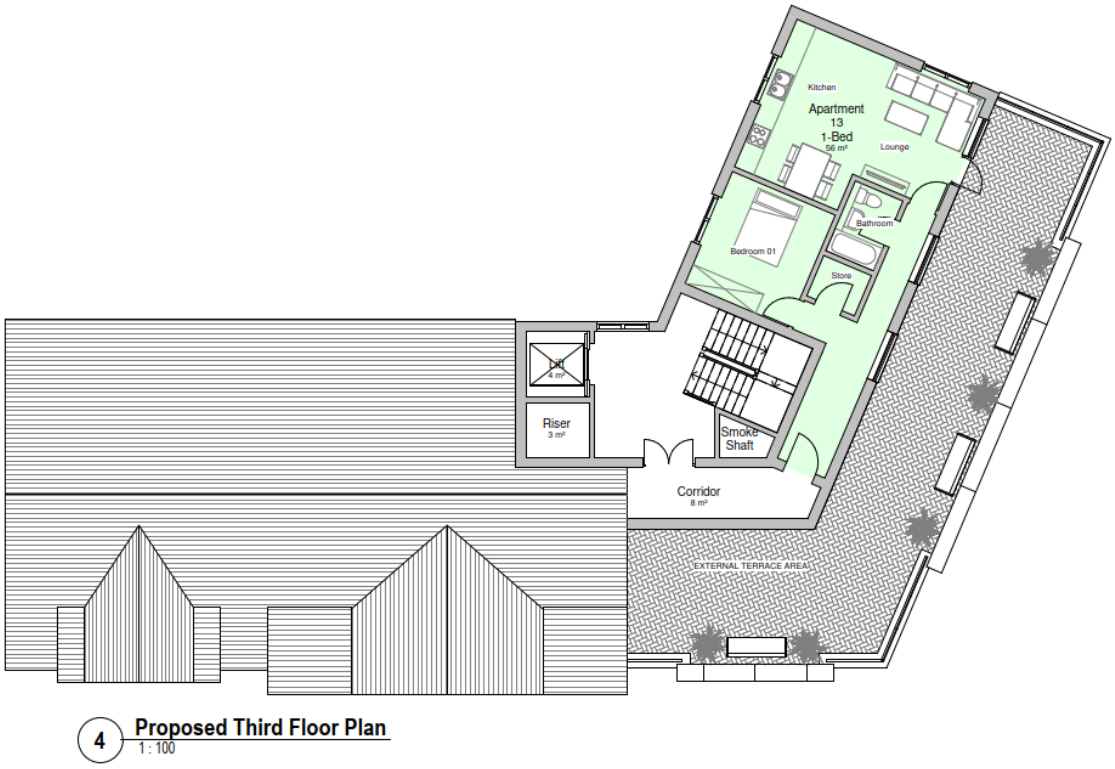


Figure 6 - 3rd Floor Plan and Roof Layout

2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the proposed development, at both a national and a local level.

2.1. National Policy

The National Planning Policy Framework was published in February 2025 and sets out the governments' planning policies for England and they should be applied. Table 2 sets out the relevant energy standards for new developments and provides an indication of the design response to be provided.

Table 2 – Key National Planning Policy Requirements and Design Responses

Section	Policy Requirements	Design Response
14. Meeting the challenge of climate change, flooding and coastal change	The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.	This development will follow the principles set out in Places for Everyone Joint Development Plan (2024), using a 'Be Lean, Be Clean, Be Green' approach in reducing operational carbon emissions. An overview of current decentralised energy schemes in Manchester and an assessment on the potential for future schemes in relation to this development is provided in Section 7 of this report. This energy statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.

2.2. Local Policy

The adopted Places for Everyone Joint Development Plan 2022 to 2039 (March 2024) provides a set of guidelines for new development. All relevant energy policy within these documents is provided within this section together with a design response.

Table 3 – Key Local Planning Policy Requirements and Design Responses

Places for Everyone Joint Development Plan 2022 to 2039 (March 2024)		
Section	**Policy Requirements**	**Design Response**
Policy JP-S1: Sustainable Development	To help tackle climate change, development should aim to maximise its economic, social and environmental benefits simultaneously, minimise its adverse impacts, utilise sustainable construction techniques and actively seek opportunities to secure net gains across each of the different objectives. Carbon and Energy Within this, new development will have a critical role to play and all new homes and commercial/industrial buildings will need to achieve net zero carbon by 2028.The definition of net zero carbon development has been established by the UK Green Building Council. It is expected that development in the Plan area will apply a net zero carbon approach to operational emissions up until 2028, thereafter emissions in construction should be considered. Minimum carbon reduction targets will be set in line with the Future Homes Standard of 80% or until such a time this is superseded. To provide further confidence in decision making, supporting research23 was commissioned to outline how the pathway to 2028 can be achieved for 'net zero in operation'24 by setting out critical milestones and measures that would be expected when following the energy 'hierarchy' and adopting a fabric first approach. 5.17 Based on the evidence which has informed the 5 Year Environment Plan and achieving net zero carbon in new development, this has shown that there will need to be a significant increase in photovoltaic technology. Therefore, where planning applications for residential development are accompanied by an energy statement, the	The proposed development will follow the principles of the Energy Hierarchy by adopting a passive fabric-first approach to design rather than adopting the use of renewable technologies. A full energy strategy is provided in Section 7 of this report, following an appraisal of a range of site-specific measures in line with the 'Be Lean, Be Clean, Be Green' approach. A fabric first approach to the development is a much-preferred

following best practice thresholds should be seen as the starting point in relation to reducing energy demand and onsite renewable energy generation. The thresholds set out in Table 5.1, for post 2025, are consistent with the GM Five Year Environment Plan.

Table 5.1 Best Practice Thresholds for Reducing Energy Demand and Onsite Renewable Energy Generation within residential developments

-	Space Heat Demand[25]	Hot Water Energy Demand[26]	Renewable Energy Generation Targets
2021 - 2025	Houses (30kWh/m2) Flats (25kWh/m2)	20% energy demand reduction in the total heat required for water heating	*Photovoltaic installation: 20% ground floorspace
2025 - onwards	Houses (20kWh/m2) Flats (15kWh/m2)	^20% energy demand reduction in the total heat required for water heating	*Photovoltaic installation: 40% ground floorspace
*Ground floorspace used as a proxy for available roof area.	-	-	-
^Will need to be reviewed with Future Homes Standard 2025 to determine if savings already embedded.	-	-	-

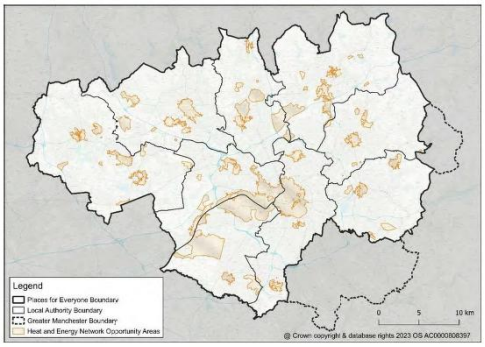
5.19 By following the energy hierarchy, new development will need to achieve net zero carbon through the maximisation of on-site measures first. However, in circumstances where a development has demonstrated that the hierarchy
has been followed and there are no reasonable alternatives to meet the minimum carbon reductions, then payment to offset remaining emissions will
also be required. Such payments should be expected to fund other carbon
saving programmes within Greater Manchester to help meet the 5 Year Environment Plan targets (such as energy efficiency retrofit and renewable
energy installations).

method with the use of Hot Water Heat Pump (HWHP) to provide hot water to the dwellings.

A PV array is mounted on the roof to further reduce the energy consumption of the building. Further information can be found within section 8.

