bdr
design limited
architectural technologists
24 conygar road

PLANNING APPLICATION

SUSTAINIBILITY STATEMENT

FOR

MS K. SUTTON

AT

HIGH TREES

POOLE LANE

STROUD

GLOUCESTERSHIRE

GL5 5LD

1231 -BDR-V1-XX-ST-A- 6103

Issue Record

Rev	Date	Status	Purpose of Issue	Author	Checked
P01	26/04/2023	D5	Issued for planning approval	[redacted]	

1.00 Introduction

This Sustainability Statement has been prepared by BDR Design Limited to accompany a detailed planning application for private garage with home office in the attic space. The application is submitted on behalf of ms K Sutton.

The statement describes the approach to developing the energy and sustainability strategy for the development.
The statement sets out the policy context in terms of national and local planning policy then describes how the development responds to these. Firstly, the statement describes how the buildings are designed to passively minimise energy consumption through efficient building fabric and consideration of the use of daylight and solar shading. It describes the efficient mechanical and electrical systems and the use of on-site renewable generation.
The statement is compiled in accordance with the requirements set out by and summarises the performance in terms of Part L as part of this.

2.00 Executive Summary

The proposals detailed provide a benchmark of sustainable development. The sustainability agenda has been prominent from the inception of the project and has resulted in the following:

- High fabric performance, exceeding regulatory requirements.
- All-electric heating technology including air source heat pumps
- Efficient services including mechanical ventilation with heat recovery (MHVR)
- A passive approach to mitigating overheating

The result of this is that the carbon performance is expected to be around 70% lower than the minimum requirements, which are themselves stretching the performance associated with the Building Regulations.
We are confident that the design is robust but are aware that the performance in practice is greatly more important. The ownership and management models lend themselves well to data collection, optimisation and occupant education such that the chances of success in practice can respond to the performance enabled by the strategic choices.

3.00 Environmental Context

3.01 The climate Emergency and the Policy Framework
It is widely accepted that the timeframe to avoid the most devasting impacts of climate change is narrowing. Man-made release of CO2 into the atmosphere is the primary reason for the warming climate that we observe and only by abating this can we reduce the risk of positive feedback loops that exaggerate the issue and accelerate the impacts on both human societies and the natural world.
The construction industry is a big part of the problem. The operation and construction of buildings contributes around 35% of the UK's carbon emissions. Yet buildings are not considered a 'hard to treat' industry: we have the technological answers, the challenge that must be met by all involved in development and construction is to implement them and ensure that the outcomes are realised.

National legislation sets a clear direction of travel:

- The UK government's Future Homes Standard requires a 20-31% reduction in carbon emissions by 2020 and 75-80% reduction by 2025;
- Stroud District Council

The proposed development has embraced the principles and goals described in these documents and exceeded them in many areas.

3.02 Additional industry guidance

In addition to local authorities and central government, a number of organisations within the UK construction industry have responded to the challenge posed and produced guidance to steer designs for new construction in a direction that is aligned to a holistic Net Zero Carbon strategy for the country as part of the 2016 Paris Agreement commitments. In many instances these build and expand on the themes set out in statutory requirements and strategies, providing practical guidance to designers on how they may be achieved.

UK Green Building Council – Net Zero Carbon Framework

This document provides a framework through which a building, tenancy, group of buildings or wider estate can credibly define itself as ‘net zero carbon’. It was produced to consolidate and clarify a framework around which strategies and targets could be delivered. It is not a target or standard within itself.

The framework accepts that for any project to be objectively net zero carbon it has to have some form of residual carbon offset. It then sets principles so that the amount of offset is reduced to a minimum as follows:

- Reduce construction Impacts
- Reduce Operational energy use
- Increase Renewable Energy Supply
- Offset remaining carbon.

In order to gain verification against this scheme building operators must collect the energy use data (construction and/or operational), have it audited by a third party, declare the value and nature of the offset scheme used and publicly disclose the results on an annual basis.

