

4. Energy Consumption and CO₂ Emissions

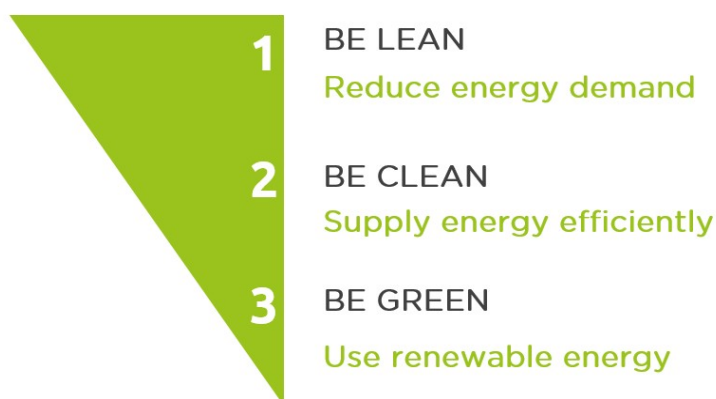
- 4.1. As one of the key areas of ongoing impact of any development, the energy demand of the buildings to be constructed is a key consideration in the overall sustainability strategy. As set out within the policy review section of this statement, it is considered that updated Building Regulations standards form the minimum requirement for new buildings in terms of energy performance.
- 4.2. As shown in Table 1, the CO₂ standards contained within Part L were increased in 2010 and 2013, reducing the TER by approximately 25% and a further 6% (9% for non-residential) respectively.
- 4.3. Part L 2021 has been mandatory from June 2023, which constitutes a much larger step change of a 31% reduction in emissions.
- 4.4. Future Homes Standards (FHS) has been released with residential emissions reduction of circa 71% over 2021 Part L1 standards. The Future Building Standards (FBS) are the upcoming changes expected to be published from late 2026 with the expected carbon emissions reduction still to be confirmed (non-residential).

Table 1. CO₂ Emissions improvements from successive Part L editions

Building Regulations	CO ₂ emissions improvements over preceding regulations – residential	CO ₂ emissions improvements over preceding regulations – non residential
L1A 2006	-	-
L1A 2010	25%	25%
L1A 2013	6%	9%
L1 2021	31%	27%
FHS/FBS ¹	Circa 71%	TBC

Energy Reduction Strategy – Fabric First

- 4.5. It is proposed that the energy demand reduction strategy for the development incorporates further improvements beyond a Part L compliant specification and initially concentrates finance and efforts on reducing energy demand as the first stage of the Energy Hierarchy.



¹ This is for reference only and does not apply to this development

Figure 2. The Energy Hierarchy

Be Lean – reduce energy demand

- 4.6. The design of a development - from the masterplan to individual building design - will assist in reducing energy demand in a variety of ways, with a focus on minimising heating, cooling and lighting loads. Key considerations include:
- Building orientation – maximise passive solar gain and daylight
 - Building placement – control overshading and wind sheltering
 - Landscaping – control daylight, glare and mitigate heat island effects
 - Building design – minimise energy demand through fabric specification

Be Clean – supply energy efficiently

- 4.7. The design and specification of building services to utilise energy efficiently is the next stage of the hierarchy, taking into account:
- High efficiency heating and cooling systems
 - Ventilation systems (with heat recovery where applicable)
 - Low energy lighting
 - High efficiency appliances and ancillary equipment

Be Green – use low carbon / renewable energy

- 4.8. Low carbon and renewable energy systems form the final stage of the energy hierarchy and can be used to directly supply energy to buildings or offset energy carbon emissions arising from unavoidable demand. This may be in the form of:
- Low carbon fuel sources – e.g., biomass
 - Heat pump technologies
 - Building scale renewable energy systems
 - Small-scale heat networks
 - Development-scale heat networks
- 4.9. As this hierarchy demonstrates, designing out energy use is weighted more highly than the generation of low-carbon or renewable energy to offset unnecessary demand. Applied to the development, this approach is referred to as 'fabric first' and concentrates finance and efforts on improving U-values, reducing thermal bridging, improving airtightness, and installing energy efficient ventilation and heating services.
- 4.10. This approach has been widely supported by industry and government for some time, particularly in the residential sector, with the Zero Carbon Hub² and the Energy Savings Trust³ having both stressed the importance of prioritising energy demand as a key factor in delivering resilient, low energy buildings.
- 4.11. The benefits to prospective homeowners of following the Fabric First approach are summarised in Table 2.

