Land at West Buntingford, Hertfordshire

Vistry Homes Limited

Energy and Sustainability Statement

AES Sustainability Consultants Ltd

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Rev0	Chris MacDougall	26.05.2022	Initial Issue
Rev 1	Maja Stanisz	23.06.2022	Amendments
Rev 2	Chris MacDougall	29.06.2022	Proposed Construction Specification Amendments
Rev 3	Chris MacDougall	14.11.2022	Addition of proposed PV systems in conclusion
Rev 4	Chris MacDougall	24.04.2023	Amendment to Development Description
Rev 5	Chris MacDougall	19.06.2023	Update development description
Rev 6	Chris MacDougall	29.06.2023	Update development description
Rev 7	Chris MacDougall	10.07.2023	Remove Fig 1

This statement has been commissioned by Vistry Homes Cotswolds to detail the proposed approach to energy and CO_2 reduction to be employed in the development of Land at West Buntingford, Hertfordshire. 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 and Sustainability Statement has been prepared on behalf of Vistry Homes Limited in support of the application for development of Land at West Buntingford, Hertfordshire.

Development Description

1.2. The development site is located west of Luynes Rise, in the market town of Buntingford, within the boundary of East Hertfordshire District Council, in the County of Hertfordshire.

1.3. The proposals will be subject to an Outline planning application (with all matters reserved except for access) for:

- *Development of 350 dwellings, with up to 4,400 sqm of commercial and services floorspace (Use Class E and B8), and up to 500 sqm of retail floorspace (Use Classes E) and other associated works including drainage, access into the site from the A10 and Luynes Rise (but not access within the site), allotments, public open space and landscaping.*
- *The application site area is 28.95 hectares.*

Purpose and Scope of the Statement

1.4. The statement has been prepared in support of the proposed development to address both local and national policy in relation to sustainable design and construction of dwellings.

1.5. National Policy relating to energy standards has undergone significant changes in recent years, and future regulations are set to undergo significant changes in the next few years. This statement will review these changes and the future standards and aim to describe an approach which remains adaptable to future changes to regulations.

1.6. The statement will demonstrate that following a fabric first approach to demand reduction, the proposed development will deliver a level of energy performance which meets or exceeds the current Building Regulation standards whilst addressing a range of additional sustainable design considerations.

1.7. Further sustainability considerations will be detailed including resource efficiency, water efficiency and sustainable transport mechanisms.

2. Planning Policy

Local Planning Policy

2.1. East Herts District Council adopted the East Herts District Plan in October 2018. Contained within the District Plan are planning policies DES4, CC1, 2 and 3, as well as Sustainabiity SPD (March 2021) relating to sustainable design and construction, climate change mitigation and renewable and low carbon energy.

Policy DES4 Design of Development

All development proposals, including extensions to existing buildings, must be of a high standard of design and layout to reflect and promote local distinctiveness. Proposals will be expected to:

... (d) Incorporate high quality innovative design, new technologies and construction techniques, including zero or low carbon energy and water efficient, design and sustainable construction methods. Proposals for residential and commercial development should seek to make appropriate provision for high speed broadband connectivity, ensuring that Fibre to the Premises (FTTP) is provided;

Policy CC1 Climate Change adaptation

All new development should:

(a) Demonstrate how the design, materials, construction and operation of the development would minimise overheating in summer and reduce the need for heating in winter; and

(b) Integrate green infrastructure from the beginning of the design process to contribute to urban greening, including the public realm. Elements that can contribute to this include appropriate tree planting, green roofs and walls, and soft landscaping.

Policy CC2 Climate Change Mitigation

I. All new developments should demonstrate how carbon dioxide emissions will be minimised across the development site, taking account of all levels of the energy hierarchy. Achieving standards above and beyond the requirements of Building Regulations is encouraged.

II. Carbon reduction should be met on-site unless it can be demonstrated that this is not feasible or viable. In such cases effective offsetting measures to reduce on-site carbon emissions will be accepted as allowable solutions.

III. The energy embodied in construction materials should be reduced through re-use and recycling , where possible, of existing materials and the use of sustainable materials and local sourcing.