RIBA 2030 Challenge

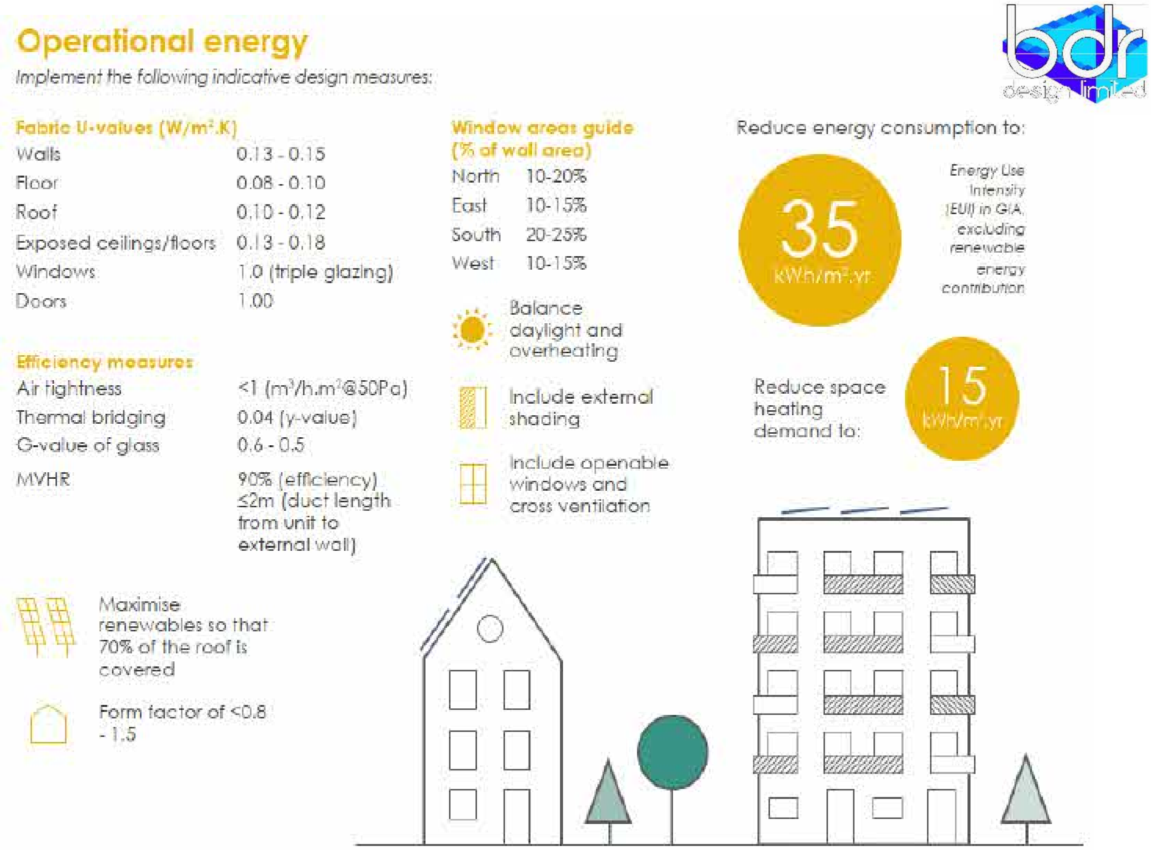
The RIBA 2030 Challenge sets numerical design targets for new buildings. The means by which designers may reach the targets are not discussed.

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m^2/y	146 kWh/m^2 /y (Ofgem benchmark)	< 105 kWh/m^2/y	< 70 kWh/m^2/y	< 0 to 35 kWh/m^2/y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO$_2$e/m^2	1000 kgCO$_2$e/m^2 (M4i benchmark)	< 600 kgCO$_2$e/m^2	< 450 kgCO$_2$e/m^2	< 300 kgCO$_2$e/m^2	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

It also sets comfort metrics to reflect design quality such that these are not sacrificed in seeking exemplary environmental performance.

