SUSTAINABILITY & ENERGY STATEMENT
LAND WEST OF BACKSETTOWN,
FURNERS LANE,
HENFIELD,
WEST SUSSEX.

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This report provides a brief overview of the range of opportunities for sustainable energy and is not intended as detailed design advice. As such data and information should only be treated as indicative at this stage of the process. Further investigation can be undertaken when more accurate and detailed information is required on specific measures.

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Executive Summary

This Statement has been prepared in support of a planning application for the erection of 29 new dwellings on Land West of Backsettown, Furners Lane, Henfield, West Sussex. Refer to schedule of accommodation prepared by Elivia Homes for more details on tenure, floor areas and house types.

The Statement demonstrates how the proposed development addresses Policy 35 Climate Change and demonstrates, and quantifies, how the development accords with the Energy Hierarchy as laid out under Policy 36 and 37 of the Horsham District Council's Planning Framework. The statement also includes details of compliance with Part L1A (2021) of the current Building Regulations and includes details of electric vehicle charging points in accordance with the requirements of West Sussex County Council's Standards.

For clarification, Policies 35, 36 and 37 of the Horsham District Planning Framework (HDPF) were created in November 2015. The Building Regulations Part L1A (2013) for calculating carbon emissions was in use at that time. In June 2022, the Government implemented an interim uplift to Part L of the Building Regulations, updating the Building Regulations 2013. The updated Building Regulations are titled the Building Regulations 2021. Homes built to the interim standard will be expected to produce 31% less CO_2 emissions compared to standards set out in the 2013 Building Regulations. We have therefore carried out energy rating and carbon emission calculations using Part L (2021) as Part L1A (2013) is no longer used and therefore does not provide accurate data.

Due to the uplift in minimum requirements set out in Part L (2021) it is our opinion that the required energy hierarchy – Be Lean, Be Clean, Be Green is no longer fit for purpose as the dwellings will require some form of renewable energy (e.g. Photovoltaic Panels, Air Source Heat Pumps etc.) just to achieve compliance with the current regulations, therefore creating a baseline that already exceeds the 35% reduction required by many Local Authorities. It is our opinion that this policy should have been reviewed prior to the introduction of the new Part L 2021 which came into effect 15th June 2022.

Arcadian Architectural Services Ltd. Has therefore created an energy statement in line with Part L 2021 demonstrating savings in carbon emission considerably above 35%.

Working drawings have yet to be produced, but SAP 10 energy rating calculations have been carried for all the units based upon the construction specification set out within this report, and the detailed planning drawings. These calculations provide an accurate assessment of the carbon dioxide emissions and energy use arising from the dwellings.

It is proposed to enhance the fabric insulation standards of the building above the minimum required in Part L (2021) Building Regulations. The site is of insufficient size to warrant a communal heating infrastructure, with or without, a combined heat and power unit. Space heating and hot water will be provided by individual air source heat pumps. The strategy provides for reductions in carbon emissions below the minimum required to achieve compliance under Part L (2021) of the Building Regulations through energy efficiency measures.

The reductions in carbon emissions can be summarised as follows:

	Total Emissions	% Reduction
Baseline (Part L1A 2021) TER	**958,600 kgCO_2/yr/m²**	-
Emissions after Be Lean, Be Clean, Be Green) DER	**445,689 kgCO_2/yr/m²**	**53.51%**

1.0 Introduction

This report provides a Sustainability and Energy Statement for the construction of 29 new dwellings at Land West of Backsettown, Furners Lane, Henfield, West Sussex.

This report describes the methodology used in assessing the development, and the initiatives proposed.

The buildings have been designed; and will be constructed; to reduce the energy demand and and consequently, carbon dioxide emissions. The objective is to reduce the energy demand to an economic minimum by making investment in the parts of the buildings that have the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric. Once cost-effective construction methods have been designed, low-carbon and/or renewable technologies will be considered to provide heat and/or electricity.

The following hierarchy will be followed:

- Be Lean Reduce demand and consumption
- Be Clean Increase energy efficiency
- Be Green Provide low carbon renewable energy sources

2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled “A better quality of life: A strategy for sustainable development in the UK”. This sets out four main objectives for sustainable development in the UK:

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in

parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:
• National Planning Policy Framework - 2023

Paragraph 152 states:

"Support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy)"

Regional and Local Policies

Horsham District Council's Planning Framework Policies 35, 36 and 37 apply. The policies have been edited for clarity.