Policy CC3

I. The Council will permit new development of sources of renewable energy generation, including community led projects, subject to assessment of the impacts upon:

(a) environmental and historic assets;

(b) visual amenity and landscape character;

(c) local transport networks;

(d) the amenity of neighbouring residents and sensitive uses;

(e) air quality and human health; and

(f) the safe operation of aerodromes.

II. In considering the impact of renewable technologies, the Council will attach particular importance to maintaining the special countryside character of the rural area, including the preservation of long-distance views from public rights of way.

National Planning Policy Framework

2.2. On the 20th July 2021, the Government published the revised National Planning Policy Framework (NPPF), which sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development

2.3. Chapter 14 of the NPPF outlines its energy and climate change policies. New development should be planned in ways that:

- avoid increased vulnerability to the range of impacts arising from climate change…
- can help to reduce greenhouse 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.

2.4. In determining planning applications, local planning authorities should expect new developments to:

- comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

2.5. This chapter also outlines the requirement of Local Plans to take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. The key focus of the NPPF is to support local and regional planning authorities.

Current and Future National Policy Standards

2.6. Government policy in relation to the energy performance of buildings has been evolving over the past decade, following government commitments to reduce the emission of greenhouse gases – particularly CO_2. This obligation was enshrined in the Climate Change Act 2008, which commits the UK to achieving a mandatory 80% reduction in the UK's CO_2 emissions by 2050, compared with 1990 levels.

2.7. In 2016, the UK government ratified the Paris Agreement, which provides a framework for governments to pursue the target of limiting global warming below 2°C.

2.8. In June 2019, the Government announced it had set a new net zero greenhouse gas emission target for the UK by 2050, compared with the previous target of at least 80% reduction from 1990 levels.

2.9. The built environment has a key role to play in delivering on these international commitments, as it accounts for approximately a third of overall CO_2 emissions. These commitments have been translated into national policies within the built environment driven by, amongst other mechanisms, the EU Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive.

2.10. Following the introduction of the 2013 edition of Building Regulations Part L, the successive updates now require regulated CO_2 emissions levels from new build domestic buildings to be approximately 30% lower than 2006 levels.

2.11. The Government proposes that the Building Regulations are the appropriate mechanism to drive future standards with respect to energy consumption, with local authorities able to apply the optional requirements of the national technical standards with respect to water consumption and space.

2.12. As an acknowledgement of the challenge to the built environment in meeting future 'net zero' targets, the Government published the next revision to the Building Regulations Approved Document L1A (Part L) in December 2021.

2.13. The uplift to Part L 2021 will incorporate:

Higher Standards for Carbon Dioxide Emissions

2.14. This is to be delivered through what is expressed as a 'fabric' approach to deliver a 31% reduction over current standards (referred to as 'Option 2' in the original consultation).

Introduction of Primary Energy Demand Compliance Metric

2.15. The regulations will introduce a primary energy demand compliance metric. This is in order to align the regulations with the amended EU Energy Performance of Building Directive (2018), which states:

"The energy performance of a building shall be expressed by a numeric indicator of primary energy use in kWh/ (m^2.y) for the purpose of both energy performance certification and compliance with minimum energy performance requirements."

2.16. Primary energy is an expression of the energy content available in a fuel / fuel source which has not undergone any conversion or transformation process. Individual factors are assigned to all fuel types to take account of upstream processes and energy use – e.g., mains electricity has a higher factor due to the additional transformation and distribution processes that the energy undergoes before it reaches the home, compared with gas where the fuel is burned directly within the dwelling.

2.17. Dwellings will therefore be assessed based on their primary energy consumption in a similar way to current carbon compliance.

Revised Transitional Arrangements

2.18. Revised transitional arrangements will apply once the new regulatory standards are introduced. Dwellings will now need to be covered by the building notice, initial notice, or full plans before July 2022 and individual plots commenced prior to July 2023 in order to continue under Part L 2013. Registration or commencement falling after these dates means that dwellings will be required to meet Part L 2021 standards.

Proposed Strategy

2.19. Due to development timescales, the site will fall under Part L 2021, and therefore the development will be designed to meet these increased standards. With respect to carbon reduction, all dwellings will therefore deliver a >31% reduction compared with current regulatory standards.

2.20. It is therefore considered that the strategy proposed to meet Part L 2021 will far exceed current regulatory standards with regard to CO_2 emissions.