LETI Climate Emergency Design Guide

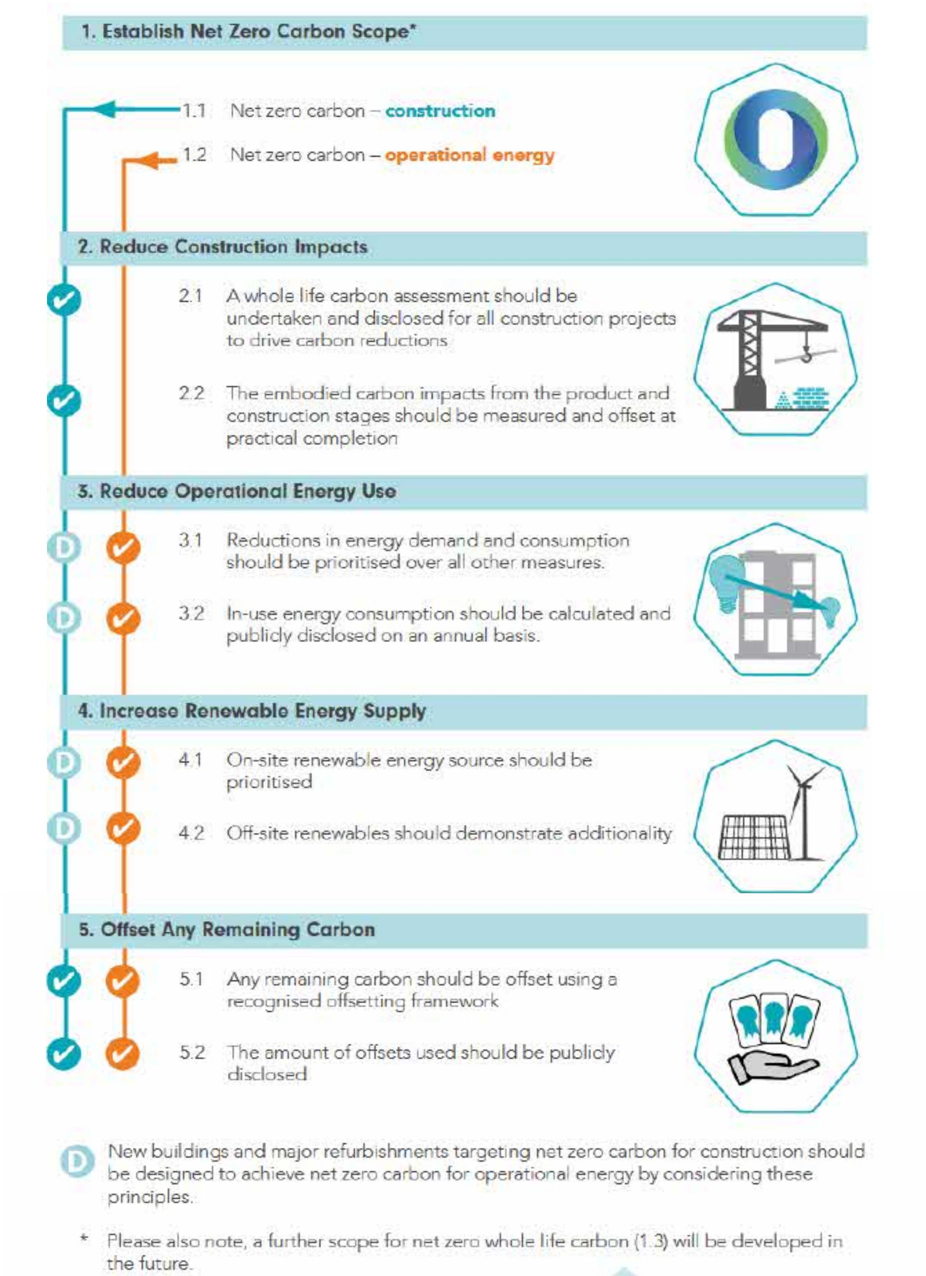
The LETI design guide was crowd-authored by the building design community. It gives practical advice on how to reach the targets it defines as in keeping with the climate emergency and the Paris 1.5 oC target and is the most detailed design guide focused on the climate emergency.



3.03 Alignment of the proposed development with industry guidance

The key aspects of the proposed scheme align with these emerging guides.

UK Green Building Council – Net Zero Carbon Framework
The hierarchy of approaches is followed precisely. Further consideration is being given to the offsetting and associated disclosure. If this were undertaken, then zero carbon verification would be completed.



- All comfort metrics are achieved under the preferred strategy
- Further calculation of embodied carbon is required, although a predominantly cross-laminated timber (CLT) structure would reduce embodied energy considerably and would likely meet the ‘2025’ or ‘2030’ category.
- Operational Energy is contingent on the occupant behaviour and is highly uncertain. The dwellings provided give good opportunities to reduce this to meet the 2025/2030 targets.
- Potable water use – 2020 target met.

LETI Design Guide (Medium and Large Scale housing)

- Form factor, glazing ratios, air tightness and U-values, generally met or slightly below (see
- next section).
- Daylight and overheating well balanced including the use of external shading and openable windows.
- All heat is fossil fuel free.
- Metering and disclosure as described below.

l Low embodied carbon expected, although not quantified at present.

It is important to note that these guides and documents are intended to be stretch targets to be followed by 2030, in keeping with a trajectory to a net zero future. Aligning closely with them in 2020 should be considered exemplary.