Policy JP-S2: Carbon and Energy	The aim of delivering a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions, will be supported through a range of measures including: 1. Promoting the retrofitting of existing buildings with measures to improve energy efficiency and generate renewable and low carbon energy, heating and cooling; 2. Promoting the use of life cycle cost and carbon assessment tools to ensure the long-term impacts from development can be captured; 3. Taking a positive approach to renewable and low carbon energy schemes, particularly schemes that are led by, or meet the needs of local communities; 4. Increasing the range of nature-based solutions including carbon sequestration through the restoration of peat-based habitats, woodland management, tree-planting and natural flood management techniques; 5. An expectation that new development will, unless it can be demonstrated that it is not practicable or financially viable; a. Be net zero carbon which applies: • from adoption– to regulated operational carbon emissions; • from 2028 -to all emissions 'in construction'. From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions. Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy, which in order of importance seeks to: i. Minimise energy demand; ii. Maximise energy efficiency; iii. Use renewable energy; iv. Use low carbon energy; and v. Utilise other energy sources. From 2025 any residual carbon emissions that cannot be fully mitigated on-site should be offset, in agreement with the relevant local planning authority through a financial contribution to a carbon offset fund. As an interim measure, development should be consistent with the 2022 Part L Building Regulations unless superseded by changes to building regulations and/or national or local planning policies. b. Incorporate adequate electric vehicle charging points, in line with Part S of the Building Regulations, unless superseded by relevant Local	The scheme utilises low carbon technology with the use of an Hot Water heat pump, and includes for low energy lighting, and improved thermal elements to minimise energy demand and enhance energy performance in line with current Building Regulations

	Plan policies, to future proof for the likely long-term demand, taking account of the potential maximum energy demand for the site; c. Where practicable, prioritise connection to a renewable energy/heating/cooling network in the first instance or a low carbon energy/heating/cooling network that is adaptable to non-fossil fuels at a later date; d. In residential developments, achieve energy demand reductions in terms of space heat demand; hot water energy demand and the delivery of on-site renewable energy generation, in accordance with Table 5.1. For renewable energy generation priority should be given to PV installation where technically feasible, alternative technologies will be appropriate where the equivalent generation is evidenced. Include a detailed energy statement to demonstrate via site relevant evidence how the development has sought to maximize reductions in carbon emissions in line with relevant policy targets, including the minimisation of overheating risks and appropriate measures for post occupancy evaluation.	
Policy JP-S3: Heat and Energy Networks	The provision of decentralised energy infrastructure is critical to the delivery of our objectives for low carbon growth, carbon reductions and an increase in local energy generation. The following measures will help to achieve this: 1. Delivery of renewable and low carbon energy schemes will be supported with particular emphasis on the use of decentralised energy networks in areas identified as "Heat and Energy Network Opportunity Areas". These have been identified where: • Existing heat/energy networks are operational or have been commissioned; • Proposals for new heat networks/energy networks are being progressed, or future opportunities have been identified in city-region master planning; • Sufficient density of existing heat demand occurs; and • Significant future development is proposed at the strategic development locations. 2. Within the identified "Heat and Energy Network Opportunity Areas", unless it can be demonstrated that there are more effective	Additionally, based on a review of available data, the site is not currently located within a designated Heat and Energy Network Opportunity Area, nor within 500m of an operational or planned district heat network. Due to the constrained, mixed-use nature of the existing building, and the relatively low and

	alternatives for minimising carbon emissions or such connection is not practicable or financially viable, it is expected that: • New residential developments that are '10 dwellings or more' or other developments over 1,000 m2 floorspace shall: a. Connect to an existing or planned heat/energy network or be designed to enable future connection (where within 500m of such a network); and/or b. Install a site-wide or communal heat/energy network solution. • An expectation that new industrial development will demonstrate that opportunities for using waste heat locally have been fully examined, and included in proposals; • An expectation that where publicly-owned buildings and assets adjoin new major development sites, opportunities for these buildings and assets to connect to site-wide proposals will be considered; and • An expectation that any site-wide networks will be designed so as to enable future expansion to adjoining buildings or assets as appropriate. Figure 5.1 Heat and Energy Network Opportunity Areas  Flood Risk and the Water Environment 5.39 Climate change and population and economic growth can put increasing pressure on the available potable water supply for homes and businesses. It is important that water is conserved and efficiently used as much as possible to help build resilience to periods of drought; avoid over abstraction; reduce carbon emissions from water treatment and disposal; and protect river and wetland habitats from degradation. All new homes have to meet mandatory national standard set out in Building Regulations (of 125 litres/person/day). Where there is a clear	dispersed heat demand across individual units, the use of decentralised energy or site-wide heat networks has not been considered practicable or financially viable in this instance. Instead, the scheme will utilise Hot Water heat pumps, supported by improved insulation and building fabric upgrades, in full compliance with Part L1A of the Building Regulations (2021).

	local need, the government's Housing Optional Technical Standards paragraph 013 and 014 set out that local authorities may also consider tighter water efficiency requirements for new homes (110 litres a day) to help manage water demand. This will be determined through the preparation of district local plans.	

3. Methodology

The first step of the full energy strategy assessment has been to undertake a baseline energy assessment. The baseline energy assessment consists of calculating the total CO_2 emissions of the development to meet Building Regulations and then compare the proposed improvement measures against this baseline. Building Regulations Part L1A 2021 (SAP) applies to the proposed dwelling and provides carbon emissions from regulated energy.

The building can then be benchmarked/thermally modelled using the energy hierarchy:

1. Be Lean *A reduction in energy use as a result of passive design and energy efficiency*
Thermal performance of the new build envelope (U-values) Glazing design Airtight construction Efficient mechanical ventilation using system 3 extract Variable speed fans and pumps Energy Efficient lighting
2. Be Clean *A focus on supplying energy to the development through efficient means*
Connect to low carbon heat networks Develop site wide heat network from single energy centre incl. potential CHP Provide energy efficient individual heating
3. Be Green *The installation of renewable technologies to meet energy demand where possible*
Consider the feasibility of renewable energy technologies Assess the integration of renewable technologies based on the above measures

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency improvements, district heating, etc...) and finally the use of renewable energy technologies, where practical. This hierarchy complements the integrated approach to the sustainable energy objectives of the Places for Everyone Joint Development Plan (2024).

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies:

- Biomass heating
- Biomass combined heat and power
- Solar hot water
- Solar photovoltaic
- Ground source heat pumps
- Air source heat pumps / exhaust air heat pumps
- Wind power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, maintenance and operation, etc...

Feasible renewable energy technologies have been considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site are considered as part of this statement.

3.1. Sustainable Approach

Under the Places for Everyone framework, the GMCA provides a set of guidelines and design principles that all developments across Greater Manchester's nine boroughs are expected to follow. The Greater Manchester Combined Authority (GMCA) has established a policy to guide energy performance and sustainability in new developments. The policy requires dwellings to meet strict space-heating and energy-efficiency targets, including limiting energy consumption per square metre (e.g., ≤ 35 kWh/m²/yr for overall energy use) and ensuring adequate on-site renewable energy generation. Developments must integrate renewable technologies, such as photovoltaic (PV) systems covering a significant proportion of the internal ground-floor area and eliminate reliance on fossil-fuelled heating. Together, these measures aim to reduce carbon emissions, improve energy efficiency, and support the region's transition to net-zero energy use.

This development of 13No. new build apartments falls under Table 4 'Major' Development but to our knowledge is not TANZ applicable ie EIU not required.

Table 4 – GMCA Targets for Building development

	Minor development		Major development	
	Small minor Single home and XL extensions	**Minor** 2-9 homes	**Major** 10-149 homes	**Large major** +150 homes
Space heating demand (kWh/m²GIA/yr) *Minimise energy demand*	Specs	≤ 20 kWh/m²/yr – Space heating demand - HOUSES; ≤ 15 kWh/m²/yr – Space heating demand - FLATS	≤ 20 kWh/m²/yr – Space heating demand - HOUSES; ≤ 15 kWh/m²/yr – Space heating demand - FLATS	
Energy Use Intensity (EUI) (kWh/m2GIA/yr) *Maximise energy efficiency*	*Not applicable (35kWh/m²/yr for all TANZ homes)*	≤ 35 kWh/m²/yr – Energy use intensity; *Requirement for all TANZ homes*	≤ 35 kWh/m²/yr – Energy use intensity; *Requirement for all TANZ homes*	
PV footprint area (% of ground floor space) *Use renewable energy*	≥ 40 % fp – PVs installed	≥ 40 % fp – PVs installed	≥ 40 % fp – PVs installed	
Fossil fuel free (yes/ no) *Use low carbon energy*	Yes – Fossil fuel free	Yes – Fossil fuel free	Yes – Fossil fuel free	
Building regulations Part O met without mechanical cooling (yes/no) *Reduce overheating risk*	GHA – Overheating risk assessment tool	Yes – Cooling avoided	Yes – Cooling avoided	
Upfront embodied carbon ($kgCO_2e/m^2_{GIA}$) *Minimise embodied carbon*	Summary of efforts – Upfront embodied carbon	Summary of efforts – Upfront embodied carbon	≤500 kgCO₂e/m² – Upfront embodied carbon - HOUSES; ≤600 kgCO₂e/m² – Upfront embodied carbon - FLATS	
Offset contribution (£) *Offsets*	*Not applicable*	*Not applicable*	£ – Offsets; *Options for offsetting currently under development and to be adopted by each local authority.*	

Below tables show the values for the proposed dwellings in the categories outlined in the GMCA policy.

