

Land West of Kingfisher Grove Sovereign Housing Association

Energy & Sustainability Statement

AES Sustainability Consultants Ltd

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This statement has been commissioned by Sovereign Housing Association to detail the proposed approach to energy and CO₂ reduction to be employed in the development of Land West of Kingfisher Grove. It should be noted that the details presented, including the proposed specifications, are subject to change as the detailed design of the dwellings progresses, whilst ensuring that the overall commitments will be achieved.

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1. Introduction

Preface

- 1.1. This Energy Statement been prepared on behalf of Sovereign Housing Association in support of the reserved matters application for development of the site know as Land west of Kingfisher Grove, Three Mile Cross.

Development Description

- 1.2. The development site is located on the south western side of Three Mile Cross, approximately 5 miles to the south of Reading. The development lies within the administrative boundary of Wokingham Borough Council.
- 1.3. The proposed development comprises a total of 49 dwellings across a mix of maisonettes, semi-detached and terraced houses . The proposed site layout is shown in Figure 1.

Purpose and Scope of the Statement

- 1.4. The statement has been prepared to address national and local policy relating to sustainable design and construction of dwellings, including relevant policies within the Wokingham Borough Council Adopted Core Strategy Development Plan Document adopted in 2010 and the Managing Development Delivery Local Plan, adopted in February 2014
- 1.5. The statement will demonstrate that by following a 'fabric first' approach to demand reduction and with the inclusion of low-carbon technologies, the proposed development will deliver a level of energy performance and CO₂ reductions that exceed the current Building Regulation standards whilst addressing a range of additional sustainable design considerations.
- 1.6. Further sustainability considerations will be addressed, including resource and water efficiency, overheating risk and passive design and electric vehicle charging.