4.00 Energy Strategy

4.01 Energy Hierarchy

This is established good practice and has been applied as follows:

1 Fabric Performance

Optimising fabric performance is widely recognised as the most cost effective and robust strategy to reduce building energy loads and carbon emissions.

2 Passive Design

Passive design principles have been used to avoid summertime overheating and maximise daylighting. Optimising the passive design helps reduce the buildings energy consumption by avoiding the need for cooling systems and reliance on artificial lighting.

3 Efficient Servicing

The buildings heating and hot water generation employs an electric only approach, which will benefit from reductions in CO2 emissions that increase over time as the electricity grid further de-carbonises. Air source heat pumps are proposed to maximise the efficiency with which the electricity is used.

4 Renewable Energy Generation

All potential areas of roof (East to West through a Southern arc) that can provide PV electricity generation are expected to be used to supply the development.

5 Monitoring, Reporting, Improving

The development will have it's performance in terms of energy use and internal comfort monitored so that the performance can be optimised and the design targets realised.

The following section gives an outline of the design features of the building affecting energy use and how energy efficiency has been considered throughout the design of the building. It should be noted that the values given are targets that will be sought through the detailed development of the scheme.

4.02 Fabric Performance

A high thermal performance has been targeted for all building elements. Table 1 outlines the proposed U-values for different elements in comparison to the Part L upper limits and notional building values. As can be seen, the targets for the development far exceed those set by the Building Regulations

Table 1.1 Building Fabric U-Values for New Dwellings

Building Element	Building Regulations L2A Upper Limit (W/sq.m.K)	Building Regulations L2A Notional Building (W/sq.m.K)	Development Target values (W/sq.m.K)
All Roof Types	0.15	0.11	
Walls	0.18	0.18	
Floors	0.18	0.13	
Party Walls	-	0.00	
External Glazing (Including frame factor)	1.4 or Window Energy Rating B	1.20	
Rooflights (Including frame factor)	2.20	-	
External Doors (60% glazed)	1.4 or Window Energy Rating C	1.00	
Other External Doors	1.4 or Window Energy Rating B	1.00	
Air Permeability cu.m/(h-m) @ 50Pa		5.00	
Ventilation		Natural with extract fans	
Heating Appliance		49.5% gas boiler	
Heating Emitters		Design Flow temperature + 55 DegC	
Waste Water Heat Recovery		Yes	
Photovoltaics		40% of ground floor area	

Table 1.2 Building Fabric U-Values for new or replacement elements in new and existing buildings

Building Element	Building Regulations L2A Upper Limit (W/sq.m.K)	Building Regulations L2A Notional Building (W/sq.m.K)	Development Target values (W/sq.m.K)
Pitched Roof - Rafter level	0.16	-	
Pitched Roof - Ceiling level	0.16	-	
Flat Roof	0.18	-	
Walls	0.26	-	
Floor	0.18	-	
Windows	1.4 or Window Energy Rating B	-	
Rooflights	2.20	-	
Other windows, rooflights, curtain walling & pedestrian doors	1.60	- -	
Vehicle access and similar large	1.30	-	
High Usage entrance doors	3.00	- -	
Roof ventilators	3.00	-	
Air Permeability cu.m/(h-m) @ 50Pa	8.00	- -	

The enhanced fabric performance for each element will therefore form a large component of the overall carbon saving.

4.03 Passive Design

Overheating Approach

Overheating risk has been a growing concern amongst the domestic design, construction and provider community for at least a decade. Domestic overheating has not always been a problem in the UK but climate change, increased urbanisation, construction of more dense accommodation and winter energy efficiency measures have all contributed in the amplification of high internal temperatures. Homes that overheat cause significant discomfort and stress to the occupants and can ultimately lead to homes becoming almost uninhabitable during heatwaves. This trend is set to continue as global temperatures increase and both the severity and frequency of heatwaves increases.

A successful passive overheating strategy must see many aspects of the environmental design align so that the solar gains are managed and using the opening windows does not cause a nuisance or incur a security risk. The key elements of the strategy for Wolverton are as follows, with examples in the table below:

1. Moveable, secure external shading – Solar gains can be stopped before they enter the dwellings through the use of external blinds, which can be left deployed when away from the dwelling and retracted during cooler periods to maximise daylight and useful gains in winter. Blinds are to be considered to all high-gain windows.
2. Secure ventilation – Being able to ventilate safely at night is key. Windows will have a secure latching position mode to enable this. MVHR will be specified with a bypass mode to facilitate the intake of cooler air.
3. High levels of ventilation – The ability to move large volumes of air (‘purge’ ventilation) relies on large windows, which are achieved by large side-hung and casement windows which open inwards.
4. Consideration of noise nuisance – opening windows lets more noise in. We have used the noise survey plus recent guidance documentation to ensure that modelled window openings do not impose an unmanageable noise nuisance.