² Zero Carbon Hub, Zero Carbon Strategies for tomorrow's new homes, Feb 2013

³ Energy Savings Trust, Fabric first: Focus on fabric and services improvements to increase energy performance in new homes, 2010

Table 2. Benefits of the Fabric First approach

	Fabric energy efficiency measures	Bolt-on renewable energy technologies
Energy/CO ₂ /fuel bill savings applied to all buildings	✓	✗
Savings built-in for life of building	✓	✗
Highly cost-effective	✓	✗
Increases thermal comfort	✓	✗
Potential to promote energy conservation	✓	✓
Minimal ongoing maintenance / replacement costs	✓	✗
Significant disruption to retrofit post occupation	✓	✗

Building Regulations Standards – Fabric Energy Efficiency

- 4.12. In addition to the CO₂ reduction targets, the importance of energy demand reduction was further supported by the introduction of a minimum fabric standard into Part L1A 2013, based on energy use for heating and cooling a dwelling. This is referred to as the 'Target Fabric Energy Efficiency' (TFEE) and expressed in kWh/m²/year.
- 4.13. This standard enables the decoupling of energy use from CO₂ emissions and serves as an acknowledgement of the importance of reducing demand, rather than simply offsetting CO₂ emissions through low carbon or renewable energy technologies.
- 4.14. The TFEE is calculated based on the specific dwelling being assessed with reference values for the fabric elements contained within Approved Document L. These reference values are described as 'statutory guidance' as opposed to mandatory requirements, allowing full flexibility in design approach and balances between different aspects of dwelling energy performance to be struck so that the ultimate goal of achieving the TFEE is met. The proposed approach and indicative construction specifications are set out in the following sections of this Strategy.

Proposed Residential Fabric Specification

- 4.15. In order to ensure that the energy demand of the development is reduced, the dwellings should be designed to minimise heat loss through the fabric wherever possible. Table 3 details the proposed fabric specification of the major building elements, with the first column in this table setting out the Part L 2021 limiting fabric parameters to demonstrate the improvements delivered.

Table 3. Proposed construction specification residential houses – main elements

	Part L1 2021 Limiting Fabric Parameters	Proposed Specification
External wall	0.26 W/m ² K	0.18W/m ² K
Party wall	0.20 W/m ² K	0.00 W/m ² K
Plane roof	0.16 W/m ² K	0.09 W/m ² K
Ground floor	0.18 W/m ² K	0.13 W/m ² K (P/A)
Windows	1.60 W/m ² K	1.30 W/m ² K
Doors	1.60 W/m ² K	1.20 W/m ² K
Air Permeability	8.00 m ³ /h.m ² at 50 Pa	≤4.50 m ³ /h.m ² at 50 Pa
Thermal Bridging	Y = 0.150 (default)	Y = ≤ 0.040 (average)

Proposed Non-Residential Fabric Specification

- 4.16. Table 4 details an indicative fabric specification of the major building elements for the nursery and pre-school buildings with the first column in this table setting out the Part L2 limiting fabric parameters in order to demonstrate the improvements that will be made.
- 4.17. The non-residential units are anticipated to be designed to meet, as a minimum, the requirements of the Part L2 2021 building specification. However, it is recognised that within the calculation methodology set out in Approved Document L2 – which governs the energy performance of non-residential development – the primary drivers of overall building performance are building services and artificial lighting, given their disproportionately significant contribution to regulated energy consumption in non-domestic buildings.
- 4.18. Notwithstanding this, in order to reduce overall energy demand, the design of the non-residential units will seek to minimise heat loss through the building fabric wherever practicable, through the adoption of enhanced insulation levels, high-performance glazing, and the reduction of thermal bridging and air infiltration, consistent with a fabric-first approach to energy efficiency.

Table 4. Indicative construction specification non-residential buildings– main elements

	Part L1 2021 Limiting Fabric Parameters	Indicative Specification
External wall	0.26 W/m ² K	0.18 W/m ² K
Plane Roof	0.16 W/m ² K	0.11 W/m ² K
Sloping Roof	0.16 W/m ² K	0.15 W/m ² K
Ground floor	0.18 W/m ² K	≤ 0.15 W/m ² K (P/A)
Windows	1.60 W/m ² K	1.40 W/m ² K
Doors	1.60 W/m ² K	1.40 W/m ² K
Air Permeability	8.00 m ³ /h.m ² at 50 Pa	*15.00 m ³ /h.m ² at 50 Pa

*Buildings with less than 500m² total useful floor area may avoid the need for a pressure test provided that the air permeability used to calculate the BER and BPER is taken as 15.00 m³/h.m² at 50 Pa.