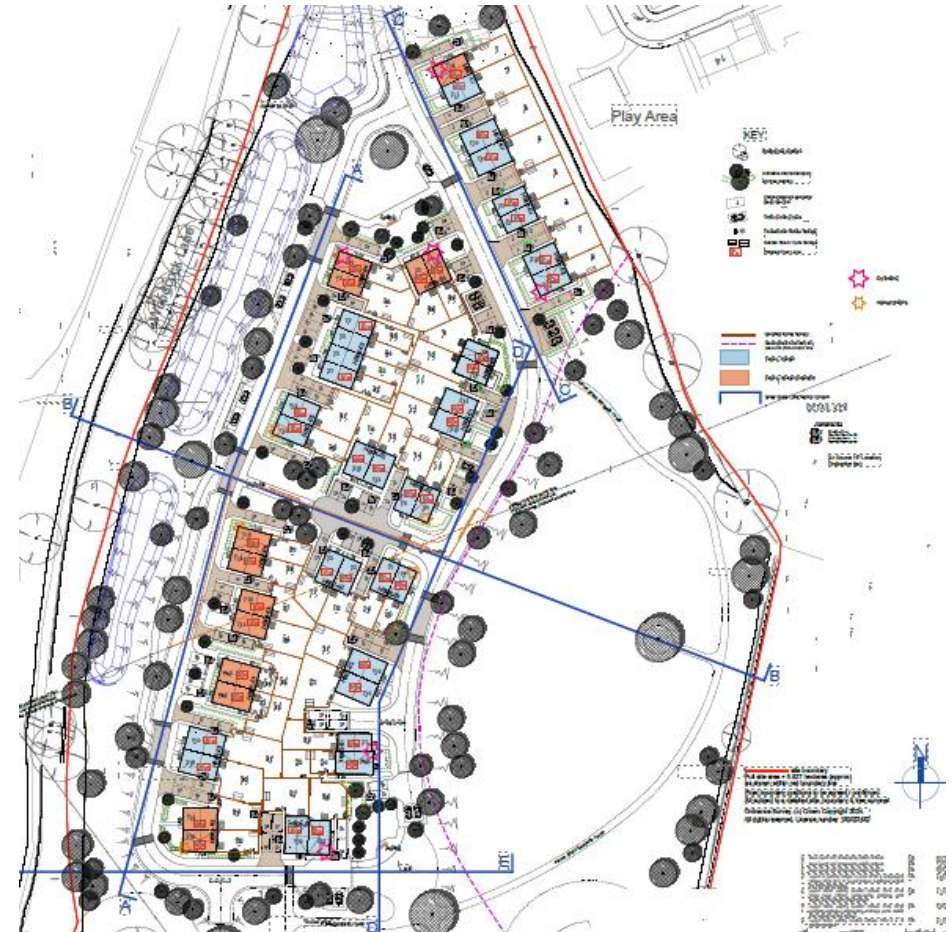


Figure 1. Land west of Kingfisher Grove - Proposed site layout

2. Planning Policy and Conditions

Planning Conditions

- 2.1. Outline permission for development was granted in January 2023. There are no relevant conditions attached to the appeal decision.

Local Planning Policy

- 2.2. This statement will address requirements set out in the Wokingham Borough Council Adopted Core Strategy Development Plan Document, adopted in January 2010, relating to sustainable design and construction:

Policy CP1: Sustainable Development

Planning permission will be granted for development proposals that:

- 1) Maintain or enhance the high quality of the environment;
- 2) Minimise the emission of pollutants into the wider environment;
- 3) Limit any adverse effects on water quality (including ground water);
- 4) Ensure the provision of adequate drainage;
- 5) Minimise the consumption and use of resources and provide for recycling;
- 6) Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;
- 7) Avoid areas of best and most versatile agricultural land;
- 8) Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;
- 9) Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);
- 10) Provide attractive, functional, accessible, safe, secure and adaptable
- 11) schemes;
- 12) Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and
- 13) Contribute towards the goal of reaching zero-carbon developments as soon as possible by:
 - a) Including appropriate on-site renewable energy features; and
 - b) Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.

- 2.3. This statement will additionally address requirements set out in the Wokingham Borough Council Adopted Managing Development Delivery Local Plan, adopted in February 2014, relating to sustainable design and construction and contained with Policies CC04 and CC05:

Policy CC04: Sustainable Design and Construction

Planning permission will only be granted for proposals that seek to deliver high quality sustainably designed and constructed developments by:

1. In respect of all new homes:
 - a) Seeking to achieve the requirements of the full Code for Sustainable Homes Level 4;
 - b) Meet internal potable water consumption targets of 105 litres or less per person per day (as part of the requirement to meet full Code for Sustainable Homes Level 4).
2. All new non-residential proposals of more than 100 sq m gross non-residential floorspace shall at least:
 - a) Achieve the necessary mandatory Building Research Establishment Assessment Method (BREEAM) requirements or any future national equivalent
 - b) Meet or exceed statutory requirements for water resource management.
3. All development, including conversions, alterations and extensions shall incorporate suitable waste management facilities, including on-site recycling.

Policy CC05: Renewable energy and decentralised energy networks

1. Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged
2. Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology where the development is for:
 - a) Schemes of more than 10 dwellings (gross), or
 - b) Non-residential proposals of more than 1,000 sq m gross floorspace
3. Proposals for renewable energy and decentralised energy works, including wind turbines, must demonstrate that:
 - a) They are appropriate in scale, location and technology type;
 - b) Are compatible with the surrounding area, including the impact of noise and odour;

Policy CC05: Renewable energy and decentralised energy networks (continued)

- c) Do not have a damaging impact on the local topography and landscape;
- d) There is no significant impact upon heritage assets, including views important to their setting;
- e) In the case of wind turbines, take account of their cumulative effect and properly reflect their increasing impact on the landscape and on local amenity

Planning Conditions

- 2.4. Outline permission for development was granted in

Code for Sustainable Homes

- 2.5. The Code for Sustainable Homes, as referenced in Policy CC04, was a scheme sponsored by the government, intended to promote and support the transition to more sustainable homes. Following updates to the Building Regulations, the CSH was withdrawn following the conclusion of the Housing Standards Review on 25th March 2015.