Acoustic Restrictions

The window opening areas for bedrooms, expressed as percentage of the room floor area, exceed the maximum available for the actual windows. The figures have been used as set out below in the overheating modelling.

It is important to note that noise nuisance is subjective. In practice some occupants accept greater noise intrusion for thermal comfort than others. However, by designing to these opening proportions we gain confidence that acoustic nuisance does not undermine the passive design strategy.

Overheating Modelling

The modelling followed CIBSE TM59 methodology as this provides a standardised process for assessing overheating in dwellings. This methodology sets out standardised heat gains depending on the room type as well as profiles for when these heat gains occur. All dwellings should be assessed against a DSY1 2020 50th percentile high emissions scenario weather file. This represents a “moderately warm summer” in the time frame from 2011-2040.

To assess performance under future climate scenarios the dwellings have also been assessed against DSY2 2050 50th percentile high emissions scenario weather file.

Where appropriate external blinds were modelled with a thermal transmission of 8% and glass with a g-value of 0.4.

Overheating Criterion

TM59 requires the dwellings to be assessed against two criteria:

- Criterion a for living rooms, kitchens, and bedrooms: the number of hours during which ΔT is greater than or equal to 1K during the period May to September inclusive shall not be more than 3% of occupied hours;

- Criterion b for bedrooms only: the operative temperature in bedrooms from 10pm to 7am shall not

Outcome

The key points arising from the assessment are:

- Blinds are likely to be required to pass to the TM59 standard.
- With blinds, generally most rooms in the most challenging flats pass all criteria.
- Without external blinds some rooms start to fail against TM59.
- During the hottest week, some rooms require marginally more opening of the windows. This is technically possible but incurs a slightly greater noise risk.
- DSY2 is generally challenging, although this doesn't technically need to be passed in order to satisfy

Conclusion

The proposed development has taken into account TM59 on a voluntary basis in order to consider how best to provide a good living environment for residents, consistent with the aims of a holistically sustainable development.

Additionally, by showing a pass whilst managing noise nuisance we are demonstrating a further robustness to the approach that ensures occupants the capability of managing overheating risk without their homes becoming noisy.

4.4 Efficient Services

The proposed strategy for MEP services installations has been driven by energy efficiency, carbon performance and indoor comfort. A range of technologies were initially considered with the chosen strategy clearly optimal for the location, density and form of development. Gas heating was not considered for any part of the development, anticipating and forerunning the ban on gas in new development from 2025.

Air Source Heat Pumps

The electricity grid in the UK is in the process of decarbonising and is projected to do so particularly rapidly over the coming decade. The figure below shows the projected decarbonisation resulting from the grid's changing energy mix along with the measured grid average intensity since 2010.

Air source heat pumps (ASHPs) use electricity to extract heat from the air. They produce approximately 3 units of heat for every unit of electricity used such that the carbon intensity of the heat is 1/3 that of the electricity used. The projected reduction in grid electricity results in a subsequent reduction in the operational carbon emissions of the development into the future.

The intention is to use an individual air source heat pump for the development. This reduces noise risk associated with larger plant and mitigates the losses associated with heat networks. The plant will generally be accommodated in enclosures in gardens away from the dwellings themselves.

Mechanical Ventilation with Heat Recovery (MVHR)

The passive overheating approach described above will provide ventilation during the warmer months. During the heating season the ventilation requirements will generally be met with an MVHR system that will:

- reduce space heating loads;
- assist secure night ventilation for summer overheating; and
- provide a reliable source of draught-free fresh air.

Ducts will be arranged to minimise the fan power associated with the system.

Lighting

LED internal lighting will be used throughout. This will generally target a minimum of 80 lms/W.

Summary

The MEP services and all electric services reduce carbon emissions now and will continue to do so into the future.

4.5 Photovoltaic Electricity Generation and On-site storage

Proposal summary

Roof-mounted PV generation is routed back to a central battery, for later use.

Carbon Saving

The carbon benefits of this scheme are not reflected in regulatory calculations, which do not differentiate between electricity used on site or exported to the grid.
In reality, this simplification misses a key carbon benefit. PVs generate electricity at a time when demand is low, which is reflected in the overall intensity of the electricity grid.
By harvesting the electricity generated during this period and using it later in the day when the carbon intensity is higher the overall carbon impact of the development is decreased.