Table 5 – GMCA Space Heating Demand

	Target	Target Value	APT 1	APT 2	APT 3	APT 4	APT 5	APT 6	APT 7	APT 8	APT 9	APT 10	APT 11	APT 12	APT 13
Minimise Energy Demand	**Space Heating (kWh/m²/yr)**	<15 Flats <20 Houses	14.33	12.84	10.32	12.39	11.33	12.89	12.29	12.54	14.25	12.71	11.74	12.94	13.4
	Calculation Method	Predicted Energy Modelling	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10
	Form Factor per Building	<2	2.26	1.86	2.28	1.26	1.37	1.37	1.74	2.26	2.44	2.04	2.59	1.52	3.05
	Average External Wall U-Value W/m²K	<0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
	Average Window U-Value W/m²K	<1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Air Leakage Rate m³/m²/hr	<1	3	3	3	3	3	3	3	3	3	3	3	3	3

As demonstrated in the table above, the dwelling achieves the required target and complies with the GMCA space-heating performance criteria of <15kWh/m²/yr.

The table above demonstrates the scheme's clear commitment to minimising energy demand in line with GMCA Planning Policy. A highly efficient fabric-first approach has been consistently applied, resulting in all apartments meeting or outperforming the GMCA Space Heating targets, with values as low as 10.32 kWh/m²/yr which well within the target range for flats. Where minor shortfalls against target metrics have occurred, the design team has responded proactively introducing double glazing and an improved air tightness, to compensate and even exceed the overall energy performance criteria.

A key policy aim is to limit form factor (<2) to reduce surface heat loss. Apartments 2,4,5,6,7 and 12 all comfortably meet this requirement, demonstrating the architect's intent to achieve compact, efficient building forms. While form factor was not achieved in the other apartments, it should be viewed as an expected design difference due to the nature of apartments in comparison to the others. While some apartments have party roofs and floors, others do not, so initially start with higher exposed heat loss perimeters.

Though the use of glazing at 1.2W/m^{2}k and an air tightness of 1m^3 is stated as the ideal target under GMCA, this was discussed in detail, and it was agreed targeting only where needed was best approach due to the strict acoustic requirements on the development. Making these two lower site wides would have put further strain on the overheating assessment that was already a critical part of the design due to a variety of factors such as acoustics, orientation etc. and therefore was not targeted site wide. To further support that the scheme has still aimed for a fabric first approach, it is requested consideration is given that the Building Regulations (2021) minimum for air testing is 8m^3, with the 'notional SAP dwelling' at 5m^3. Our initial design was for 3m^3, far exceeding worst case of Building Regulations and further supporting the fabric first approach.

Table 6 – GMCA Energy Use Intensity

	Target	Target Value	APT 1	APT 2	APT 3	APT 4	APT 5	APT 6	APT 7	APT 8	APT 9	APT 10	APT 11	APT 12	APT 13
Maximise Energy Efficiency	**Energy Use Intensity (EUI)**	<35 kWh/m2/yr	42.4	39.42	37.09	44.78	40.86	47.16	42.16	39.35	41.09	39.89	37.11	42.92	39.15
	Calculation Method	Predicted Energy Modelling	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10	SAP 10
	TANZ Home	-	No	No	No	No	No	No	No	No	No	No	No	No	No
	EUI Met	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

The outcome is a result of a balanced, fabric-first design approach combined with appropriate mechanical and electrical (M&E) specifications and on-site renewable energy generation, supporting both energy efficiency and compliance with local low-carbon planning goals. Key to this performance are three integrated factors:

- High Fabric Efficiency: The development employs a robust thermal envelope, with low U-values and strong airtightness, significantly reducing space heating demand and allowing smaller, more efficient systems to be used without compromising occupant comfort or energy performance.

- Targeted Low-Carbon Technologies: Given the very low predicted space heating loads, the selected approach uses simple, responsive electric heating solutions that are well matched to actual performance requirements, avoiding unnecessary system complexity or oversizing. Meanwhile, domestic hot water demand, which accounts for a larger share of energy use, is met using air source heat pumps with a seasonal coefficient of performance (SCOP) of 3.5, ensuring highly efficient year-round operation.

- Renewable Energy Integration: In addition to efficient building design, the scheme incorporates renewable energy generation on site to further reduce net energy consumption and support local carbon reduction objectives, contributing positively to the development's overall energy and environmental credentials.

Together, these strategies result in a development that not only meets but exceeds the expectations of modern energy policy: delivering low operational energy use, high thermal comfort, and long-term affordability for occupants, all within a design that is fully aligned with planning principles.

Table 7 – GMCA PV Footprint

	Target	Target Value	APT 1	APT 2	APT 3	APT 4	APT 5	APT 6	APT 7	APT 8	APT 9	APT 10	APT 11	APT 12	APT 13
Use Renewable Energy	PV Footprint Area	>40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
	Predicted Panel Wattage	-	450W	450W	450W	450W	450W	450W	450W	450W	450W	450W	450W	450W	450W
	Predicted kWp Total	-	18												
	Predicted Energy Generated (kWh)	-	1,166	777	1,166	389	777	255	777	1,555	1,555	1,555	1,943	777	1,943
	Orientation and Pitch	-	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)	South (30°)
	Overshading	-	None	None	None	None	None	None	None	None	None	None	None	None	None

The development meets the local policy requirement to provide photovoltaic (PV) coverage equivalent to 40% of the ground floor Gross Internal Floor Area (GIFA) across the site. This has been achieved through a carefully coordinated roof design that prioritises solar efficiency, orientation, and available surface area from the outset.

The PV arrays are installed on south-facing flat roof, maximising solar gain and system performance. Importantly, the overall roofscape has been consciously designed by the architect to optimise usable PV area, ensuring that renewable energy delivery was embedded in the core design principles and not applied as an afterthought.

The array on the development is rated at 18 kWp, with a predicted annual generation of approximately 15,411.7 kWh per year. For planning the PV array will be supplied into the communal areas although it is feasible to consider supplying directly into each flat to benefit each dwelling EPC rating.

Assuming average domestic electricity rates of ~30p/kWh (standing charges excluded), this level of generation could represent a notional annual saving of approximately £4,623 per year across the building which reduces environmental impact.