National Planning Policy Framework

- 2.6. In December 2024, the Government published the updated National Planning Policy Framework (NPPF), which sets out the Government's planning policies for England and how these are expected to be applied.
- 2.7. The planning process has been identified as a system to support the transition to a low carbon future in response to climate change by assisting in the reduction of greenhouse gas emissions and supporting renewable and low carbon energy.
- 2.8. Paragraph 159 sets out what is expected from new developments when considering strategies to mitigate and adapt to climate change:

159. New development should be planned for in ways that:

Avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaption measures, including through the planning of green infrastructure; and

Can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

National Policy Standards – Energy performance

- 2.9. The government introduced the current revision in Building Regulations, known as Part L 2021 in December 2021, which came into effect for buildings where construction commenced after 15th June 2023. The new standards require a 31% reduction in CO₂ emissions compared with the previous Building Regulations standard.
- 2.10. In December 2023 the government launched a consultation on the next uplift to Building Regulations, to be known as the 'Future Homes Standard'. Details of the standard are still awaiting a government response to the consultation and publication of the final required specification, however it is likely that it will require at least a 75% reduction in CO₂ emissions compared with Part L 2013 and a move towards electrified heating systems.

Proposed Approach

- 2.11. The development will be designed to meet national standards with respect to Building Regulations Part L 2021 requirements, as a minimum, while delivering additional carbon reductions in line with local adopted policy. This statement provides the proposed fabric specification and a strategy which would enable the dwellings to meet these higher standards.
- 2.12. This statement will therefore detail the proposed approach to delivering a low carbon development through a 'fabric first' approach and the implementation low carbon and renewable energy systems. All dwellings are proposed to incorporate air source heat pumps ensuring a fossil fuel free development.
- 2.13. The development also considers the changing future climate and seeks to build in resilience through appropriate construction techniques and materials to reduce future risks of overheating, sustainable and responsible material usage and water consumption of the dwellings.

3. Energy and CO₂ Reduction Strategy

- 3.1. As one of the key areas of ongoing impact of any development, the energy demand of the dwellings to be constructed is a key consideration in the overall sustainability strategy.
- 3.2. As set out within the policy review section of this statement, it is considered that Building Regulations form the minimum requirement for new dwellings in terms of energy performance.
- 3.3. As shown in Table 1, the CO₂ standards contained within Part L were increased in 2010 and 2013, reducing the 'Target Emission Rate' (TER) by approximately 25% and a further 6% (9% for non-residential) respectively, requiring substantial improvements to thermal insulation and heating services, or a significant increase in on-site renewable energy provision.
- 3.4. Part L 2021, mandatory from June 2023, constitutes a much larger step change of a 31% reduction in emissions over previous regulatory standards.

Table 1. CO₂ Emissions improvements from successive Part L editions

Building Regulations	CO ₂ emissions improvements
L1A 2006	-
L1A 2010	25%
L1A 2013	6%
L1A 2021	31%

Homes and Place Standard

- 3.1. Sovereign Housing Association have introduced a 'Homes and Place' standard to guide its development activity. The development will apply the principles of this standard on this site to provide high quality sustainable homes.
- 3.2. The Homes and Place standard is outlined as follows:

"At Sovereign we believe that everyone should live in a home and a place where they feel safe, part of their community and where they can thrive. Our Homes and Place Standard promotes affordable homes of all kinds, which enhance wellbeing for people in every stage of life. It will ensure that our homes are built to last, are adaptable, sustainable, and enjoyable to live in. We are a housebuilder, but we are also a landlord with a lasting stake in the communities we build. We understand our responsibility to future generations, who will inherit the built environment we are investing in today. Our Standard is explicit about the need to build in a way that is sustainable and to build homes that can be sustainably maintained. Our homes will help people move towards zero carbon, reducing energy and water use and save money".
- 3.3. Sovereign are committed to delivering energy efficient, low-carbon dwellings, and are proposing an energy strategy that addresses and exceeds local and national energy policy.
- 3.4. The proposed dwellings will be constructed following a 'fabric first' approach, applying the 'energy hierarchy' approach (Figure 2), incorporating very high standards of thermal insulation, airtightness and thermal bridging, together with efficient heating and lighting systems, including the incorporation of low carbon space and water heating.