Policy 35 – Strategic Policy: Climate Change

Development will be supported where it makes a clear contribution to mitigating and adapting to the impacts of climate change and to meeting the district's carbon reduction targets as set out in the Council's Acting Together on Climate Change Strategy, 2009.

Measures which should be used to mitigate the effects of climate change include;

- *Reduced energy use in construction*
- *Improved energy efficiency in new developments, including influencing the behaviour of occupants to reduce energy use*
- *The use of decentralised, renewable and low carbon energy supply systems*
- *The use of patterns of development which reduce the need to travel, encourage walking and cycling and include good accessibility to public transport and other forms of sustainable transport*
- *Measures which reduce the amount of biodegradable waste sent to landfill. Development must be designed so that it can adapt to the impacts of climate change, reducing vulnerability, particularly in terms of flood risk, water supply and changes to the district's landscape.*

Developments should adapt to climate change using the following measures

- *Provision of appropriate flood storage capacity in new building development*
- *Use of green infrastructure and dual use SuDS to help absorb heat, reduce surface water runoff, provide flood storage capacity and assist habitat migration*
- *Use of measures which promote the conservation of water and/or grey water recycling.*
- *Use of site layout, design measures and construction techniques that provide resilience to climate change (opportunities for natural ventilation and solar gain). If it is not possible to incorporate the adaption and mitigation measures proposed, an explanation should be provided as to why this is the case.*

Policy 36 – Strategic Policy: Appropriate Energy Use

All development will be required to contribute to clean, efficient energy in Horsham based on the following hierarchy:

- *Lean – use less energy – e.g. through demand reduction*
- *Clean – supply energy efficiently – e.g. through heat networks*
- *Green – use renewable energy sources*

District Heating and Cooling Commercial and residential developments in Heat Priority Areas or the strategic development locations will be expected to connect to district heating networks where they exist using the following hierarchy or incorporate the necessary infrastructure for connection to future network. Development should demonstrate that the heating and cooling systems have been selected in accordance with the following heating and cooling hierarchy.

- *Connection to existing (C)CHP distribution networks*
- *Site wide renewable (C)CHP*
- *Site wide gas-fired (C)CHP*
- *Site wide renewable community heating/cooling*
- *Site wide gas-fired community heating/cooling*
- *Individual building renewable heating*
- *Individual building heating, with the exception of electric heating*

All (C)CHP must be of a scale and operated to maximise the potential for carbon reduction. Where site-wide (C)CHP is proposed, consideration must be given to extending the network to adjacent sites. Energy Statements All applications for residential or commercial development must include an Energy Statement demonstrating and quantifying how the development will comply with the Energy Hierarchy.

Policy 37 – Sustainable Construction

Proposals must seek to improve the sustainability of development; to deliver sustainable design, development should incorporate the following measures where appropriate according to the type of development and location:

- Maximise energy efficiency and integrate the use of decentralised, renewable and low carbon energy
- Limit water use to 110 litres/person/day
- Use design measures to minimise vulnerability to flooding and heatwave events
- Be designed to encourage the use of natural lighting and ventilation
- Be designed to encourage walking, cycling, cycle storage and accessibility to sustainable forms of transport
- Minimise construction and demolition waste and utilise recycled and low-impact materials
- Be flexible to allow future modification of use or layout, facilitating future adaptation, refurbishment and retrofitting
- Incorporate measures which enhance the biodiversity value of development.

All new development will be required to provide satisfactory arrangements for the storage of refuse and recyclable materials as an integral part of design. New homes and workplaces should include the provision of high-speed broadband access and enable provision of future technologies where available.

3.0 Assessment Methodology

The baseline energy demand and carbon dioxide emissions for the dwellings have been established by preparing SAP 10 calculations for each unit. These calculations have been based upon certain assumptions with regards to the building specification and these are clarified below. These are not design calculations but serve to establish the environmental, technical and economic viability of various renewable and low carbon technologies.