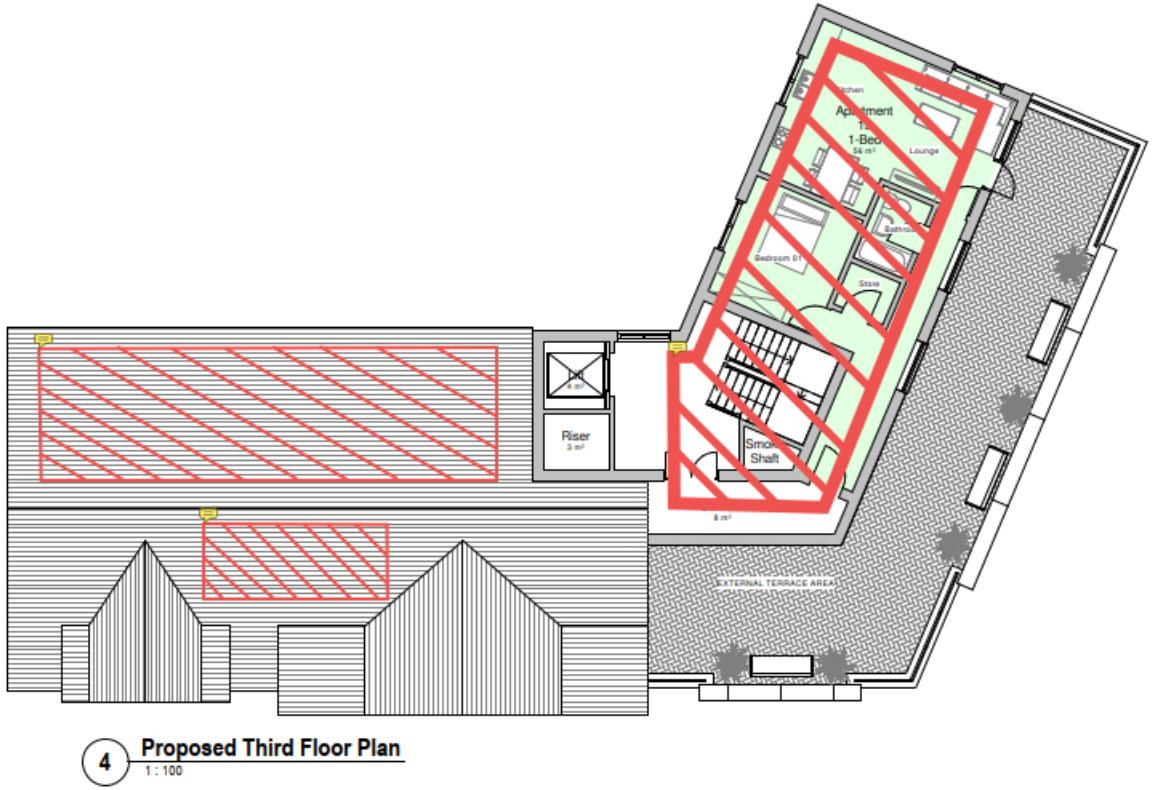


Figure 7 – Possible areas for PV

The proposed building can accommodate a flat roof area of 62 m², which is suitable for approximately 33No. 450W solar panels. Additional panels can also be installed on the sloped roof—around 5No. panels on the southeast-facing slope. These areas are optimal for PV. The hatched areas opposite the dormer roofs are facing North West and are therefore not optimal These could accommodate 24No. panels on the northwest-facing slope, if extra capacity is required but we have not included for this area for PV at the current time.

Table 8 – GMCA Fossil fuel free

	Target	Target Value	APT 1	APT 2	APT 3	APT 4	APT 5	APT 6	APT 7	APT 8	APT 9	APT 10	APT 11	APT 12	APT 13
Use Low-Cabon Energy	Heat Source	-	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric
	Low Carbon Appraisal Complete	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Heat Network Suitability	-	No	No	No	No	No	No	No	No	No	No	No	No	No
	Exemption Requested	-	No	No	No	No	No	No	No	No	No	No	No	No	No
	SCOP of Space Heating	>3.5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	SCOP of Water Heating	>3.5	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49

In accordance with planning policy and GMCA sustainability guidance, a low carbon energy appraisal has been undertaken as part of the design development process. The appraisal assessed a range of heating solutions, including electric, individual air source heat pumps (ASHPs), and communal heat networks, with each considered in relation to technical viability, site constraints, predicted energy demand, and carbon performance.

Given the scheme's strong passive design credentials and very low predicted space heating demand, the most suitable solution for the apartments is the use of high-efficiency electric panel heating. These systems are simple, compact, and responsive; offering effective comfort heating without the capital, maintenance, or spatial requirements associated with larger ASHP or centralised systems. While direct electric heating systems inherently have a Seasonal Coefficient of Performance (SCOP) of 1.0, their use here is justified by the exceptionally low heat demand achieved through high fabric performance, keeping space heating loads minimal and manageable.

To ensure that the largest energy load, domestic hot water (DHW) is addressed via low-carbon means, each unit is provided with an integrated hot water heat pump water cylinder, with a targeted SCOP of 3.49. This significantly improves the overall carbon and energy profile of the system and addresses the highest cost component of tenants' energy bills. The combined strategy ensures a targeted and efficient response to actual performance needs, rather than oversizing or over-specifying systems unnecessarily.

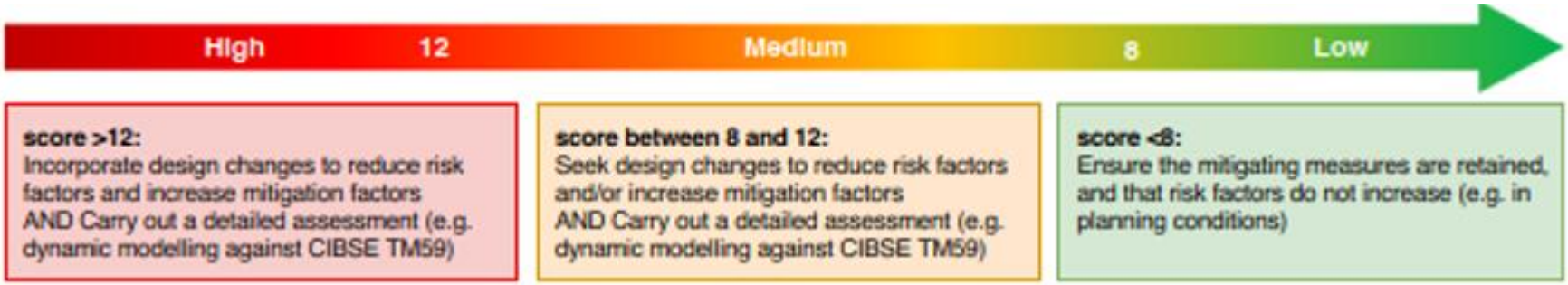
Roofs have been maximised for solar PV installation in order to meet a 40% GIFA coverage policy requirement. This significantly limits space for large-scale communal plant such as central ASHPs or thermal stores.

Communal heating systems are misrepresented in SAP 10, often resulting in inflated distribution losses and under-represented performance, making it more difficult to meet space heating and energy demand targets under that methodology, therefore individual electric heating panels have been proposed for each habitable rooms within dwellings to ensure a responsive heating solution for the residents.

Table 9 – GMCA Overheating

	Target	Target Value	APT 1	APT 2	APT 3	APT 4	APT 5	APT 6	APT 7	APT 8	APT 9	APT 10	APT 11	APT 12	APT 13
Overheating	Part O Met without Cooling	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Good Homes Alliance (GHA) Risk Tool – Worst Case	-	12												
	Good Homes Alliance (GHA) Risk Tool – Best Case	-	5												

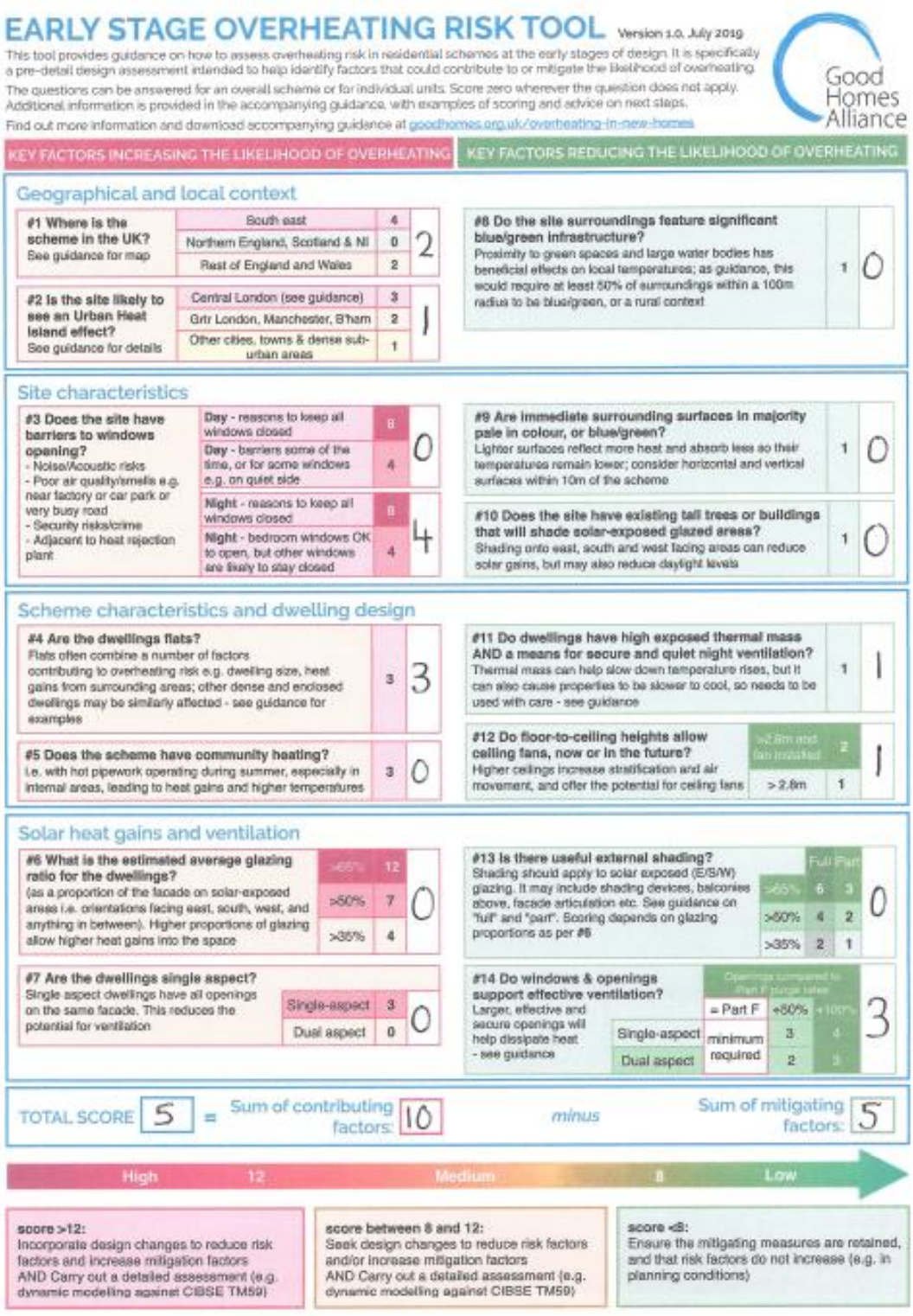
Based on the GHA Overheating risk the flats have been assessed as Medium to Low risk depending on position in the block.