- 4.19. The U-values shown in Table 4 are only an indication of what might be required to meet compliance. A Part L2 assessment should be completed at an appropriate stage in the design process before any of the values are adopted, in order to retain flexibility in the design.

Thermal bridging

- 4.20. The significance of thermal bridging as a potentially major source of fabric heat losses is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the thermal bridging will not achieve the desired energy and CO₂ reduction targets.
- 4.21. The specification should seek to minimise unnecessary bridging of the insulation layers, with avoidable heat loss therefore being reduced wherever possible. Accurate calculation of these heat losses forms an integral part of the SAP calculations undertaken to establish energy demand of the dwellings, and as such thermal modelling will be undertaken to assess the performance of all main building junctions.

Air leakage

- 4.22. After conductive heat losses through building elements are reduced, convective losses through draughts are the next major source of energy wastage. The proposal adopts an airtightness standard of 4.50m³/h.m² at 50Pa for the residential units and a default value of 15.00m³/h.m² for the non-residential units, with pressure testing of all dwellings to be undertaken on completion to confirm that the design figures have been met.

Fabric Energy Efficiency

- 4.23. Table 5 demonstrates that the dwellings will exceed the uplifted Fabric Energy Efficiency targets within Part L 2021 through the designed specification. The full SAP calculations can be found within the Appendices.

Table 5. Fabric Energy Efficiency of sample dwellings

Dwelling Plot	Target Fabric Energy Efficiency (kWh/m ² /year)	Design Fabric Energy Efficiency (kWh/m ² /year)	Improvement %
1	42.82	40.21	6.10
2	37.71	35.32	6.34
3	37.71	35.32	6.34
4	43.39	40.71	6.20
5	36.96	34.39	6.96
6	37.57	34.92	7.06

Provisions for Energy-Efficient Operation of the Dwelling

- 4.24. The occupant of the dwelling should be provided with all necessary literature guidance relating to the energy efficient operation of fixed building services. The residential units will be provided with high efficiency gas boilers, fully insulated primary pipework, and controls including programmers, thermostats and Thermostatic Radiator Valves to avoid unnecessary heating of spaces when not required.

5. Low Carbon and Renewable Energy

- 5.1. A range of technologies have been assessed for potential incorporation into the scheme in accordance with Regulation 25A of the Building Regulations and consideration being given to Policy CC05, with the goal of showing energy use and emissions mitigation through building design as per local regulations.

Combined Heat and Power (CHP) and District Energy Networks

- 5.2. A CHP unit is capable of generating heat and electricity from a single fuel source. The electricity generated by the CHP unit is used to displace electricity that would otherwise be supplied from the national grid, with the heat generated as effectively a by-product utilised for space and water heating.
- 5.3. The economic and technical viability of a CHP system is largely reliant on a consistent demand for heat throughout the day to ensure that it operates for over 5000 hours per year. Heat demand from mainly residential schemes is not conducive to efficient system operation, with a defined heating season and intermittent daily profile, with peaks in the morning and the evening. For this reason, the use of a CHP system is considered unfeasible for this development.
- 5.4. There are currently no heat networks which extend near the proposed development. High network heat losses associated with distribution to individual houses, as opposed to large high-rise apartment blocks and commercial developments mean that a new heat network to serve the area is not considered viable or an environmentally preferred option.

Wind Power

- 5.5. Locating wind turbines adjacent to areas with buildings presents a number of potential obstacles to deployment. These include the area of land onsite required for effective operation, installation and maintenance access, environmental impact from noise and vibration, visual impact on landscape amenity and potential turbulence caused by adjacent obstacles.
- 5.6. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 4.9m/s. Wind turbines at this site are therefore unlikely to generate sufficient quantities of electrical energy to be cost effective. For these reasons wind power is not considered feasible.

Building Scale Systems

- 5.7. The remaining renewable or low carbon energy systems considered potentially feasible are at a building scale. These are as follows:
- Individual biomass heating
 - Solar thermal
 - Solar photo-voltaic (PV)
 - Air Source Heat Pumps (ASHPs)
 - Ground Source Heat Pumps (GSHPs)
 - Hot Water Heat Pumps (HWHPs)
- 5.8. The advantages and disadvantages of these technologies are evaluated in Tables 6-10.