Emission Factors

The CO_2 emission factors, where applicable, used throughout this report have been taken from the Building Regulation Approved Document L (2021)

	Kg CO_2/kWh
Natural Gas	0.21
Grid Supplied Electricity	0.136
Electricity Sold to Grid	0.136

In assessing this proposal, we have also been informed by following guidance BRE Green Guide to Specification which is The Building Research Establishment Green Guide to Specification lists building materials and components and ranks their potential life cycle environmental impact.

4.0 Proposal

Plot Number	**Unit Type**	**Front Door Orientation**	**Area (Internal)**
Plot 1	4-Bed Detached	West	174.66m²
Plot 2	3-Bed Detached	West	132.70m²
Plot 3	3-Bed Detached	West	152.23m²
Plot 4	3-Bed Detached	North	154.56m²
Plot 5	2-Bed Detached	North	111.29m²
Plot 6	4-Bed Detached	East	174.66m²
Plot 7	3-Bed Detached	East	132.70m²
Plot 8	3-Bed Detached	East	152.23m²
Plot 9	2-Bed Detached	East	114.40m²
Plot 10	2-Bed Detached	East	114.40m²

Plot 11	1-Bed Flat	South	56.41m²
Plot 12	1-Bed Flat	South	69.19m²
Plot 13	3-Bed Mid-Terrace	South	93.34m²
Plot 14	2-Bed Mid-Terrace	South	81.34m²
Plot 15	3-Bed End-Terrace	South	93.34m²
Plot 16	3-Bed End-Terrace	South	93.34m²
Plot 17	2-Bed Mid-Terrace	South	81.34m²
Plot 18	3-Bed Mid-Terrace	South	93.34m²
Plot 19	1-Bed Flat	South	69.19m²
Plot 20	1-Bed Flat	South	56.41m²
Plot 21	3-Bed Detached	North	152.23m²
Plot 22	3-Bed Detached	North	152.23m²
Plot 23	3-Bed Detached	West	142.39m²
Plot 24	3-Bed Detached	West	142.39m²
Plot 25	2-Bed Detached	East	111.29m²
Plot 26	2-Bed Detached	East	111.29m²
Plot 27	2-Bed Detached	East	114.40m²
Plot 28	2-Bed Detached	East	114.40m²
Plot 29	2-Bed Detached	North	114.40m²
TOTALS	**29 Plots**	**/**	**3356.09m²**

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean and Be Clean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupants in reducing energy consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical. It is possible to exceed Building Regulations requirements (Part L (2021) through demand reduction measures alone, which typically include a combination of passive design measures (e.g., building design and efficient building fabric) and active design measures.

Passive Design Measures

The passive design measures proposed include:

Passive Solar Gain - Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain. The dwellings will be designed to comply with Part O of the Building Regulations "Overheating Mitigation"

Natural Daylighting - The orientation and the size of the windows have been optimised to maximise the amount of natural daylight and therefore reduce the demand for artificial lighting.

Building Envelope - The proposed 'U' values of the building envelope must meet Building Regulations Part L (2021) standards and additional improvements to 'U' values will consequently reduce the building's heating requirements.

There is a commitment to exceed the minimum 'U' values required by the Building Regulations. Whilst the construction type has not been formally agreed. The dwellings will likely be timber frame construction with beam & block ground floors. 'U' values have been based upon the use of 140mm timber frame walls insulated with 120mm PIR insulation. The Ground floor will be insulated with 150mm Celotex insulation under a 75mm cement screed. Loft spaces will be insulated with 400mm mineral wool with rafters having PIR insulation between & under rafters.

The following U-values are set as the backstop:

Element	Part L (2021) Limiting 'U' Value	Proposed 'U' value	Proposed Improvement
	W/m^2K	W/m^2K	
External Walls	0.26	0.18	31%
Dormer Walls	0.26	0.18	31%
Ashlar Walls	0.26	0.18	31%
Ceiling Level Insulation	0.16	0.11	31%
Flat Roof	0.16	0.13	19%
Rafters	0.16	0.13	19%
Ground Floor	0.18	0.11	39%
Windows	1.60	1.20	25%
External Doors	1.60	1.00	38%
Rooflights	2.20	1.20	45%

Air Leakage - Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building. The Building Regulations set a minimum standard for air permeability of 8.00 m^3

of air per hour per m^2 of envelope area, at 50Pa. For the purposes of this report, it has been assumed that each dwelling will achieve a permeability of 5.00 $m^3/hr/m^2$.