2.21. The development will achieve these carbon reductions through a combination of higher fabric standards and low carbon and renewable energy systems.

2.22. This statement provides an indicative fabric specification and a strategy which would enable the dwellings to meet these higher standards, with the precise strategy to achieve this being subject to change as detailed design progresses.

2.23. Additional sustainable construction considerations are also addressed, including overheating risk and climate resilience, sustainable and responsible materials usage and water consumption of the dwellings.

3. Energy and CO_2 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 CO_2 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. The 2021 uplift to the regulations will require a further 31% reduction in emissions, delivering dwellings with emissions levels less than half of homes built to L1A 2006 standards.

Table 1. CO_2 Emissions improvements from successive Part L editions

Building Regulations	CO_2 emissions improvements
L1A 2006	-
L1A 2010	25%
L1A 2013	6%
L1A 2021	31%

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).

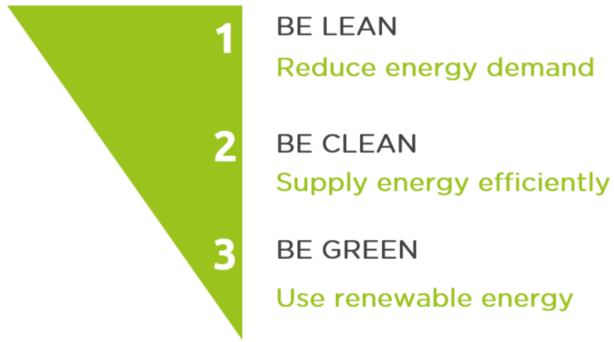

Figure 2. The Energy Hierarchy

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, 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

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 Hub[1] and the Energy Savings Trust[2] 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.

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 CO_2 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/m^2/year.

3.13. This standard enables the decoupling of energy use from CO_2 emissions and serves as an acknowledgement of the importance of reducing demand, rather than simply offsetting CO_2 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.

[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

3.15. These standards will be tightened under Part L 2021. The proposed approach and indicative construction specifications are set out in the following sections of this Strategy subject to the final SAP software confirming the proposed specifications.

Fabric Standards

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 L1A 2013 and Part L1A 2021 limiting fabric parameters in order to demonstrate the potential improvements.

Table 3. Proposed Construction Specification – Main Elements

	Part L1a 2013 Limiting Fabric Parameters	Part L1a 2021 Limiting Fabric Parameters	Proposed Specification
External wall – u-value	0.30 W/m²K	0.26 W/m²K	0.25 W/m²K
Party wall – u-value	0.20 W/m²K	0.20 W/m²K	0.00 W/m²K
Plane roof – u-value	0.20 W/m²K	0.16 W/m²K	0.11 W/m²K
Ground floor – u-value	0.25 W/m²K	0.18 W/m²K	0.13 W/m²K
Windows – u-value	2.00 W/m²K	1.60 W/m²K	1.26 W/m²K
Doors – u-value	2.00 W/m²K	1.60 W/m²K	1.00 W/m²K
Air Permeability	10 m³/h.m² at 50 Pa	8.00 m³/h.m² at 50 Pa	4.01 m³/h.m² at 50 Pa
Thermal Bridging	Y = 0.150 (default)	Y = 0.150 (default)	Y = ≤ 0.034 (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 CO_2 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.

Energy Efficient Heating and Lighting

3.19. Heat generation and distribution systems will be designed to give the occupants a high level of control over their use, encouraging and allowing energy-efficient behaviour. High efficiency combi boilers should be installed to properties to eliminate the need for hot water cylinders where feasible. Primary pipework should be fully insulated, and time and temperature zoning controls installed in all dwellings.

3.20. Internal lighting should be low energy wherever possible, and areas of infrequent use will be fitted with occupancy sensors. External security and space lighting should be low energy and fitted with PIR and daylight sensors where appropriate.

3.21. Where necessary, units will be installed with a Waste Water Heat Recovery (WWHR) system. WWHR retrieves thermal energy from hot water used in a shower before it disappears down the drain. This happens through a heat exchanger, in which cold mains water is passed around a copper waste pipe to gain a temperature rise, before continuing to the boiler 'pre heated'. This in turn relieves the workload of the boiler.

Passive Design Measures and Overheating Risk Mitigation

3.22. 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.