Table 6. Individual Biomass Heating feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Potential to significantly reduce CO₂ emissions as the majority of space and water heating will be supplied by a renewable fuel • Decreased dependence on fossil fuel supply	• A local fuel supply is required to avoid increased transport emissions • Fuel delivery, management and security of supply are critical • Space is required to store fuel, a thermal store and plant • A maintenance regime would be required even though modern systems are relatively low maintenance • Building users or a management company must be able to ensure fuel is supplied to the boiler as required. • Local environmental impacts potentially include increased NO_x and particulate emissions
Conclusions	
Sustainable and local fuel supply is critical to ensuring predicted CO₂ emissions savings for biomass energy systems. Fuel storage capacity on site dictates the length of time required between deliveries and the volume of fuel delivery required. With limited space for access and storage of fuel more frequent deliveries would be required. Combustion of wood products would give rise to significant NO_x and particulate emissions raising air quality concerns. For these reasons, biomass is not considered an appropriate fuel source for this proposed development.	

Table 7. Solar Thermal systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Mature and reliable technology offsetting the fuel required for heating water (typically gas) • Solar thermal systems require relatively low maintenance • Typically, ~50% of hot water demand in dwellings can be met annually	• Installation is restricted to favourable orientations on an individual building basis • The benefit of installation is limited to the water heating demand of the building • Safe access must be considered for maintenance and service checks • Buildings need to be able to accommodate a large solar hot water cylinder • Distribution losses can be high if long runs of hot water pipes are required • Visual impact may be a concern in special landscape designations (e.g. AONB)
Conclusions	
Solar thermal systems are considered technically feasible on all buildings with suitable roof orientations, however the contribution to carbon reduction is expected to be low. In addition, due to the intermittent and unknown level of water usage within the non-residential buildings, especially during periods of unoccupancy, this option is not considered favourable and therefore it is not a preferred technology.	

Table 8. Solar Photovoltaic (PV) systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• The technology offsets the high carbon content of grid supplied electricity used for lighting, pumps and fans, appliances and equipment • Mature and well proven technology that is relatively easily integrated into building fabric • Adaptable to future system expansion • Solar resource is not limited by energy loads of the dwelling as any excess generation can be transferred to the national grid • PV systems generally require very little maintenance • Service and maintenance requirement minimal, and 2-3 storey buildings should not require significant additional safety measures (mansafe systems etc) for roof access	• Poor design and installation can lead to lower-than-expected yields (e.g. from shaded locations) • Installation is restricted to favourable orientations • Safe access must be considered for maintenance and service checks • Visual impact may be a concern in special landscape designations (e.g. AONB) or conservation areas • Reflected light may be a concern in some locations
Conclusions	
PV panels are considered technically feasible for all buildings with suitable roof orientations. The relatively low cost, high carbon saving potential and limited additional impacts mean that PV is considered a feasible option for this development.	

Table 9. Air Source Heat Pump systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
- Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle - Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 250% - Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings	- Air source heat pumps are powered by electricity, with a significantly higher unit price than gas, leading to potentially increased running costs - It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved. Users must be educated in how heat pump systems should be operated for optimal efficiency - Air source heat pump plant should be integrated into the building design to mitigate concerns regarding the visual impact of bolt-on technology - Noise in operation may be an issue particularly when operating at high output
Conclusions	
Air source heat pumps are technically feasible for this scheme. An ASHP will provide efficient heat and hot water without the need for fossil fuels and can reduce running costs, lower carbon emissions and offer reliable, sustainable heating and hot water all year round. However, system design and integration into a communal system, together with visual impact and noise implications would need to be carefully considered. ASHPs are therefore considered a viable technology. For non-domestic spaces where heating is predominately required during daytime hours ASHP can provide a cost effective and efficient solution for heating and cooling where required.	

Table 10. Ground Source Heat Pump systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
- Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle - Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 320% - Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings	- Low temperature heating circuits (underfloor heating) would be required to maximise the efficiency of heat pumps - A hot water cylinder would also be required for both space and water heating - Ground source heat pumps are powered by electricity with a significantly higher unit price than gas, leading to potentially increased running costs - It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved - Ground source heat pumps either require significant land to incorporate a horizontal looped system or significant expense to drill a bore hole for a vertical looped system
Conclusions	
The ground pipe system of a GSHP can be horizontal or vertical. For horizontal systems, a coiled pipe network, commonly called a 'slinky', may be used. It is buried at around 2m below ground level. This requires a large area of open space and intensive civil works. For vertical systems, the pipes are placed in holes bored straight into the ground to a depth of between 15 and 150 metres depending on ground conditions and size of system. The installation of GSHPs requires a large amount of civil engineering works and feasibility of installation is highly dependent upon the geological conditions at the site, due to extensive groundworks and costs this option is discounted.	