Energy Reduction Strategy – Fabric First

- 3.5. 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 (Figure 2).

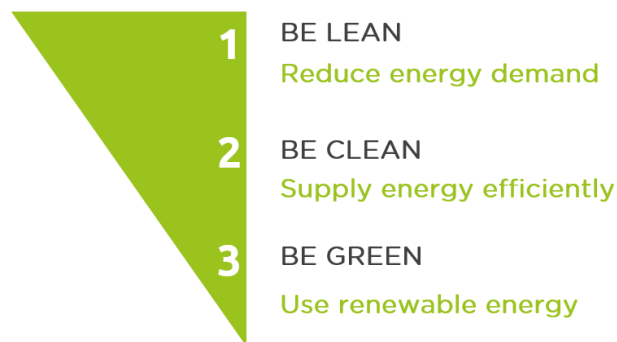


Figure 2. The Energy Hierarchy

Be Lean – reduce energy demand

- 3.6. 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

- 3.7. The design and specification of building services to utilise energy efficiently is the next stage of the hierarchy, considering:
- 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

- 3.8. 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
- 3.9. 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.
- 3.10. This approach has been widely supported by industry and government for some time, particularly in the residential sector, with the Zero Carbon Hub¹ and the Energy Savings Trust² having both stressed the importance of prioritising energy demand as a key factor in delivering resilient, low energy buildings.
- 3.11. The benefits to prospective homeowners of following the ‘Fabric First’ approach are summarised in Table 2.

¹ Zero Carbon Hub, Zero Carbon Strategies for tomorrow's new homes, Feb 2013

² 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 dwellings	✓	✗
Savings built-in for life of dwelling	✓	✗
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

- 3.12. 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.
- 3.13. 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.
- 3.14. The TFEE is calculated based on the specific dwelling being assessed with reference values for the fabric elements contained within Approved Document L1A. 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.
- 3.15. These standards have been tightened under Part L 2021. The proposed approach and construction specifications are set out in the following sections of this Strategy.

Proposed Fabric Specification

- 3.16. In order to ensure that the energy demand of the development is reduced, the dwellings have been 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 L1 limiting fabric parameters in order to demonstrate the potential improvements.

Table 3. Proposed Construction Specification – Main Elements

	Part L1 Limiting Fabric Parameters	Proposed Specification
External wall – u-value	0.26 W/m ² K	0.18 W/m ² K
Party wall – u-value	0.20 W/m ² K	0.00 W/m ² K
Plane roof – u-value	0.16 W/m ² K	0.10 W/m ² K
Ground floor – u-value	0.18 W/m ² K	≤ 0.13 W/m ² K
Windows – u-value	1.60 W/m ² K	1.30 W/m ² K
Doors – u-value	1.60 W/m ² K	1.00 W/m ² K
Air Permeability	8 m ³ /h.m ² at 50 Pa	4.00 m ³ /h.m ² at 50 Pa
Thermal Bridging	Y = 0.150 (default)	Junctions calculated

Thermal Bridging

- 3.17. 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.
- 3.18. The specification seeks 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. It is calculated that the average total Y value is around 0.070.

Air leakage

- 3.19. 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 4.00m³/h.m² at 50Pa, with pressure testing of all dwellings to be undertaken on completion to confirm that the design figure has been met.

Fabric Energy Efficiency

- 3.20. Table 4 demonstrates that the dwellings will exceed the uplifted Fabric Energy Efficiency targets within Part L 2021 through the proposed specification.