3.23. Where feasible, dwellings will be fitted with high-efficiency combination boilers, removing the need for hot water cylinders which would lose useful heat to the dwelling at the rate of around 1.5kWh/day, or circa 550kWh over the course of a year.

3.24. 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.

3.25. 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.

Air Leakage

3.26. 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 ≤ 4.50$m^3/h.m^2$ at 50Pa, with pressure testing of all dwellings to be undertaken on completion to confirm that the design figure has been met.

Provisions for Energy-Efficient Operation of the Dwelling

3.27. 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 all dwellings will be provided with modern gas-fired heating systems, with controls enabling different temperature profiles in a minimum of two defined zones, a measure which services to avoid unnecessary heating of spaces when not required – for example, bedrooms and living rooms with differing hours of occupancy.

4. Low Carbon and Renewable Energy

4.1. 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 meet Part L 2021 or any future Regulatory standards.

Combined Heat and Power (CHP) and District Energy Networks

4.2. 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. However, the reduced emissions from the national grid due now means that CHP systems will not deliver CO_2 savings.

4.3. 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.

4.4. 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

4.5. 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.

4.6. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 4.80m/s[3]. Wind turbines at this site are therefore unlikely to generate sufficient quantities of electrical energy to be cost effective[4]. For these reasons wind power is not considered feasible.

Building Scale Systems

4.7. 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 Pump (GSHPs)

4.8. The advantages and disadvantages of these technologies are evaluated in Tables 4-8.

[3] NOABL Wind Map (http://www.rensmart.com/Weather/BERR)

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

Table 4. Individual biomass heating feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Potential to significantly reduce CO_2 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 5. 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 6. 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 7. 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. However, the capital and running cost increases in comparison to a gas baseline means that they are not considered a preferred low carbon technology at this stage.	

Table 8. 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 or around 5-6p/kWh (higher than mains gas) • Additional costs to upgrade electricity infrastructure currently unknown	
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 9. 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
Conclusions	
Hot water heat pumps are considered feasible for dwellings with a relatively low number of wetrooms and appropriate cylinder location to allow for duct runs to building façade.	

Summary

4.9. 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 is 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.

- Air source heat pumps may be technically feasible for the houses, however the potential increase in running costs, compared with a gas and solar PV approach, means that it is not a preferred option at this stage.

4.10. There are two main technologies with significant potential for the development:

- Solar photovoltaics

- Hot water heat pumps

4.11. It is considered that solar PV systems are most appropriate in meeting a significant proportion of energy demand without introducing additional energy loss through larger hot water cylinders.

4.12. PV system designs will be worked up when bringing forward designs for each phase of development,, however it is provisionally assessed that all dwellings will be specified with solar PV systems of between around 0.5 – 4kWp, depending on the specific characteristics of the homes. Full PV system designs will be developed once the calculations can be completed.

5. As-Designed Dwelling Performance

5.1. Through following the strategy described, the dwellings will significantly reduce energy demand and consequent CO_2 emissions beyond a Part L compliant level of performance through the dwelling fabric alone, without requiring low carbon or renewable energy systems with shorter service lives to offset unnecessary emissions.

5.2. SAP calculations have been undertaken on a sample of the proposed dwelling types to provide an overview of the typical as-designed energy performance, in comparison with Building Regulations standards. The results of these calculations are shown in Tables 10 and 11.

Table 10. As-designed dwelling performance – CO_2 emissions

House type	Part L compliant emissions ($kgCO_2$/year)	As-designed emissions ($kgCO_2$/year)	Improvement %
Aspen Det	1,244	1,285	3.70
Cypress Det	1,126	1,159	2.84
Rowan Semi	929	975	4.70
Spruce Det	1,108	1,152	3.81
Apple Semi	938	970	3.28
Cherry Mid	774	817	5.22
Beech Semi	1,062	1,112	4.55
Holly Mid	777	829	6.29

Table 11. As-designed site-wide performance - CO_2 emissions

	Part L compliant emissions ($kgCO_2$/year)	As-designed emissions ($kgCO_2$/year)	Improvement %
Site-wide emissions	360,710	346,484	3.94

4.4 This calculated performance indicates that the dwellings will exceed the requirements of Part L through the proposed specification.