Summary

- 5.9. Following this feasibility assessment, a range of technically feasible low carbon and renewable options were considered, however some of these were discounted on the grounds of increased running costs for residents, or other adverse effects including:
- Biomass heating systems would require significant storage space for fuel as well as regular deliveries at different times to all dwellings. Local NOx and particulate pollution are also an increasing concern, and therefore they are not appropriate for this development.
 - Ground source heat pump systems may be technically feasible; however, the ground conditions are unknown, and the capital cost is likely to be prohibitive.
 - Solar Thermal systems were discounted in favour of the greater performance of heat pump systems, as well as to allow unimpeded PV installation.
- 5.10. There are two main technologies with significant potential for the development:
- Solar photovoltaics
 - Air source heat pumps
- 5.11. It is proposed that the residential units will retain gas-fired heating supplemented by solar PV panels, in accordance with Part L1 2021, and the non-residential buildings will incorporate air source heat pump systems in accordance with Part L2 2021.

6. Proposed Low-Emission Systems

Air Source Heat Pumps

- 6.1. An ASHP is a low-carbon technology which can be used for heating in the winter and can be reversed for cooling in the summer months. ASHPs work by extracting latent heat from the outside air and passing it through a heat exchanger which increases its temperature. The heat is then fed to the required rooms (or in reverse for cooling).
- 6.2. An air-source heat pump with a heating efficiency of 3.5 will supply 3.5 kilowatts of heat energy for the consumption of 1 kilowatt of electricity and can therefore deliver significant carbon savings.
- 6.3. Air-source heat pumps can have a number of environmental and operational advantages. The amount of heat being supplied to the building is greater than the amount of energy consumed by the heat pump.
- 6.4. Using monobloc system installations can help to reduce ongoing maintenance.
- 6.5. Factors to consider:
 - During times of peak demand (i.e., during winter months) the ambient air temperatures are at their minimum, meaning the ASHP needs to work harder to extract the desired amount of heat.
 - External space is required for the units, which will need to have adequate air flow whilst being made safe and secure within the building's grounds.
 - Due to being powered by grid-sourced electricity, they can potentially result in increased energy bills for the occupant when compared with gas-fired heating systems in the short term; however, with the government's plan of grid decarbonization, costs will continue to decrease over time.
- 6.6. Air source heat pumps are proposed to be installed to the non-domestic buildings, delivering low carbon heating and hot water, this will provide space and water heating to meet the requirements of Part L1.
- 6.7. The non-residential benchmark figures for the scheme have been based on a leading brand air source heat pump monobloc system which can operate singularly, or form part of a multiple unit system.

Solar Photovoltaics

- 6.8. Photovoltaics (PV) or solar cells, as they are often referred to, are semiconductor devices that convert sunlight into direct current (DC) electricity.
- 6.9. Groups of PV cells are electrically configured into modules and arrays which can be used to charge batteries, operate motors and power any number of electrical loads. With the appropriate power conversion equipment (inverters), PV systems can produce alternating current (AC) compatible with any conventional appliances and operate in parallel with the utility grid.
- 6.10. Excess electricity can be sold to the National Grid when the generated power exceeds the local need, this can be beneficial with a large system, when the building is not used all of the time. PV systems require only daylight, not sunlight to generate electricity (although more electricity is produced with more sunlight). Therefore, energy can still be produced in overcast or cloudy conditions and used successfully in all parts of the UK.
- 6.11. Ideally the panels should face between south-east and south-west, at an elevation of about 30-40°. However, in the UK even flat roofs receive 90% of the energy of an optimum system.

- 6.12. Roof mounted photovoltaic panels are considered a feasible technology for the dwellings within this development.
- 6.13. Systems must be carefully sited to avoid shading and lower than expected energy yields. Therefore, installation on favourable orientations is recommended. Safe access for installation, maintenance and service checks must be considered.
- 6.14. Solar PV systems will be installed on the roof pitches for each dwelling, with the specific units and system sizes to be assessed when bringing forward designs for the development as required.

7. Indicative Emissions

- 7.1. The development is to be designed and constructed to meet the requirements of Part L of the Building Regulations 2021, therefore compliance with this standard forms the first stage in the sustainable construction approach.

Residential

- 7.2. By following the strategy outlined, the dwellings will achieve a significant reduction in energy demand and associated CO₂ emissions, surpassing the minimum compliance threshold set by Part L 2021. This will be delivered through the performance of the dwelling fabric, alongside the incorporation of solar photovoltaic (PV) systems.
- 7.3. Using the latest SAP 10 software, a sample range of dwellings have been assessed under Part L 2021 to build a representative site model and establish the predicted CO₂ emissions of the development under Part L 2021, with the proposed fabric strategy applied to provide an overview of the typical as-designed CO₂ emissions. Table 11 shows the expected results of the as-designed CO₂ reduction for individual units.