Table 4. Fabric Energy Efficiency of proposed dwellings

	Target Fabric Energy Efficiency (kWh/m ² /year)	Design Fabric Energy Efficiency (kWh/m ² /year)	Improvement %
Maisonette	32.29	29.78	7.79
3 Bed Semi	36.16	33.82	6.46
3 Bed Semi	39.70	38.00	4.30
3 Bed Mid	28.94	27.02	6.65

Energy Efficient Heating and Lighting

- 3.21. All dwellings will be provided with low carbon heat supply and the development will avoid fossil fuel combustion on site, improving local air quality.
- 3.22. The houses will incorporate a full air source heat pump solution, with an external heat exchange unit and low temperature heat distribution. These systems will operate at efficiencies of circa 250% plus, ensuring that energy bills are reduced while delivering very low carbon heat.
- 3.23. The apartments, due to the constraints of placing an external heat exchange unit, will incorporate ducted hot water heat pumps to provide the domestic hot water demand. In modern, well-insulated apartments this equates to circa 60% of overall heat demand. Space heating can then be met via high efficiency modern storage heaters, operating from an off-peak tariff to further reduce energy bills.

- 3.24. Internal lighting should be low energy wherever possible. External security and space lighting should be low energy and fitted with PIR and daylight sensors where appropriate.

Passive Design Measures and Overheating Risk Mitigation

- 3.25. Glazing will be specified with a solar transmittance value (g-value) to strike the balance between useful solar gain in the winter and unwanted solar gain in the summer.
- 3.26. Due to these measures to reduce internal heat gain, natural ventilation provided through window openings and the opportunity for cross ventilation will allow sufficient air exchange rates to purge any heat build-up. Active cooling systems are therefore not proposed.
- 3.27. By following these principles, the development will be designed to build in resilience to a potentially changing climate over the lifetime of the buildings and minimise overheating risk, which can be exacerbated by the drive to build better insulated, more airtight homes if not considered within the design and construction process.

Provisions for Energy-Efficient Operation of the Dwelling

- 3.28. The occupant of the dwelling should be provided with all necessary literature and guidance relating to the energy efficient operation of fixed building services. Currently it is assumed that houses will be provided with air source heat pumps (ASHP), fully insulated primary pipework, and time and temperature zone controls to avoid unnecessary heating of spaces when not required.

4. Baseline CO₂ Emissions

- 4.1. The development is to be designed and constructed to meet the requirements of Part L1 of the Building Regulations 2021, therefore compliance with this standard forms the first stage in the sustainable construction approach.
- 4.2. Part L1 compliance is assessed through the Standard Assessment Procedure (SAP), which uses the 'Target Emission Rate' (TER) – expressed in kilograms CO₂ per meter squared of total useful floor area, per annum – as the benchmark. The calculated performance of the dwelling as designed – the Dwelling Emission Rate (DER) – is required to be lower than this benchmark level.
- 4.3. Calculations have been undertaken to a sample of dwellings proposed to assess the carbon emissions of the development. The Part L1 2021 compliant calculated baseline carbon emissions per house type are reported in Table 5.

Table 5. Part L compliant CO₂ emissions by house type

House type	CO ₂ emissions (kgCO ₂ /yr/m ²)
Maisonette	11.39
3 Bed Semi	10.30
3 Bed Semi	9.38
3 Bed Mid	15.74

- 4.4. Based on these calculations, the estimated site-wide Part L compliant CO₂ emissions are shown in Table 6.

Table 6. Part L compliant baseline CO₂ emissions for the site

	Part L Compliant CO ₂ emissions (kgCO ₂ /year)
Site-wide emissions baseline	46,068

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 to assess the systems which may be applicable on site to future Regulatory standards.

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. In addition, 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, including the significant amount of woodland on and around the development.
- 5.6. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 4.50m/s³. Wind turbines at this site are therefore unlikely to generate sufficient quantities of electrical energy to be cost effective⁴. 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)
- Hot Water Heat Pumps (HWHPs)
- Ground Source Heat Pump (GSHPs)

- 5.8. The advantages and disadvantages of these technologies are evaluated in Tables 7-12.