Thermal Bridging - Improving the 'U' values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO_2 reduction targets set out in this strategy. Bespoke thermal bridges Psi values will be calculated at Building Regulation submission stage. BRE appendix R Psi values have been used for the purposes of preparing this report.

Ventilation - As a result of increasing thermal efficiency and air tightness, Building Regulations Approved. Document F was also revised in 2021 to address the possibility of overheating and poor air quality. It is assumed mechanical extract ventilation will be provided to all WCs, bathrooms and kitchens.

Active Design Measures will include:

Efficient Lighting and Controls - Throughout the scheme natural lighting will be optimised.

Approved Document L requires all light fittings to be dedicated low energy fittings i.e. 75 lumens per circuit Watt.

External lighting will be fitted with time controls and light sensors to ensure illumination is restricted to required times. External lighting will be limited to a maximum fitting output of 150w.

Heating - Space heating and hot water demand will be provided to the dwellings by electrically powered air source heat pumps.

A 'fabric first' approach has been considered during the preparation of the preliminary planning stage SAP calculations & energy statement. The Dwelling Fabric Energy Efficiency (DFEE) required to achieve compliance with Part L1A (2021) demonstrates that the dwellings have improved on the Target Fabric Energy Efficiency (TFEE).

The results from the TFEE/DFEE calculations from the SAP calculations are as follow:

Plot Number	TFEE (BASELINE)	DFEE (BE LEAN)	% Reduction
Plot 1	41.03 kWh/yr/m²	40.95 kWh/yr/m²	**0.21%**
Plot 2	37.73 kWh/yr/m²	37.30 kWh/yr/m²	**1.14%**
Plot 3	40.34 kWh/yr/m²	39.93 kWh/yr/m²	**1.03%**
Plot 4	40.57 kWh/yr/m²	40.22 kWh/yr/m²	**0.86%**
Plot 5	41.23 kWh/yr/m²	39.68 kWh/yr/m²	**3.79%**
Plot 6	41.03 kWh/yr/m²	40.95 kWh/yr/m²	**0.21%**
Plot 7	37.73 kWh/yr/m²	37.30 kWh/yr/m²	**1.14%**

Plot 8	40.34 kWh/yr/m²	39.93 kWh/yr/m²	**1.03%**
Plot 9	41.02 kWh/yr/m²	40.47 kWh/yr/m²	**1.36%**
Plot 10	41.18 kWh/yr/m²	40.63 kWh/yr/m²	**1.35%**
Plot 11	39.04 kWh/yr/m²	38.06 kWh/yr/m²	**2.51%**
Plot 12	31.65 kWh/yr/m²	31.33 kWh/yr/m²	**1.01%**
Plot 13	31.62 kWh/yr/m²	30.89 kWh/yr/m²	**2.31%**
Plot 14	32.32 kWh/yr/m²	31.58 kWh/yr/m²	**2.28%**
Plot 15	36.25 kWh/yr/m²	35.78 kWh/yr/m²	**1.29%**
Plot 16	36.25 kWh/yr/m²	35.78 kWh/yr/m²	**1.29%**
Plot 17	32.32 kWh/yr/m²	31.58 kWh/yr/m²	**2.28%**
Plot 18	31.62 kWh/yr/m²	30.89 kWh/yr/m²	**2.31%**
Plot 19	31.65 kWh/yr/m²	31.33 kWh/yr/m²	**1.01%**
Plot 20	39.04 kWh/yr/m²	38.06 kWh/yr/m²	**2.51%**
Plot 21	39.39 kWh/yr/m²	38.97 kWh/yr/m²	**1.06%**
Plot 22	39.39 kWh/yr/m²	38.97 kWh/yr/m²	**1.06%**
Plot 23	41.52 kWh/yr/m²	41.12 kWh/yr/m²	**0.96%**
Plot 24	40.45 kWh/yr/m²	40.05 kWh/yr/m²	**0.99%**
Plot 25	42.15 kWh/yr/m²	40.59 kWh/yr/m²	**3.70%**
Plot 26	42.42 kWh/yr/m²	41.67 kWh/yr/m²	**1.78%**
Plot 27	41.18 kWh/yr/m²	40.63 kWh/yr/m²	**1.35%**
Plot 28	41.18 kWh/yr/m²	40.63 kWh/yr/m²	**1.35%**
Plot 29	39.78 kWh/yr/m²	39.06 kWh/yr/m²	**1.83%**
TOTALS	**1111.42 kWh/m²/yr**	**1094.33 kWh/m²/yr**	**1.55%**