Table 11. Sample dwellings as-designed regulated CO₂ emissions - Part L 2021

Dwelling Plot	TER (kgCO ₂ /m ² /year)	DER (kgCO ₂ /m ² /year)	% Reduction
1	12.24	11.90	2.78
2	11.61	11.23	3.27
3	11.61	11.23	3.27
4	12.37	11.94	3.48
5	11.53	11.13	3.47
6	11.66	11.17	4.20

- 7.4. PV system designs will be worked up once final house designs are available, however indicative SAP calculations indicate that all houses will be specified with solar PV systems of between around 0.75 – 1.1 kWp. Individual initial SAP calculations have been produced and assessed according to orientation for each plot once the design process progresses, design stage SAP calculations will be provided which would allow the full PV system designs to be produced.

Table 12. Estimated residential CO₂ savings over Part L 2021

	CO ₂ emissions kgCO ₂ /yr	
Part L 2021 compliant	6,324	
As proposed specification	6,109	
	kgCO ₂ /yr	%
Total savings over Part L 2021	215	3.39

- 7.5. This demonstrates that the total residential CO₂ emissions reduction for the development equates to around 3.39% above the Part L 2021 baseline, achieved through the proposed strategy. As the site comprises of only six dwellings, this falls below the threshold of the minimum number of 10 units required to meet the 10% reduction required by Policy CC05.

Non-residential

- 7.6. The following table presents the estimated Part L compliant emissions for the non-residential elements of the development based on initial DSM calculation of the nursery building (439.7m²), please see the BRUKL document within the appendices. For the pre-school building (299.61m²) benchmark emissions figures derived from comparable previously completed developments — with analogous energy systems and fabric specifications — have been applied and extrapolated across the estimated gross floor area to provide an indicative assessment of likely energy performance. Please see table 13 for the estimated figures for the proposed non-residential units.

Table 13. Indicative non-residential buildings CO₂ emissions - Part L 2021

Building	TER (kgCO ₂ /year)	BER (kgCO ₂ /year)	% Reduction
Pre-school	1183	1171	1.09
Nursery	3109	2990	3.81

- 7.7. Table 14 demonstrates that the estimated regulated CO₂ emissions reduction for the proposed non-residential aspects of the development equates to around 3% above the Part L 2021 baseline. As the site comprises of only 774m² of non-domestic floor space, this falls below the threshold of the minimum requirements of 1000m² in Policy CC05, and the buildings do not need to achieve a 10% reduction.

Table 14. Estimated non-residential CO₂ savings over Part L 2021

	CO ₂ emissions kgCO ₂ /yr	
Part L 2021 compliant	4292	
As proposed specification	4161	
	kgCO ₂ /yr	%
Total savings over Part L 2021	131	3.05

Total Site CO₂ Reductions

- 7.8. Through a combination of the described fabric first approach to sustainable construction and the installation of ASHPs and solar PV panels, the development will deliver an estimated overall CO₂ emission reductions of 3.25% over Part L 2021.
- 7.9. Table 15 demonstrates the total CO₂ reduction achieved through the combination of the Fabric First approach and the addition of renewable and low carbon technology for both the residential and non-residential buildings.

Table 15. Total site-wide estimated CO₂ savings over Part L 2021

	CO ₂ emissions kgCO ₂ /yr	
Part L 2021 compliant	10,616	
As proposed specification	10,270	
	kgCO ₂ /yr	%
Total savings over Part L 2021	346	3.25

8. Resource Efficiency

- 8.1. It is important that development is efficient with resources both during construction and in operation of the development. This section sets out details of additional resource efficiency and sustainable design principles to be applied at the development in line with Policy CC04.

Materials

- 8.2. The impacts of construction materials range from the depletion of natural resources to the greenhouse gas emissions and water use associated with their manufacture and installation.
- 8.3. Within the development choices will be made in order to reduce the consumption of primary resources and using materials with fewer negative impacts on the environment, including but not limited to the following;
- Use fewer resources and less energy through designing buildings more efficiently.
 - Specify and select materials and products that strike a responsible balance between social, economic and environmental factors.
 - Incorporate recycled content, use resource-efficient products and give due consideration to end-of-life uses.
 - Influence, specify and source increasing amounts of materials which can be reused and consider future deconstruction and recovery.