³ NOABL Wind Map (<http://www.rensmart.com/Weather/BERR>)

⁴ CIBSE TM38:2006. Renewable energy sources for buildings.

Table 7. 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
Estimated costs and benefits	
• Cost £2,000 upwards for a wood-pellet boiler, not including cost of fuel	
Conclusions	
Biomass heating is considered technically feasible in large dwellings provided sufficient space can be accommodated for fuel supply, delivery and management however air quality concerns mean that it is not considered appropriate.	

Table 8. 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)
Estimated costs and benefits	
• Cost £2,000 - 5,000 for standard installation • Ongoing offset of heating fuel, minimal maintenance requirements	
Conclusions	
Solar thermal systems are considered technically feasible on all buildings with suitable roof orientations.	

Table 9. Solar photovoltaic 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 • Feed in Tariff support mechanism has been discontinued • 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
Estimated costs and benefits	
• Cost £1,500 upwards (1kWp+) and scalable • Ongoing offset of electricity fuel costs, minimal maintenance requirements	
Conclusions	
PV panels are considered technically feasible for all buildings with suitable roof orientations. The relatively low cost, carbon saving potential and limited additional impacts mean that PV is considered a feasible option for this development.	

Table 10. 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 • With grid decarbonisation will be a low carbon heating source in future	• 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
Estimated costs and benefits	
• Cost £5,000 - £7,000 for standard installation	
Conclusions	
Air source heat pumps are technically feasible for the buildings in this scheme and are considered a preferred low carbon technology at this stage.	

Table 11. 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 - With grid decarbonisation will be a low carbon heating source in future	- 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
Estimated costs and benefits	
- Cost circa £10,000+ - Running cost linked to COP of heat pump, circa 3.0 equates to 66% reduction vs electricity	
Conclusions	
Ground source heat pumps are considered technically feasible for buildings in this scheme. However, the cost and difficulty associated with vertical boreholes at this site means that they are not considered a preferred low carbon technology at this stage.	

Table 12. Hot Water Heat Pump Feasibility Appraisal

Potential Advantages	Risks & Disadvantages
- Hot water demand met through grid electricity with low effective emissions factor - Heat pump element increases efficiency over immersion heater, circa 200%+ - No external heat exchanger requirement, only intake and exhaust duct runs - Low noise levels - Compact solution in same footprint as hot water cylinder	- Maximum length of duct runs means that cylinder positioning needs to be considered within the dwelling - Less appropriate for larger dwellings with higher hot water demands due to potentially slower recharge rate - Some noise, however likely to be easily suppressed with appropriate cylinder location - Space heating must be met through separate system
Estimated costs and benefits	
- Cost circa £2,500 - No external heat exchanger reduces noise and increases suitability for apartments and maisonettes	
Conclusions	
Hot water heat pumps are considered feasible for dwellings with a low number of wetrooms and appropriate cylinder location to allow for duct runs to building façade.	

Summary

- 5.9. Following this feasibility assessment, it is considered that there are a range of technically feasible low carbon or renewable energy systems, however a number of these may be discounted on the grounds of increased running costs for residents or other adverse effects:
- Biomass heating systems would require significant storage space for fuel as well as regular deliveries at different times to all dwellings. Local NO_x 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.
- 5.10. There are two main technologies with significant potential for the development:
- Solar photovoltaics
 - Air Source Heat Pumps
- 5.11. It is currently proposed that all dwellings will incorporate air source heat pumps (ASHP) to deliver low carbon heat across the development.
- 5.12. When positioning heat pumps, a number of considerations will be made with regard to the running and maintenance of the systems, as well as the impacts they will have on the aesthetics of the dwellings and potential noise implications for the dwellings occupants.
- 5.13. It is considered that solar PV panels would be an appropriate additional technology to further reduce CO₂ emissions, however they are not included in the current calculations, which demonstrate substantial CO₂ savings without these systems.