Summary

The inclusion of a PV generated electricity in the development would lower carbon emissions as well as the price of electricity to the consumer.
The net result is a greater amount of PV than is required to meet building regulations.

5.0 Strategy Performance and Compliance Calculations

Approach to Part L calculations

Residential SAP

Building Fabric	U-Value (W/sq.m.K)			Notes
External Walls	0.16			Exposed wall
Exposed Floor	0.10			-
Roof	0.10			Flat Roof - Insulated flat roof
Windows	1.2 (g-value 0.4)			Glazing: Double glazed, 12mm argon filled gap, Frame Factor:0.7 Overhang Depth: 100mm Curtain Type: Light coloured curtains or roller blind (by default), 100% closed.
Thermal Bridges	0.10 average			Assumed

Ventilation	General Info			Notes
Ventilation Strategy	Balanced with heat recovery (MVHR)			-
SFP	0.52			By Sap Catalogue
Duct Type	Rigid and insulated			-
Air Permeability	2 cu.m/h.sq.m			-

Heating	General Info			Notes
Heating Group	Heat pump with radiators or underfloor heating			
Sub Group	Electric Heat pumps			
Heating Emitters	UFH, pipes in insulated timber floor			
Heating Fuel	Heat from electric heat pump (standard tariff)			
Heating Controls	Programmer and at least 2no. room thermostats			

Water Heating	General Info			Notes
Domestic Hot Water strategy	From main system			
Cylinder Volume	150 litres			Datasheet
Manufacturer Loss Factor	0.54 kWh/day			Datasheet
Cylinder in Heated Space	YES			
Cylinderstat	YES			
Primary Pipework Insulated	YES - Fully insulated primary pipework			
Water Heating Timed Separately	YES			

Renewable Technology	General Info			Notes
Photovoltaics	Present			
Installed Peak Power	2.5 kWp			
Tilt of Collector	30 deg, or 45 deg			
Overshadowing	None or very little			

Overheating	General Info			Notes
Window Opening	Windows fully open			
Night Ventilation	Yes			
Low Energy Lights	100%			

Results Summary
The SAP calculations summary is as follows:

Type	Unit ID	TER	DER - no PV		DER-250kWp PV/unit	
		kgCO2/sq.m	kgCO2/sq.m	% reduction vs TER	kgCO2/sq.m	% reduction vs no PV
Flat	1	21.47	14.68	31.63%	3.64	75.20%
Flat	2	25.80	19.24	25.43%	5.93	69.18%
House	3	22.65	14.34	36.69%	5.82	59.41%
House	4	23.78	13.01	45.29%	6.06	53.42%
Average Flat		23.64	16.96	28.24%	4.79	71.79%
Total kgCO2		123091	88328	28.24%	24920	71.79%
Average House		23.22	13.68	41.09%	5.94	56.56%
Total kgCO2		97503	57435	41.09%	24948	56.56%

Applying these results to the entire site provides the following outcomes:

- 5208 sq.m total floor area of flats
- 4200 sq.m total floor area of houses

	SITE TER	SITE DER - no PV		SITE DER-250kWp PV	
	kgCO2	kgCO2	% reduction vs TER	kgCO2	% reduction vs no PV
Whole Site	220594	145763	33.92%	49868	65.79%

This site wide outcome compares favourably with the requirements set by Part L

	No PV	250kWp PV
Reduction relative to Part L	35%	80%

The carbon offset calculated in accordance with 'Calculating Carbon Neutral' is £-|-|-|-|-

7.00 Materials and Waste

7.01 Materials and Construction

Concrete is expected to be used for the ground-floor and any retaining structures.
Brick will be the principal cladding material. Brick has high levels of embodied energy, but a long life.
Windows are proposed to be aluminium-faced timber composite
The use of uPVC will be avoided in rainwater goods and other detailing
Internal specifications will be developed taking account of appropriate guidance such as the BRE Green Guide.
The opportunity for green roofs has been considered. Owing to the objective, discussed above, of maximising usable roof space for PV installations the opportunities for formal green roofs are likely to be limited to outbuildings such as garden and bin stores.

7.02 Lifecycle Considerations

The use of long-life low-maintenance materials – timber, concrete and brick – for the bulk of the structure strikes a balance between mitigating the embodied carbon in building materials and processes and creating a robust and stable built form that lasts. Hard landscaping emphasises the use of robust paving elements which with proper detailing, construction and maintenance will last indefinitely.
The design and construction of buildings is being specified with longevity and adaptability in mind, with consideration given ensuring that residential dwellings are capable of responding to the changing needs of households over time
Timber, is recyclable and widely reusable, and the detailing of cladding (including mortar) and other elements will be considered to allow future ‘demounting’ and reuse of other materials.