Embodied Carbon

- 8.4. As the operational energy use of buildings is reduced through design and specification as described, the embodied carbon in the building materials and process becomes a much greater proportion of the overall impact of a development.
- 8.5. There is currently no legislation governing embodied carbon, however measures to reduce embodied carbon may include consideration of:
- Selection of materials with high natural content
 - Selection of low embodied carbon option for all materials
 - Recycled plastics in windows, pipework and cavity closers
 - Recycled content in gypsum plasterboard
 - Use of recycled (crushed) aggregate as hardcore
 - Recycled elevation treatments where feasible i.e., roof tiles, bricks, architectural features

Waste

- 8.6. Sending waste to landfill has various environmental impacts, such as the release of local pollution, ecological degradation and methane emissions, in addition to exacerbating resource depletion. Waste in housing comes from two main streams: construction waste and domestic waste during occupation.

Household Waste

- 8.7. In this respect, regard has been given to the policy advice contained in the NPPF together with the Council's current strategy in terms of waste and recycling, to ensure that the new dwellings are provided with adequate storage facilities for both waste and recyclable materials.
- 8.8. Wokingham Borough Council currently offer kerbside collection for recycling, separated into the below collection streams:
- Plastics, Paper and cardboard (Green recycling bags)
 - General rubbish (black bin)
 - Garden waste (brown bin)
 - Food waste (Caddy)
- 8.9. Dedicated bin storage space will be provided on plot to accommodate the relevant collection boxes.
- 8.10. Future occupiers of the dwellings will be provided with an information pack detailing the Council's current collection arrangements for waste and recycling and advising of the nearest recycling centres to the Application site.
- 8.11. The non-residential units will be provided with suitable internal and external spaces to sort and store waste for recycling as appropriate to Wokingham Borough Council's collection services. There will be designated external storage for rubbish and recycling bins for collection.

Construction Waste

- 8.12. The development will additionally be designed to monitor and manage construction site waste effectively and appropriately. Target benchmarks for resource efficiency will be set in accordance with best practice – e.g., 5m³ of waste per 100m² / tonnes waste per m².
- 8.13. Wherever possible materials will be diverted from landfill through re-use on site, reclamation for re-use, returned to the supplier where a 'take-back' scheme is in place or recovered and recycled using an approved waste management contractor.

9. Water Efficiency

- 9.1. The UK Climate Change Risk Assessment 2017 identified risks of shortages in water supply as a future climate change impact. Therefore, the efficient use of water is an important factor when considering future resilience to climate change.
- 9.2. As well as aiming to minimise water usage through the materials used, water consumption of the end user will be considered in line with current national policy. Building Regulations Part G require water efficiency measures for all new dwellings:

Water Efficiency

G2. Reasonable provision must be made by the installation of fittings and fixed appliances that use water efficiently for the prevention of undue consumption of water.

Water Efficiency of New Dwellings

36. (1) The potential consumption of wholesome water by persons occupying a new dwelling must not exceed the requirement in paragraph (2)

(2) The requirement referred to in paragraph (1) is either –

(a) 125 litres per person per day; or

(b) in a case to which paragraph (3) applies, the optional requirement of 110 litres per person per day,

- 1.1. As measured in either case in accordance with a methodology approved by the Secretary of State.

- 9.3. Water efficiency measures are met under Part G if: The estimated consumption of wholesome water resulting from the design of cold and hot water systems (calculated in accordance with the methodology set out in Appendix A) is not greater than the standard set by the Secretary of State of 125/litres/person/day, or the optional standard of 110 litres/person/day.
- 9.4. Appendix A of Part G provides a water efficiency calculation methodology. This assesses the whole house potable water consumption in new dwellings. The calculation methodology is to be used to assess compliance against the water performance targets in Regulation 36 to ensure that all new dwellings meet the water efficiency requirement.
- 9.5. The references provided in Part G Table 2.1 will be considered to ensure that efficient fittings are installed to each dwelling. Each new dwelling will minimise water usage to at least 105 litres/person/day in line with the current national optional standards and in compliance with Policy CC04.

Indicative Water Efficiency Measures

- 9.6. Water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.
- 9.7. Water efficiency measures including the use of efficient dual flush WCs, low flow showers and taps, and appropriately sized baths will be encouraged, with the aim to limit the use of water during the operation of the development.
- 9.8. Table 16 shows how the development could achieve a result less than 105 litres/occupier/day complying with Policy CC04. The current Part G Building Regulations requirement is to meet the 125 litres/occupier/day.