6. As-Designed Performance

- 6.1. It is proposed that all dwellings incorporate high standards of thermal insulation and use heat pump technology to deliver energy and carbon reductions. Through following the strategy described, the dwellings will reduce energy demand and consequent CO₂ emissions significantly beyond a Part L 2021 compliant level of performance.

Carbon Emissions

- 6.2. The carbon reduction figures are presented in Table 13 for the proposed dwellings, demonstrating an average of circa 77% improvement on Part L 2021 standards.

Table 13. Proposed as-designed CO₂ emissions – (Part L 2021)

	Part L compliant emissions (kgCO ₂ /year/m ²)	As-designed emissions (kgCO ₂ /year/m ²)	Improvement %
Maisonette	12.87	5.5	57.3%
3 Bed Semi	11.34	4.93	56.5%
3 Bed Semi	11.32	4.96	56.2%
3 Bed Mid	9.27	4.29	53.7%

- 6.3. Based on these calculations, the estimated site-wide as-designed CO₂ emissions are shown in Table 14.

Table 14. Part L compliant baseline CO₂ emissions for the site

	CO ₂ emissions (kgCO ₂ /year)
Part L Compliant Baseline	46,068
As-Designed Emissions	20,124
Saving	25,944
%	56.3

7. Overheating Risk and Passive Design

- 7.1. Dwellings constructed today may be operating in a substantially different climate over the coming decades, and therefore should be designed to ensure that they are able to adapt and reduce the risk of overheating with potentially higher summer temperatures and longer hot spells. Therefore, Passive design measures will be considered and incorporated to enhance resilience to climate change impacts throughout the lifetime of the development.
- 7.2. Key design decisions can affect the potential risk of overheating:
- Poor consideration of orientation of large glazed facades
 - High density development contributing to urban heat island effects
 - High glazing ratios contributing to excessive unwanted solar gain
 - Inadequate ventilation strategies
 - Very high levels of thermal insulation without considering heat build-up
- 7.3. Other factors which additionally contribute to heat build-up within homes and should be addressed where possible include:
- High levels of occupation
 - Appliance use contributing to internal gains

Cooling hierarchy

- 7.4. In common with sustainable heating strategies, it is possible to apply a sustainable 'cooling hierarchy' which sets out the priorities to ensure overheating risk is minimised:
- Minimise internal heat gain
 - Manage heat through internal thermal mass and design of spaces
 - Passive ventilation strategies
 - Mechanical ventilation systems
 - Active cooling systems

Addressing overheating risk

- 7.5. The cooling hierarchy described has been considered, with passive measures of reducing overheating risk given priority. Key measures which will be taken within the development include:
- A layout which incorporates significant green space around the site and in rear gardens reducing the potential for heat build-up in enclosed and low albedo external areas such as tarmac and dark roofs
 - Glazing specification which has been considered to balance the requirements for useful solar gain with unwanted summer gain
 - Consideration of thermal mass of construction materials to smooth internal temperature profiles, storing excess heat during the day and releasing at night
- 7.6. The development is proposed to use traditional masonry construction, which has a relatively high thermal mass, compared with timber or steel construction. A construction with a high thermal mass can help to reduce overheating risk as it absorbs heat during the day and slowly releases it during cooler nighttime hours, effectively smoothing out temperature fluctuations within the property.
- 7.7. Within the development layout, orientation and massing has been considered to maximise useful passive solar gain. Glazing will be specified with a solar transmittance value (g-value) to strike the balance between useful solar gain in the winter and unwanted solar gain in the summer.
- 7.8. All houses will be able to benefit from cross-ventilation to effectively purge warm air from the properties during periods of hot weather. Window opening areas will be considered and guided by the Part O assessment, with increased opening areas being designed in as required.