5.2 Establishing Energy Demand and Carbon Dioxide Emissions

The results from the baseline SAP calculations are summarised as follows:

Plot Number	TER (BASELINE)	Area
Plot 1	8.53 $kgCO_2/yr/m^2$	174.66m^2
Plot 2	9.23 $kgCO_2/yr/m^2$	132.70m^2
Plot 3	8.98 $kgCO_2/yr/m^2$	152.23m^2
Plot 4	8.66 $kgCO_2/yr/m^2$	154.56m^2
Plot 5	9.35 $kgCO_2/yr/m^2$	111.29m^2
Plot 6	8.53 $kgCO_2/yr/m^2$	174.66m^2
Plot 7	9.23 $kgCO_2/yr/m^2$	132.70m^2
Plot 8	8.98 $kgCO_2/yr/m^2$	152.23m^2
Plot 9	9.33 $kgCO_2/yr/m^2$	114.40m^2
Plot 10	9.37 $kgCO_2/yr/m^2$	114.40m^2
Plot 11	13.78 $kgCO_2/yr/m^2$	56.41m^2
Plot 12	11.27 $kgCO_2/yr/m^2$	69.19m^2
Plot 13	10.00 $kgCO_2/yr/m^2$	93.34m^2
Plot 14	10.87 $kgCO_2/yr/m^2$	81.34m^2
Plot 15	10.96 $kgCO_2/yr/m^2$	93.34m^2
Plot 16	10.96 $kgCO_2/yr/m^2$	93.34m^2
Plot 17	10.87 $kgCO_2/yr/m^2$	81.34m^2
Plot 18	10.00 $kgCO_2/yr/m^2$	93.34m^2
Plot 19	11.27 $kgCO_2/yr/m^2$	69.19m^2
Plot 20	13.78 $kgCO_2/yr/m^2$	56.41m^2
Plot 21	8.82 $kgCO_2/yr/m^2$	152.23m^2
Plot 22	8.82 $kgCO_2/yr/m^2$	152.23m^2
Plot 23	8.70 $kgCO_2/yr/m^2$	142.39m^2
Plot 24	8.46 $kgCO_2/yr/m^2$	142.39m^2

Plot 25	9.49 $kgCO_2/yr/m^2$	111.29m^2
Plot 26	9.54 $kgCO_2/yr/m^2$	111.29m^2
Plot 27	9.37 $kgCO_2/yr/m^2$	114.40m^2
Plot 28	9.37 $kgCO_2/yr/m^2$	114.40m^2
Plot 29	9.11 $kgCO_2/yr/m^2$	114.40m^2
TOTALS	**285.63 $kgCO_2/yr/m^2$**	**3356.09m^2**

The maximum carbon dioxide emissions (based on the TER) are assessed as

- **958,600 kg CO2 per year**

5.3 Renewable Technologies (Be Green)

The energy demand and carbon dioxide emissions established above has been used to test the viability of various renewable and low carbon technologies as follows.

This section determines the appropriateness of each renewable technology and considers the ability of each technology to comply with the planning requirements.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are:

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location and have been discounted. The remaining technologies are considered below:

Wind - Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds to be below the level generally required for commercial investment in large wind turbines. In addition, the land take, potential for noise and signal interference make a large wind turbine unfeasible. We therefore consider this technology to unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small. In addition, the use of wind turbines will have a detrimental aesthetic impact on the appearance of the building.

Combined Heat and Power and Community Heating - Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

As a consequence, CHP can demonstrate significant CO_2 savings and although not necessary classed as renewable energy (depending on the fuel used) the technology is low carbon.

For a CHP plant to be economic it needs to operate for as much of the time as possible (usually deemed to be in excess of 14 hours per day) and therefore the size of the unit is usually based upon the hot water load of the building (s) with additional boilers meeting the peak space heating demand.

Community heating schemes are similarly communal systems but seek to supply heat only without the electricity production. Therefore, unless using a biomass or biofuel a community heating system will not demonstrate significant CO_2 reductions.

Communal heating with CHP has therefore not been considered.