The development has been assessed against the requirements of Approved Document O (ADO) – Against Good Homes Alliance Early-Stage Overheating Risk Tool.

The Good Homes Alliance Overheating Risk Tool is a simple, early-stage design tool that helps assess the likelihood of a new home experiencing overheating. It guides designers and planners through key factors—such as glazing, shading, ventilation strategy, orientation, and local climate—to identify potential risks before detailed modelling is carried out. By highlighting design features that may contribute to high indoor temperatures, the tool supports informed decision-making and encourages the incorporation of passive cooling measures to create healthier, more comfortable homes.

Due to the project still being in the early stages of development, the proposed dwelling has been assessed with an overheating risk score ranging between 5 and 12, placing it between the low and medium-risk categories. This variability indicates that certain design elements—such as glazing size, shading provision, ventilation strategy, and building orientation—may significantly influence the outcome. A score in this range suggests that, without careful refinement, the dwelling could be susceptible to elevated indoor temperatures during warmer periods, potentially impacting occupant comfort and increasing reliance on mechanical cooling. As the design progresses, addressing these factors early will be essential to reduce overheating risk and ensure the home performs well under future climate conditions.



EARLY STAGE OVERHEATING RISK TOOL Version 1.0, July 2019

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

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

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

Good Homes Alliance

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

Geographical and local context

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

→ 2

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

→ 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
- Day - barriers some of the time, or for some windows e.g. on quiet side: 4

→ 0

- Night - reasons to keep all windows closed: 8
- Night - bedroom windows OK to open, but other windows are likely to stay closed: 4

→ 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 → 0

#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 → 1

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future?
Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans

- >2.8m and fan installed: 2
- > 2.8m: 1

→ 1

Solar heat gains and ventilation

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

- >65%: 12
- >50%: 7
- >35%: 4

→ 0

#7 Are the dwellings single aspect?
Single aspect dwellings have all openings on the same façade. This reduces the potential for ventilation

- Single-aspect: 3
- Dual aspect: 0

→ 0

#13 Is there useful external shading?
Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, façade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6

	Full	Part
>65%	6	3
>50%	4	2
>35%	2	1

→ 0

#14 Do windows & openings support effective ventilation?
Larger, effective and secure openings will help dissipate heat - see guidance

	= Part F	+50%	+100%
Single-aspect	minimum required	3	4
Dual aspect		2	3

→ 3

TOTAL SCORE 5 = Sum of contributing factors: 10 *minus* Sum of mitigating factors: 5

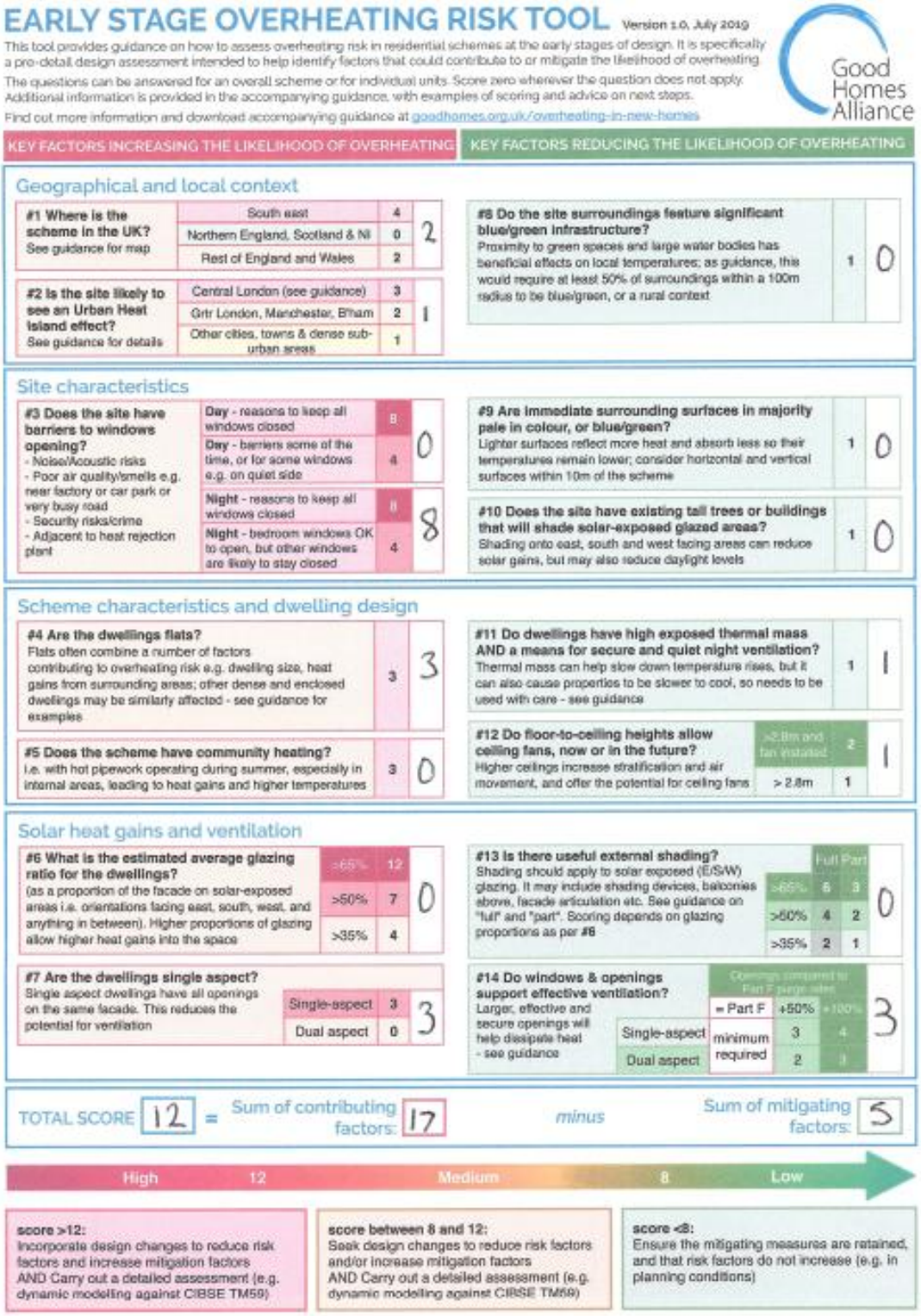
High 12 Medium 8 Low

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)

Figure 8 – Good Homes Alliance Overheating Risk Tool – Best Case



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	2
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	1
Grtr London, Manchester, Btham	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	0
Day - barriers some of the time, or for some windows e.g. on quiet side	4	
Night - reasons to keep all windows closed	8	8
Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green?
Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme

1	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	0

#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	1

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future?
Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans

≥2.8m and fan installed	2	1
> 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	0
>50%	7	
>35%	4	

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

	Full	Part	
>65%	6	3	0
>50%	4	2	
>35%	2	1	

#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	

#14 Do windows & openings support effective ventilation?
Larger, effective and secure openings will help dissipate heat - see guidance

	Openings compared to Part F purge rates		
	= Part F	+50%	+100%
Single-aspect	minimum required	3	4
Dual aspect		2	3

3

TOTAL SCORE 12 = Sum of contributing factors: 17 *minus* Sum of mitigating factors: 5

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)

Figure 9 – Good Homes Alliance Overheating Risk Tool – Worst Case

Table 10 – GMCA Embodied Carbon

	Target	Target Value	APT 1	APT 2	APT 3	APT 4	APT 5	APT 6	APT 7	APT 8	APT 9	APT 10	APT 11	APT 12	APT 13
Minimise Embodied Carbon	Upfront Embodied Carbon	<500-600	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

We acknowledge the growing importance of addressing upfront embodied carbon in the built environment, particularly in support of long-term net zero objectives. However, at this stage of the project, a formal embodied carbon assessment, particularly to a level of detail required for a comprehensive Embodied Carbon Plan, is not feasible.