Table 16. Indicative typical Internal Water Demand Calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/occupier/day
WC (dual flush)	Full flush (l)	4	5.84
	Part flush (l)	2.6	7.70
Taps (excluding kitchen taps)	flow rate (l/min)	5	9.48
Bath	Capacity to overflow (l)	130	14.30
Shower	Flow rate (l/min)	8	34.96
Kitchen sink taps	Flow rate (l/min)	4	12.12
Washing Machine	Litres/kg dry load	8.17	17.16
Dishwasher	Litres/place setting	0.76	4.50
Calculated Use			106.1
Normalisation Factor			0.91
Total Internal Consumption (L)			96.50
External Use			5.00
Building Regulations 17.K			101.50

10. Electric Vehicle Charging

- 10.1. It is recognised that there is a need to ensure that the development is adaptable to accommodate a future shift in personal transportation to electric vehicles, to promote sustainable transport and to minimise air pollution. As electric vehicle (EV) ownership increases, developers have an increasing responsibility to provide EV charging points for occupants.
- 10.2. Approved Document S, introduced in June 2023, mandates a minimum level of electric vehicle (EV) charging provision for all new developments commencing after that date. These standards will be adhered to, ensuring an appropriate level of EV charging provision across all homes within the development.
- 10.3. Further technical details of the charger, along with locations, can be provided once available.

11. Conclusions

- 11.1. This Sustainability Statement has been prepared by AES Sustainability Consultants on behalf of Crest Nicholson Operations Ltd (the Applicant), in support of the reserved matters application for the District Centre Nursery and Pre-school, Arborfield, RG2 9GB development.
- 11.2. The proposed master development will provide 6 dwellings; comprising of detached and semi-detached, dwellings alongside 1 nursery (475m²) and 1 preschool (299m²) building.
- 11.3. The development Site is located south-west of Wokingham and south-east of Reading in the village of Arborfield Green, within the boundary of Wokingham Borough Council.
- 11.4. A review of applicable local and national planning policy has been undertaken, concluding that energy standards should be encouraged and enforced through the applicable national regulations. Consideration will be paid to building design and site-layout to further reduce energy consumption, and a range of additional sustainable design considerations will be addressed in line with Policy CP1 and SPDs.
- 11.5. This strategy sets out how the proposed development addresses relevant policies contained within the Wokingham Borough Local Development Framework. The strategy follows a 'fabric first' approach to constructing energy efficient buildings, with insulation standards, thermal bridging and air leakage all improved beyond the minimum compliance levels within the Building Regulations.

Residential Strategy

- 11.6. Following the renewable technologies appraisal it has been concluded that solar PV for the houses is considered the preferred technologies for this residential units. The residential units will be heated by gas boilers, supplemented by solar PV, and are designed to meet Part L1 2021 — they are not subject to the Future Homes Standard.
- 11.7. Through following the energy efficiency approach described, supplemented with efficient heating systems and low carbon energy, the calculated carbon emissions of 6,109 kgCO₂/year would equate to an estimated 3.39% improvement over Part L 2021 equivalent to circa 33% over Part L 2013 standards prevalent at the time the outline permission was granted.
- 11.8. As the site comprises of only six dwellings, this falls below the threshold of the minimum number of 10 units required to meet the 10% reduction required by Policy CC05.

Non-Residential Strategy

- 11.9. Calculations undertaken for the non-residential units demonstrate that by following a fabric first approach supplemented by low carbon heating in the form of air source heat pumps, the overall improvement equates to circa 3% above the Part L 2021 baseline.
- 11.10. As the site comprises of only 774m² of non-domestic floor space, this falls below the threshold of the minimum requirements of 1000m² in Policy CC05, and the buildings do not need to achieve a 10% reduction.

Overall Performance

- 11.11. It has been demonstrated that all units residential and non-residential are compliant with the latest revision of Part L 2021 Building Regulations.
- 11.12. The site-wide carbon emissions for the reserved matters application are estimated at 10,270 kgCO₂/year, a reduction of circa 3.25% over the Part L 2021 baseline.

Waste & Water Conservation

- 11.13. It has been shown that the typical calculated internal water consumption would equate to circa 101.5 litres/person/day, and therefore satisfy the requirements of Policy CC04.
- 11.14. A range of additional sustainability measures have been given consideration including reduction of both construction and household waste complying with Policy CC04.
- 11.15. Appropriate provision for internal waste and recycling storage will be provided to ensure that recycling can be split into the appropriate streams for collection.
- 11.16. In conclusion, this statement demonstrates that the sustainable design and construction elements which are at the heart of the development proposals reflect the Applicant and design team's aspirations in delivering a sustainable development of a high quality and meet the sustainability planning policy requirements in response to the local, regional and national legislation.