Ground Source Heat Pumps - Ground Heat pumps are used to extract heat from the ground to provide both space and water heating. Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same process as a refrigerator. Fluid is circulated through pipes buried in the ground which passes through a heat exchanger in the heat pump which extracts heat from the fluid. The heat pump raises the temperature of the fluid via the compression cycle to supply hot water to the building. The ground pipe system can be horizontal or vertical via boreholes.

This technology is not being considered for this development as there is insufficient space for ground pipe systems and the installation cost of boreholes would prohibitive.

Solar Water Heating - Solar water heating systems use energy from the sun to heat water stored in a hot water cylinder via solar collectors on the roof of the building. Whilst theoretically solar hot water heating panels could be used, additional technologies would be required to achieve a sufficient reduction in carbon emissions. Therefore, solar hot water heating is not proposed.

Solar Photovoltaics - Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels.

Air Source Heat Pumps (ASHP) - Air source heat pumps are used to extract heat from the air to provide both space and water heating. Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same process as a refrigerator. Air passes through a heat exchanger in the heat pump which extracts heat from the fluid. The heat pump raises the temperature of the fluid via the compression cycle to supply hot water to the building. This technology is considered suitable for this development and is proposed to achieve compliance with Part L (2021) of the Building Regulations and as a renewable technology.

5.4 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

The total site maximum carbon dioxide emissions (TER) are calculated as **958,600 kg CO2 per year** with DER CO2 emissions of **445,689 kg CO2 per year.** This demonstrates a saving of **53.51%** across the site with by implementing fabric energy improvements & the use of air source heat pumps.

The planning policy requires a 35% reduction in the TER emissions.

Various technologies have been considered above and whilst wind turbines, combined heat and power, ground source heat pumps, solar hot water heating panels are not considered appropriate the use of photovoltaic panels and air source heat pumps are considered feasible and appropriate.

Be Lean

The construction standards proposed include 'U' values, which demonstrate good practice and improve upon those required by the Building Regulations.

Be Clean

For a site of this size a CHP system is deemed to be excessive and therefore not a viable solution to the space & water heating requirements of the development. Individual highly efficient air source heat pumps are proposed.

Be Green

It is proposed to install an air source heat pump into every plot in the development.

The results from the Be Lean, Be Clean, Be Green SAP calculations are summarised as follows:

Plot Number	TER (BASELINE)	DER (BE LEAN, BE CLEAN, BE GREEN)	TER/DER Reductions	Area
Plot 1	8.53 $kgCO_2/yr/m^2$	3.90 $kgCO_2/yr/m^2$	**54.28%**	174.66m^2
Plot 2	9.23 $kgCO_2/yr/m^2$	4.19 $kgCO_2/yr/m^2$	**54.60%**	132.70m^2