The development is currently in the design for planning stage, and key information that would underpin a meaningful and accurate assessment—such as confirmed construction detailing, material specifications, and input from contractors or subcontractors is not yet available. Embodied carbon calculations rely heavily on specific material quantities and verified Environmental Product Declarations (EPDs), many of which are still inconsistent or unavailable across the supply chain. Given these limitations and attempted to quantify embodied carbon and preparing a robust and meaningful embodied carbon plan at this stage would involve a high degree of estimation and carry a significant margin of uncertainty, which may reduce its value as a decision-making or compliance tool.

That said, we are mindful of this issue and will review the viability of undertaking an embodied carbon appraisal at a more advanced stage, when the design is more technically resolved and the supply chain is better defined. This would allow any assessment to be more robust, transparent, and valuable in informing specification decisions, particularly during technical design or post-tender phase.

We trust this explanation demonstrates that the current timing is not conducive to meaningful embodied carbon analysis, but in the meantime, In the meantime, our design team continues to prioritise material efficiency, low-carbon construction principles, and long-term energy performance, in line with wider sustainability objectives for the project. We remain open to further dialogue with the planning authority on this matter as the project progresses.

Table 11 – GMCA Carbon Offset

Carbon Offset	Target	Target Value	APT 1	APT 2	APT 3	APT 4	APT 5	APT 6	APT 7	APT 8	APT 9	APT 10	APT 11	APT 12	APT 13
	Offset Contribution (£)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

We acknowledge the intent of emerging policy to secure financial contributions towards carbon offsetting where onsite reductions are not sufficient to meet defined local targets.

At present, no specific offset contribution value or methodology has been adopted by the local authority, and it is understood that options for offsetting are still under development and will be formalised in due course.

In the meantime, this development has been designed with a strong emphasis on on-site carbon reduction measures, including high fabric efficiency, significant integration of rooftop solar PV (in excess of 40% of ground floor GIFA), and the use of low-carbon mechanical and electrical systems tailored to the scheme's performance needs. As such, the scheme already delivers a very low regulated energy demand and associated emissions.

We remain open to further engagement on the topic of offsetting once a formal framework is in place and will review any reasonable contribution or calculation methodology if and when it becomes applicable during the planning or post-planning stages.

4. Baseline Energy Assessment

Energy Counsel have based the analysis on current Building regulations ADL1A 2021 (SAP 10), taking into account solutions that must not only be energy efficient but also practical, reliable and user friendly.

Energy Counsel have carried out preliminary SAP 10 calculations for the dwellings. Under Building Regulations Part L1 2021, dwellings must comply with all three metrics set by the notional building shown below.

- Dwelling Emissions Rate (DER) must be lower than or equal to the Target Emissions Rate (TER)
- Dwelling Primary Energy Rate (DPER) must be lower than or equal to the Target Primary Energy Rate (TPER)
- Dwelling Fabric Energy Efficiency Rate (DFEE) must be lower or equal to the Target Fabric Energy Efficiency Rate (TFEE)

SAP 10 is the Governments Standard Assessment Procedure (SAP) for calculating the energy aspects of a dwelling. SAP is a measure of fuel costs for heating, hot water and lighting for a dwelling. SAP 10 can also be used to ascertain the energy requirements of a development.

To assess the baseline carbon emissions, we must make an estimation of the energy demands through Building Regulations in order to set a target upon which the actual development can be compared.

4.1. Predicted Baseline Energy Requirements

The predicted baseline CO_2 emission demands for the development:

Table 12 - Baseline dwelling emissions

Our Ref	Dwelling Type	No. Of Type	Floor Area m2	TER (Kg CO2/yr/m2)	TPER (kWh/ yr/m2)	Total Target Carbon Emissions (Kg CO2/yr)	Total Target Primary Energy (kWh/yr)
Z70633	Plot 1	1	52.16	16.72	89.25	872	4,655
Z70634	Plot 2	1	67.80	13.41	71.15	909	4,824
Z70635	Plot 3	1	41.20	18.52	99.28	763	4,090
Z70636	Plot 4	1	63.22	13.32	70.65	842	4,466
Z70637	Plot 5	1	41.13	19.38	103.80	797	4,269
Z70638	Plot 6	1	47.42	14.46	77.09	686	3,656
Z70639	Plot 7	1	47.50	16.78	89.64	797	4,258
Z70640	Plot 8	1	63.37	16.64	88.52	1,054	5,610
Z70641	Plot 9	1	52.48	17.40	92.84	913	4,872
Z70642	Plot 10	1	75.23	14.24	75.53	1,071	5,682
Z70643	Plot 11	1	57.79	20.43	109.02	1,181	6,300
Z70644	Plot 12	1	79.91	13.68	72.42	1,093	5,787
Z70645	Plot 13	1	54.85	18.31	97.67	1,004	5,357
Total		13				**11,983**	**63,827**

The baseline carbon emissions rate for the development is **11,983 $KgCO_2$/yr** and the baseline primary energy rate is **63,827 kWh/yr.**

5. Passive Design and Energy Efficiency

The approach of the development is to embed sustainability into the heart of the design from the outset of the project design process. The design will be developed with sustainable solutions, taking into account the relevant policies and strategies of the Places for Everyone Joint Development Plan (2024).

The development will seek to consider all aspects and principles of sustainable development, taking into account environmental, social and economic impacts.

5.1. Passive Design Measures

The philosophy for the site is to achieve as much of the necessary reduction in carbon emissions through the use of passive design techniques and energy efficient measures as possible, before resorting to the use of LZCs. This ensures that the highest standards of building fabric and energy efficiency are achieved, rather than offsetting a poorer performance with LZC contributions.

This will be undertaken through a fabric first energy efficient design approach with high levels of thermal efficiency and a reduction in energy demand through efficient lighting design

5.2. Energy Efficient Systems

Options have been reviewed for improving the energy efficiency of the development by installing an efficient heating system. The scheme will utilise high efficiency Hot Water Heat Pump serving hot water to the dwellings.

A low energy high efficiency mechanical ventilation system with heat recovery will serve apartments, in line with the requirements of Building Regulations Part F (2021).

.

6. District & Communal Heating Networks

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the dwellings in line with the Energy Hierarchy.

6.1. Decentralised Heating Networks

The energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

One of priorities for reducing CO_2 emissions is to reduce reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de-centralised energy systems.

De-centralised plant generally means any heating and hot water and/or electricity generation provided on a district wide (DHN) or site wide (CHN) basis. DHN and CHN can typically include combined heat and power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

Benefits of district heating networks can include:

- Provision of low carbon / lower cost heat to domestic and commercial customers
- Diversification of the energy mix
- Reductions in region-wide carbon emissions
- Targeting and reduction of fuel poverty
- Potential long term revenue streams for local authorities
- Alignment with regeneration programmes
- Driving the growth of the low carbon services sector

There are currently no existing district heating networks within proximity to the site, and the development of a decentralised system would not be feasible for a project of this scale. With the closest being Sheltered Housing at Victoria Square, Manchester just over 1 mile south.

7. Renewable Energy Technologies

Energy Counsel have reviewed options for the use of on-site renewable energy/Low or Zero Carbon Technology (LZT) in line with the policy aspirations of the Places for Everyone Joint Development Plan (2024).