Approved Document O

- 7.9. In order to address overheating risk more robustly, the Government has introduced a new Approved Document, 'Part O', into the Building Regulations.
- 7.10. This document requires a more in-depth assessment of the risk of overheating, taking into account site location, dwelling orientation, glazing proportions and openable window areas for natural ventilation. (This assessment will be undertaken at the start of detailed design and any mitigation measures that may be required will be built in).

8. Resource Efficiency

- 8.1. This section sets out details of additional resource efficiency and sustainable design principles to be applied at the development.

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.

Waste

- 8.4. 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

- 8.5. 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.
- 8.6. Wokingham Borough Council currently operate a household collection service through which households are able to recycle materials including paper and cardboard, plastic bottles, tins, glasses and metal foils, along with a separate collection for garden waste. 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.

Construction Waste

- 8.7. 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.
- 8.8. 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. A target to divert 85% by weight/volume of non-hazardous construction waste will be applied.

Electric Vehicle Charging

- 8.9. 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.
- 8.10. The Government has additionally introduced a new Approved Document, Part S, which sets out requirements for EV charging infrastructure within new development. This specifies that EV charge points must be provided for each dwelling (or where the total number of parking spaces is less than each dwelling, all spaces should be provided with an active EV charging point). Any remaining spaces must have cable routes for charge points to be installed.
- 8.11. For non-residential car parks with more than 10 spaces, at least one active EV charge point must be provided, with cabling to the remaining 20% of spaces.
- 8.12. EV charging units will be installed in line with Approved Document S of Building Regulations 2021 and provided to all dwellings. Each charge point will have a minimum nominal rated output of 7kW.

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. In line with Policy CC04, water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.
- 9.3. 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 to limit water use.
- 9.4. Table 15 shows how the development could achieve a result less than the required 105 litres/person/day internal water consumption target of Policy CC04.

Table 15. Typical Water Demand Calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/occupier/d ay
WC (dual flush)	Full flush (l)	6	8.76
	Part flush (l)	4	11.84
Taps (excluding kitchen taps)	flow rate (l/min)	4	7.90
Bath	Capacity to overflow (l)	181	19.91
Shower	Flow rate (l/min)	8	34.96
Kitchen sink taps	Flow rate (l/min)	6	13.00
Washing Machine	Litres/kg dry load	6.8	14.28
Dishwasher	Litres/place setting	1.04	3.74
Calculated Use			114.4
Normalisation Factor			0.91
Total Internal Consumption (L)			104.1

10. Conclusions

- 10.1. This Energy and Sustainability Statement has been prepared by AES Sustainability Consultants Ltd on behalf of Sovereign Housing Association to detail the proposed approach to sustainable construction to be employed at the development of Land west of Kingfisher Grove, Three Mile Cross
- 10.2. The proposed development comprises a total of 49 dwellings across a mix of maisonettes, semi-detached and terraced houses
- 10.3. The statement has been prepared to address national and local policy relating to sustainable design and construction of dwellings, including relevant policies within the Wokingham Borough Council Adopted Core Strategy Development Plan Document adopted in 2010 and the Managing Development Delivery Local Plan, adopted in February 2014
- 10.4. Sovereign are committed to delivering energy efficient, low-carbon dwellings, and are proposing an energy strategy that addresses and exceeds local and national energy policy through the implementation of their Homes and Place Standard.
- 10.5. This statement details the proposed approach to delivering a low carbon development through a 'fabric first' approach and the implementation low carbon and renewable energy systems. All dwellings are proposed to incorporate air source heat pumps ensuring a fossil fuel free development.
- 10.6. The calculations demonstrate that the development will deliver carbon reductions of circa 56% in excess of Part L 2021 compliance, and achieve these carbon reductions through higher fabric standards and low carbon heating systems, meeting the requirements of CPI and CC05.
- 10.7. The statement additionally details the proposed approach to addressing overheating risk and climate resilience, sustainable and responsible materials usage and water consumption of the dwellings.