Plot 3	8.98 $kgCO_2/yr/m^2$	4.04 $kgCO_2/yr/m^2$	**55.01%**	152.23m^2
Plot 4	8.66 $kgCO_2/yr/m^2$	4.07 $kgCO_2/yr/m^2$	**53.00%**	154.56m^2
Plot 5	9.35 $kgCO_2/yr/m^2$	4.68 $kgCO_2/yr/m^2$	**49.95%**	111.29m^2
Plot 6	8.53 $kgCO_2/yr/m^2$	3.90 $kgCO_2/yr/m^2$	**54.28%**	174.66m^2
Plot 7	9.23 $kgCO_2/yr/m^2$	4.19 $kgCO_2/yr/m^2$	**54.60%**	132.70m^2
Plot 8	8.98 $kgCO_2/yr/m^2$	4.04 $kgCO_2/yr/m^2$	**55.01%**	152.23m^2
Plot 9	9.33 $kgCO_2/yr/m^2$	4.64 $kgCO_2/yr/m^2$	**50.27%**	114.40m^2
Plot 10	9.37 $kgCO_2/yr/m^2$	4.65 $kgCO_2/yr/m^2$	**50.37%**	114.40m^2
Plot 11	13.78 $kgCO_2/yr/m^2$	5.85 $kgCO_2/yr/m^2$	**57.55%**	56.41m^2
Plot 12	11.27 $kgCO_2/yr/m^2$	5.14 $kgCO_2/yr/m^2$	**54.39%**	69.19m^2
Plot 13	10.00 $kgCO_2/yr/m^2$	4.59 $kgCO_2/yr/m^2$	**54.10%**	93.34m^2
Plot 14	10.87 $kgCO_2/yr/m^2$	4.90 $kgCO_2/yr/m^2$	**54.92%**	81.34m^2
Plot 15	10.96 $kgCO_2/yr/m^2$	4.87 $kgCO_2/yr/m^2$	**55.57%**	93.34m^2
Plot 16	10.96 $kgCO_2/yr/m^2$	4.87 $kgCO_2/yr/m^2$	**55.57%**	93.34m^2
Plot 17	10.87 $kgCO_2/yr/m^2$	4.90 $kgCO_2/yr/m^2$	**54.92%**	81.34m^2
Plot 18	10.00 $kgCO_2/yr/m^2$	4.59 $kgCO_2/yr/m^2$	**54.10%**	93.34m^2
Plot 19	11.27 $kgCO_2/yr/m^2$	5.14 $kgCO_2/yr/m^2$	**54.39%**	69.19m^2
Plot 20	13.78 $kgCO_2/yr/m^2$	5.85 $kgCO_2/yr/m^2$	**57.55%**	56.41m^2
Plot 21	8.82 $kgCO_2/yr/m^2$	4.00 $kgCO_2/yr/m^2$	**54.65%**	152.23m^2
Plot 22	8.82 $kgCO_2/yr/m^2$	4.00 $kgCO_2/yr/m^2$	**54.65%**	152.23m^2
Plot 23	8.70 $kgCO_2/yr/m^2$	4.25 $kgCO_2/yr/m^2$	**51.15%**	142.39m^2
Plot 24	8.46 $kgCO_2/yr/m^2$	4.18 $kgCO_2/yr/m^2$	**50.59%**	142.39m^2
Plot 25	9.49 $kgCO_2/yr/m^2$	4.72 $kgCO_2/yr/m^2$	**50.26%**	111.29m^2
Plot 26	9.54 $kgCO_2/yr/m^2$	4.78 $kgCO_2/yr/m^2$	**49.90%**	111.29m^2
Plot 27	9.37 $kgCO_2/yr/m^2$	4.65 $kgCO_2/yr/m^2$	**50.37%**	114.40m^2
Plot 28	9.37 $kgCO_2/yr/m^2$	4.65 $kgCO_2/yr/m^2$	**50.37%**	114.40m^2
Plot 29	9.11 $kgCO_2/yr/m^2$	4.57 $kgCO_2/yr/m^2$	**49.84%**	114.40m^2
TOTALS	**285.63 $kgCO_2/yr/m^2$**	**132.80 $kgCO_2/yr/m^2$**	**53.32%**	**3356.09m^2**

The maximum carbon dioxide emissions (based on the DER) are assessed as

- **445,689 kg CO2 per year**

6.0 Climate change adaption and Water resources

Water efficiency measures
In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WC's and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included in the dwellings will ensure that the water use target of 110 litres per person per day is achieved.

Water efficient devices will be fully evaluated, and installed, wherever possible. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.
The following devices will be incorporated within the dwellings:

- Water efficient taps.
- Water efficient toilets.
- Low output showers.
- Flow restrictors to manage water pressures to achieve optimum levels.
- Water meters with guidance on water consumption and savings.

Water consumption calculations have been carried out using the Water Efficiency Calculator provided by the BRE. Although not perfect this calculator gives a good indication of the probable water use in a dwelling, although this is largely dependent on the way on which occupants use their homes.

Below is a typical specification, which would achieve the 110 Litres per person per year target.

Schedule of Appliance Water Consumption	
Appliance	Total Litres
W.C. (Full Flush)	6.57
W.C. (Part Flush)	8.88
Taps (Excluding Kitchen)	9.64
Shower	34.96
Bath	17.16
Kitchen Taps	15.68
Washing Machine	13.20
Dishwasher	3.15
Total	**109.24**
Normalisation Factor	0.91
Total	**99.41**
External Water Use	5.00
Total	**104.41**

Please refer to the water neutrality statement TN01 produced by Motion for further information regarding water consumption reduction measures, rainwater harvesting systems & offsetting measures.

7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber would be sourced, where practical, certified by PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials will have a zero-ozone depleting potential.

Construction Waste

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials

APPENDIX: SAP WORKSHEETS