This renewable energy statement/strategy reviews the technical and economic feasibility of the following technologies –

- Solar Photo-voltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps / Exhaust Air Heat Pumps
- Micro Wind Power
- Biomass

7.1. Photovoltaics (PV)

Photovoltaic panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

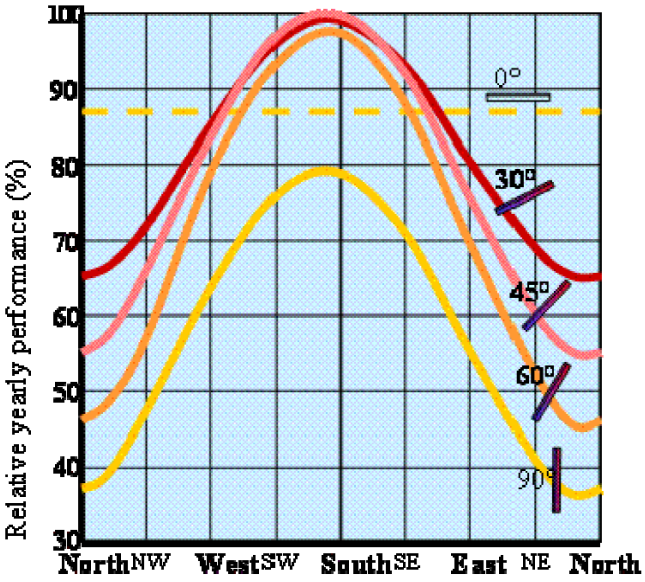


Figure 10 - Performance of photovoltaic panel orientation

The amount of energy PV cells generate is referred to as Kilowatt Peak (KWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. Solar panels are not light and the roof must be strong enough to take their weight, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle.

The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 35° and 45° and oriented south of west or east are generally suitable. If solar collectors are oriented away from due south then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph to the right:

The cost to install PV is typically £1,000 - £1,500 per kWp for 'on-roof' panel systems.



Figure 11 - Photovoltaic array on a pitched roof

Photovoltaic panels have been installed to the dwellings, this along with the use of heat pumps for hot water ensure that carbon emission reductions are provided in line with Places for Everyone Joint Development Plan (2024).

7.2. Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage, the less pipe work is required. Annual

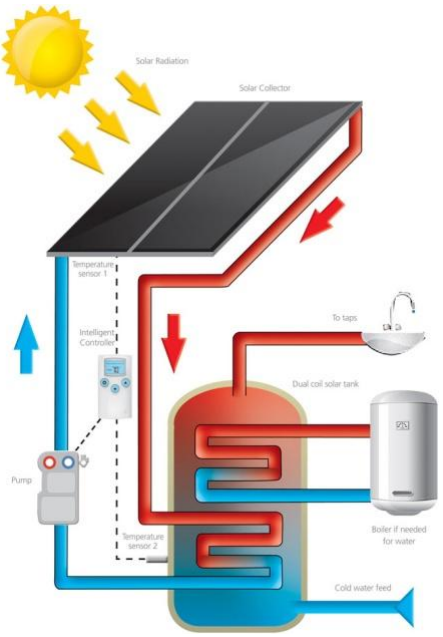


Figure 12 - The principles of a solar thermal system

maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m^2 which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

The use of solar thermal panels, work best in conjunction with individual heating systems for each dwelling. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however solar PV panels are a preferred methodology to reduce the energy consumption of the dwellings. Carbon savings of approximately 4-5% are achievable with this technology. The dwellings are likely to require sufficient hot water storage to deem solar thermal a feasible technology for this site, however following the introduction of PV panels for electricity generation space is limited for solar hot water. This along with the introduction of hot water heat pumps ensures the dwellings comply with the building regs and places for everyone policy. For the reasons aforementioned this is not an appropriate option for this scheme.

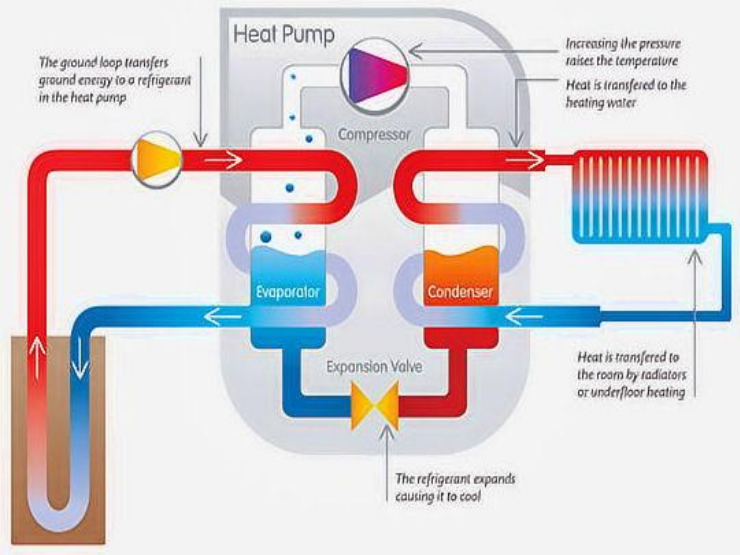


Figure 13 - Principles of a GSHP system

7.3. Ground Source Heat Pump (GSHP)

GSHPs have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to apartments as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHPs use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Due to the relatively small scale of this development, GSHPs are not considered an appropriate design solution.

7.4. Air Source Heat Pump/Exhaust Air Heat Pump/ Hot Water Heat Pump

Air source heat pumps (ASHP) and exhaust air heat pumps (EAHP) work in a similar way to GSHP. Air source heat pumps can be fitted on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

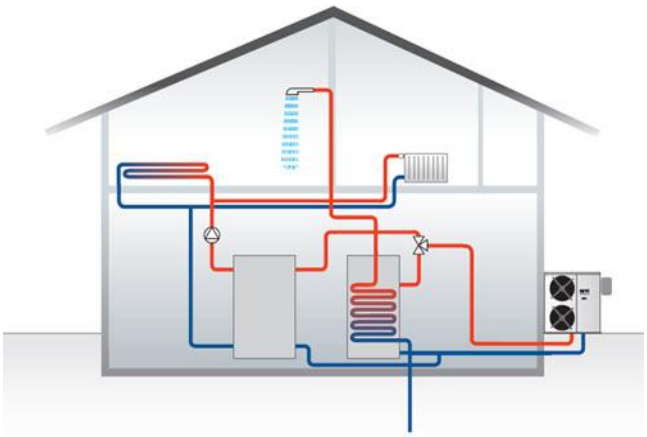


Figure 14 - Principles of an ASHP system

Exhaust air heat pumps such as the NIBE F370 work in a similar manner to ASHP units but have only indoor units (no outdoor compressors) and in addition they also recover heat from their integral exhaust air ventilation system. These units work well on apartment blocks and dwellings where mains gas is unavailable or unsuitable for a development. They are expensive in terms of capital cost of the equipment, installation and the enhanced structural requirements.

HWHPs are considered the most appropriate technology for this scheme and can be utilised for hot water throughout the dwellings. The introduction of this technology ensures that carbon emissions reductions can be provided in line with Places for Everyone Joint Development Plan (2024).

7.5. Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity. There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of dwellings
- Mast mounted – Which are free standing



Figure 15 - Mounted wind turbine

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwellings or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence

As this development is in an urban area there will be obstacles which reduce wind speed. The average wind speed in this area is 4.5 m/s at a height of 10 metres, which is less than the 6 m/s required. Therefore, micro wind is not a viable technology for this development.

7.6. Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets

- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.



Figure 16 - Biomass boiler and hopper

Air quality issues are also an important factor when looking to install biomass. The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to a communal heating system; there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason biomass is discounted.

8. Energy Assessment of Proposed Scheme

The proposed development has adopted the principles of the 'Be Lean, Be Clean, Be Green' approach.

The most practical and economically feasible solution for the development is a good quality thermally insulated fabric, airtight envelope, passive improvements and the use of highly efficient air source heat pump, supported by efficient ventilation system with heat recovery.

Table 13 - Proposed emissions from the development

Ref	Dwelling Type	No.	TER	DER	TPER	DPER	Total Carbon Emissions (Kg CO2/yr)	Total Primary Energy (kWh/yr)
Z69235	Plot 1	1	16.72	3.91	89.25	47.92	204	2,500
			76.61%		46.31%			
Z69235	Plot 2	1	13.41	3.84	99.28	42.63	260	2,890
			71.36%		40.08%			
Z69235	Plot3	1	18.52	3.20	99.28	43.72	132	1,801
			82.72%		55.96%			
Z69235	Plot 4	1	13.32	3.84	70.65	40.94	243	2,588
			71.17%		42.05%			
Z69235	Plot 5	1	19.38	3.53	103.80	42.63	145	1,753
			81.79%		58.93%			
Z69235	Plot 6	1	14.46	4.15	77.09	42.53	197	2,017
			71.30%		44.83%			
Z69235	Plot 7	1	16.78	3.68	89.64	43.04	175	2,044
			78.07%		51.99%			
Z69235	Plot 8	1	16.64	3.49	88.52	44.89	221	2,845
			79.03%		49.29%			
Z69235	Plot 9	1	17.40	3.88	92.84	51.29	204	2,692
			77.70%		44.75%			
Z69235	Plot 10	1	14.24	3.46	75.53	42.88	260	3,226
			75.70%		43.23%			
Z69235	Plot 11	1	20.43	3.38	109.02	48.47	195	2,801
			83.46%		55.54%			
Z69235	Plot 12	1	13.68	3.67	72.42	40.23	293	3,215
			73.17%		44.45%			
Z69235	Plot 13	1	18.31	3.75	97.67	53.02	206	2,908
			79.52%		45.72%			
Total		**13**	**77.18%**		**47.86%**		**2,735**	**33,280**

The carbon emissions for the new build dwellings are predicted to emit **2,735** $KgCO_2$/yr. This is a total carbon reduction of **9,248** $KgCO_2$/yr from the baseline emissions of **11,983** $KgCO_2$/yr this equates to a **77.18**% carbon reduction.