8.00 Water

8.01 Water Demand

The approach to managing water demand within the development is:

- Use dual flush WCs
- Select low flow sanitary fixtures
- Select planting with low irrigation demand

The Part G water calculator has been used to assess water demand as follows:

Table A1: The water efficiency calculator

		(1)	(2)	(3)	(4)
Installation type	**Unit of measure**	**Capacity / flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/ person/day = [(1)x(2)]+(3)**
WC (single flush)	Flush volume (litres)	0	4.42	0.00	0.00
WC (dual flush)	Full flush volume (litres)	6	1.46	0.00	8.76
	Part flush volume (litres)	3	2.96	0.00	8.88
WCs (multiple fittings)	Average effective flushing volume	0	4.42	0.00	0.00
Taps (excluding kitchen/ utility)	Flow rate (litres/ minute)	3	1.58	1.58	6.32
Bath (where shower also	Capacity to overflow (litres)	150	0.11	0.00	16.50
Shower (where bath also	Flow rate (litres/ minute)	9	4.37	0.00	39.33
Bath only	Capacity to overflow (litres)	0	0.50	0.00	0.00
Shower only	Flow rate (litres/ minute)	0	5.60	0.00	0.00
Kitchen/ utility sink taps	Flow rate (litres/ minute)	5	0.44	10.36	12.56
Washing machine	Litres/ Kg dry load	8	2.10	0.00	16.80
Dishwasher	Litres/ place setting	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/ use	0	3.08	0.00	0.00
Water softener	Litres/ person/ day	0	1.00	0.00	0.00
		(5)	Total calculated use + (Sum column 4)		113.65
		(6)	Contribution from greywater (litres/ person/ day)		
		(7)	Contribution from rainwater (litres/ person/ day)		
		(8)	Normalisation factor		0.91
		(9)	Total water consumption		103.42
		(10)	External water use		5.00
		(11)	Total water consumption = (9) + (10) (litres/ person/ day)		**108.42**

The result is lower than the required 110 litres/ person/ day

8.02 Water Reuse

There are a number of downpipes that collect water and discharge it to the below ground pipework. The intention is to intercept this and provide reliable downpipe filters and water butts for communal use.

9.00 Summary

The term sustainability is over-used within new developments and often applied inaccurately.

We are confident that our proposals provide a road map to an environmentally sustainable development. Current understanding and future directions of sustainability within new construction have been anticipated and will be implemented where possible.

The use of a CLT structural solution would reduce the environmental impact of the development. The fabric standards, services approach, renewable energy strategy and passive design approach reduce the ongoing energy use and carbon emissions. The dwellings have up to an 80% reduction in calculated carbon emissions compared to the Part L requirements. Achieving these ambitious targets would exceed Local and National policy.

Solar generation and battery storage would allow us to maximise solar electricity generation and use 100% of the electricity on site, providing an asset for the local community. The ability to use live, historic and forecast energy data will enable the grid to optimise the
electrical energy use on site. This will minimise the developments impact on the wider electrical grid and become an exemplar of how developments can respond to the climate emergency in an effective and pragmatic way.

10.00 Resources

Information used to prepare this report and to further assist the design can be obtained from the following:

Net Zero Carbon Toolkit:
How to achieve net zero carbon homes - West Oxfordshire District Council (westoxon.gov.uk)

Project LEO – Local Energy Oxfordshire:
Home - Project LEO (project-leo.co.uk)

Parity Projects: Plan Builder:
Programmes - Parity Projects

LETI Climate Emergency Design Guide:
Climate Emergency Design Guide | LETI

LETI Climate Emergency Retrofit Guide:
Climate Emergency Retrofit Guide | LETI

LETI Embodied Carbon Primer:
Embodied Carbon Primer | LETI

Levitt Bernstein Easi Guide Passivhaus Design:
Easi Guide to Passivhaus Design — Levitt Bernstein

CIBSE TM52 The limits of thermal comfort: avoiding overheating (2013):
TM52: The Limits of Thermal Comfort: Avoiding Overheating in European Buildings | CIBSE

CIBSE TM54 Evaluating operational energy use at the design stage (2022):
TM54 Evaluating operational energy use at the design stage (2022) | CIBSE