The primary energy rate is **33,280** kWh/yr. This is a primary energy reduction of **30,547** kWh/yr from the baseline primary energy rate of **63,827** kWh/yr. This equates to a **47.86**% primary energy reduction.

The development proposal meets local policy including energy efficient lighting, efficient ventilation, improved thermal bridging, low air leakage and highly efficient water heating delivered via a heat pump.

9. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy, the proposed design solutions are predicted to:

1) Reduces the total carbon emissions by 77.18% compared to new building regulations ADL 2021.
2) The heat pumps are the renewables/ low carbon technology. Their contribution to the overall energy reduction under the 'be green' energy hierarchy is approx. 50%.
3) Reduces the total primary energy by 47.86% compared to new building regulations ADL 2021. This is a new metric under Part L.

The approach for the development at 101 Queens Road, Cheetham Hill, is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Enhanced building fabric to meet Building Regulation ADL1A 2021 (15/06/2021)
2. Enhanced air tightness and thermal bridging.
3. Highly efficient mechanical ventilation with heat recovery system to all dwellings
4. Heating will be provided by highly efficient electric panel heaters
5. Hot water will be provided by highly efficient hot water heat pump
6. Efficient lighting strategy primarily using LED type fittings.
7. 18kW PV Array mounted on the roof to benefit the building

9.1. Low/ Zero Carbon Technologies (LZT) Review

- Solar Thermal Hot Water is not a viable option as hot water will be provided by heat pumps.
- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a centralised larger plant space for storing fuel, which on this constrained site is not viable.
- Micro-wind turbines do not work on this type of development due to problems with wind turbulence and mounting of the units. The wind speeds in the area are not conducive to wind power electricity generation and there would be issues with turbulence, wind shading, noise and air traffic.
- GSHPs are not viable for site because of spatial and financial costs. There is no room to accommodate a GSHP vertical bore and associated communal plant room, ground conditions are unknown, and systems are very costly.

- HWHP units have been proposed for the hot water delivery on this development due to their high COPs providing carbon savings in addition to the future proofing of the dwellings when considering the future of mains gas boilers.

A more detailed overview of LZT technologies is provided in the appendices of this report.

9.2. Summary Headlines

- A passive fabric-first approach has been taken to reduce the energy demand of the proposed development. By focusing on passive design measures and energy efficiency through the energy hierarchy, the project offers an efficient and sustainable solution for the life of the building.

Table 14 - Proposed development emissions against Building Regulations Part L1A 2021

	Total CO_2 Emissions ($kgCO_2/yr$)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	**11,983**	**63,827**
Proposed Dwelling Performance	**2,735**	**33,280**
Total Reduction	**9,248**	**30.547**
Percentage Improvement (above ADL1 2021)	**77.18%**	**47.86%**

10. Appendices

10.1. LZT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Solar photovoltaics	South facing aspects of the roof could support a rooftop array to ensure energy consumption is reduced sufficiently if sought.	A 8kWp system could save around 2,480 kg of CO2 per year per dwelling, although	Average cost for such a system is around £1.5K per dwelling.	Current potential income generation is around £230 per annum per dwelling, with a fuel cost saving of around £60 per year per dwelling.
Wind	Average wind speeds on the site according to the NOABL Wind Speed Database are 4.5m/s. To be technically feasible a minimum of 6m/s is required, therefore this site is not considered feasible.	N/A	N/A	N/A
Micro Hydro	There is no capacity for micro hydro on this site since there are no local water courses available.	N/A	N/A	N/A
District Heating	There are currently no existing or planned district heating networks to facilitate connection at this stage.	N/A	N/A	N/A
Solar Hot Water	This technology has been discounted as the level of hot water usage in each dwelling does not merit a storage system, which poses space issues.	Around 270 kg of CO2 per year per dwelling.	£3-5K per dwelling	Income generation from RHI in a 4 person household would be in the region of £340 / year (per dwelling) with a fuel saving of around £65 per year per dwelling
Heat Pumps	GSHP: Ground conditions on site are unknown, and installation of coils are likely not economically viable for this project. HWHP: An HWHP for hot water is the preferred option due to the high efficiency and energy savings	GSHP: 2,100 to 3,300 kg CO2 per year per dwelling ASHP: 1,700 to 2,700 kg CO2 per year per dwelling.	GSHP @ £13-20K per dwelling ASHP: £7-11K per dwelling	GSHP: £2,590 minimum annual RHI income generation per dwelling with fuel saving of £440 per year minimum per dwelling ASHP: £920 minimum annual RHI income generation per dwelling with fuel saving of £335 per year minimum per dwelling
Biomass	The small scale of this development would not facilitate the installation of biomass boilers due to the space required for pellet storage.	N/A	N/A	N/A

10.2. Specification for New Build Dwelling Assessments (ADL1A 2021 - SAP)

Item	Brief Description	Notes	Confirm
	The following information is required for the design submission (as per requirements of approved doc L1A).	Please note submission is now in two stages. A) **Design**, B) As installed	
1. Dwelling Type			
1.1	Building Regulations Part L1A 2021 apply.		
1.2	Post code of site is Unknown.	101 Queens Road, Cheetham Hill. M8 8UT	
1.3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.	*Assumed Standard tariff*	
1.4	It is assumed that the dwellings have a Medium thermal mass parameter.		
2. Floor Construction Details			
2.1	Ground floor is to achieve the U-value stated opposite.	U-Value = 0.12 W/m²K	
3. Wall Construction Details			
3.1	Main external walls are to achieve the U-value stated opposite.	U-Value = 0.18 W/m²K	
3.2	Walls to Unheated Corridors are to achieve the U-value stated opposite.	U-Value = 0.18 W/m²K	
4. Roof Construction Details			
4.1	Cold Roofs are to achieve the U-value indicated opposite.	U-Value = 0.11 W/m²K	
4.2	Flat Roofs to achieve the U-value indicated opposite	U-Value = 0.13 W/m²K	
5. Openings			
5.1	All double-glazed windows to achieve the U-Value stated	U-value = 1.2 W/m²K. double glazed window argon fill g-value = 0.5 BFRC Certified	
5.2	Gnd Floor - Half Glazed doors to achieve the U-Value stated	U-value = 1.4 W/m²K. double glazed window argon fill g-value = 0.5	
5.3	Solid Doors to Unheated Corridors to achieve the U-Value stated	U-value = 1.4 W/m²K.	
6. Ventilation			
6.1	Design stage SAP calculation assumes an air permeability of 4m3/m2/hr at 50pa will be achieved.		
6.2	Mechanical ventilation with heat recovery system installed in all wet rooms.	Nuaire MRXBOXAB_ECO2 S-W switch or equivalent	
6.3	No open flues or fireplaces or flue-less gas fires are present anywhere.		
7. Space Heating			
7.1	There is one main heating system installed.	No secondary heating.	
7.2	Heating is provided to the dwellings by individual electric panel heaters		
7.3	The heating system has programmer and appliance stat		

8. Water Heating			
8.1	Hot water to dwellings is provided from hot water heat pumps with cylinder storage	Dimplex EDL200 Size of Hot water to be confirmed by specialist.	
8.2	Water usage per person per day is ≤125 Litres.	To meet Part G	
9. Renewables			
9.1	We have currently allocated 18kWp PV to the roof, which equates to around 40% of the ground floor area as PfE policy.		
10. Other			
10.1	Use standardized thermal bridging details wherever possible to enhance thermal performance of the building.	Y=0.05 W/mK	
10.2	If masonry, thermally broken lintels will be installed to achieve improved thermal bridging for SAP ref: E2	Psi value of 0.05W/mK.	
10.3	Low energy (LE) lights are installed throughout.	All lighting must be specified with efficacy of 80 lumens/circuit watt or more.	

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