CIBSE TM59 Design methodology for the assessment of overheating risk in homes (2017):
Technical Memorandum 59: Design methodology for the assessment of overheating risk in homes | (

CIBSE TM65 Embodied carbon in building services: A calculation methodology (2021):
Embodied carbon in building services: a calculation methodology (TM65) | CIBSE

BRE Green Guide to Specification:
Green Guide to Specification : BRE Group

RIBA Embodied and whole life carbon assessment for architects:
Embodied and whole life carbon assessment for architects sustainable design (architecture.com)

Cycle infrastructure design (LTN1/20):
Cycle infrastructure design (LTN 1/20) - GOV.UK (www.gov.uk)

Infrastructure for charging electric vehicles: Approved Document S:
Infrastructure for charging electric vehicles: Approved Document S - GOV.UK (www.gov.uk)

UWLA Water Calculator:
The Water Calculator

Sanitation, hot water safety and water efficiency: Approved Document G:
Sanitation, hot water safety and water efficiency: Approved Document G - GOV.UK (w

BREEAM Non-domestic Buildings Technical Manual:
BREEAM New Construction 2018 (UK) - Cover_temp (bregroup.com)

Environment Agency Rainwater harvesting: regulatory position statement:
Rainwater harvesting: regulatory position statement - GOV.UK (www.gov.uk)

HVRH Rainwater harvesting design and installation guide (2016):
Rainwater harvesting design and installation guide (2016) | CIBSE

Preparing a flood risk assessment: standing advice:
Sustainability Standards Checklist (Feb 2023) (westoxon.gov.uk)

Check the long term flood risk for an area in England:
Check the long term flood risk for an area in England - GOV.UK (www.gov.uk)

CIRIA The SuDS Manual:
https://www.ciria.org/CIRIA/Memberships/The_SuDs_Man ual_C753_Chapters.aspx

Susdrain:
Susdrain - The community for sustainable drainage

Green roofs and living walls:
Livingroofs.org, the leading UK green roof website

Considerate Constructors Scheme:
Considerate Constructors Scheme (ccscheme.org.uk)

Wrap:
WRAP - The Climate Crisis: Act Now

Waste Management Guidelines for Architects and Property Developers:
Waste Management Guidelines for Architects and Property Developers 2014 (newham.gov.uk)

Natural environment, including the mitigation hierarchy:
Natural environment - GOV.UK (www.gov.uk)

Protected species and development:
Protected species and development: advice for local planning authorities - GOV.UK (www.gov.uk)

Biodiversity metric:
Biodiversity metric: calculate the biodiversity net gain of a project or development - GOV.UK (www.gc

The Biodiversity Metric 3.1 (JP039):
The Biodiversity Metric 3.1 - JP039 (nepubprod.appspot.com)

Enabling a Natural Capital Approach (ENCA):
Enabling a Natural Capital Approach (ENCA) - GOV.UK (www.gov.uk)

Environmental Benefits for Nature Tool - Beta Test Version (JP038):
The Environmental Benefits from Nature Tool - Beta Test Version - JP038 (naturalengland.org.uk)

CIEEM:
Home | CIEEM

BREEAM:
BREEAM | BRE Group

Building with Nature:
About — Building with Nature — Building with Nature

One Planet Living:
One Planet Living® sustainability framework – Bioregional

Historic England Statements of Heritage Significance:
Statements of Heritage Significance: Analysing Significance in Heritage Assets (historicengland.org.u

Historic England Retrofit and Energy Efficiency in Historic Buildings:
Retrofit and Energy Efficiency in Historic Buildings | Historic England

Building Regulations, Approved Documents and Historic Buildings:
Building Regulations, Approved Documents and Historic Buildings | Historic England

STBA Planning responsible retrofit of traditional buildings:
https://historicengland.org.uk/images-books/publications/planning-responsible-retrofit-of-traditional-b

STBA Responsible Retrofit Guidance Wheel:
Responsible Retrofit Guidance Tool (responsible-retrofit.org)

BSI PAS 2035/2030 - Retrofitting dwellings for improved energy efficiency
How our new energy retrofit PDF will help improve energy efficiency | BSI (bsigroup.com)

BS 7913:2013: Guide to the conservation of historic buildings
BS 7913:2013 | 31 Dec 2013 | BSI Knowledge (bsigroup.com)

BREEAM Technical Manual for Refurbishment of Domestic Buildings:
BREEAM Domestic Refurbishment Manual 2014 - cover_dynamic (bregroup.com)