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6. Overheating Risk and Passive Design

6.1. 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.

6.2. 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

6.3. 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

6.4. 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

6.5. 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. Sustainable Design

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

Materials

7.2. 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.

7.3. 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
- All insulating materials will have a Global Warming Potential (GWP) of < 5 in manufacture and installation.
- All materials used in construction will be responsibly sourced, with certification obtained wherever possible. Materials with a low environmental impact as per the BRE Green Guide will be preferred.

Waste

7.4. 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

7.5. In this respect regard has been given to the policy advice contained in the NPPF together with the Council's current guidance to ensure that the new dwellings are provided with adequate storage facilities for both waste and recyclable materials.

7.6. East Herts District Council currently operates domestic waste collection services through which households are able to recycle materials including paper and cardboard, plastic bottles and food containers, tins, glasses and metal foils, together with garden waste.

Construction waste

7.7. The construction process will be managed to effectively and appropriately monitor and manage construction site waste. Target benchmarks for resource efficiency will be set in accordance with best practice – e.g., m^3 of waste per $100m^2$ / tonnes waste per m^2.

7.8. 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.

Water Conservation

7.9. In line with current Building Regulations, water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.

7.10. 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.

7.11. Table 12 shows how the development could achieve a result less than the required 125 litres/occupier/day calculated in accordance with Building Regulations 17.K methodology.

7.12. The calculation results in a total water consumption of 105.9 Litres/Person/Day for the intended specification, well below the maximum of 125 Litres/Person/Day required by Building Regulations and below the limit of 110Litres/Person/Day, required by Policy WAT4 of the East Herts District Plan 2018.

Table 12. Typical Water Demand Calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/Person/Day
WC (dual flush)	Full flush (l)	6	8.76
	Part flush (l)	4	11.84
Taps (excluding kitchen taps)	flow rate (l/min)	5	9.48
Bath	Capacity to overflow (l)	181	19.91
Shower	Flow rate (l/min)	6	26.22
Kitchen sink taps	Flow rate (l/min)	6	13.00
Calculated Use			110.9
Normalisation Factor			0.91
Total Internal Consumption (L)			100.9
External Use			5.0
Building Regulations 17.K			105.9

8. Conclusions

8.1. This Sustainability Statement has been prepared by AES Sustainability Consultants Ltd on behalf of Vistry Homes Limited to detail the proposed approach to sustainable construction to be employed at the Land West of Luynes Rise, Buntingford, Hertfordshire.

8.2. The development site is located west of Luynes Rise, in the market town of Buntingford, within the boundary of East Hertfordshire District Council, in the County of Hertfordshire.

8.3. The proposals will be subject to an Outline planning application (with all matters reserved except for access) for: *Development of 350 dwellings, with up to 4,400 sqm of commercial and services floorspace (Use Class E and B8), and up to 500 sqm of retail floorspace (Use Classes E) and other associated works including drainage, access into the site from the A10 and Luynes Rise (but not access within the site), allotments, public open space and landscaping.*

8.4. A review of the East Herts District Plan 2018, Sustainability SPD 2021, the NPPF and relevant recent Government statements has established that the Building Regulations are considered the appropriate method for setting standards relating to energy use and CO_2 emissions, giving consideration to building design and site-layout to further reduce energy consumption.

8.5. Due to development timescales, the site will fall under Part L 2021, and therefore the development will be designed to meet these increased standards. This will deliver a >31% reduction compared with current regulatory standards, which equates to emission levels less than half of homes built to L1A 2006 standards, which were in place during the adoption of the East Herts District Plan 2018.

8.6. Improvements in insulation specification, efficient building services, a reduction in thermal bridging and unwanted air leakage paths and further passive design measures will enable the relevant standards to be met, whilst building in low energy design and future climate resilience to the design and construction of the dwellings.

8.7. Calculations undertaken on the proposed house types under the approved Standard Assessment Procedure demonstrate that Part L compliant emissions would equate to an estimated 346,484 $kgCO_2$/year. Through following the energy efficiency approach described, the predicted emissions are reduced by 3.94% over Part L 2021 requirements.

8.8. It has been determined that the calculated water consumption would offer significant betterment over the maximum level allowable by Building Regulations, with the proposed specification equating to an internal water consumption of 100.9 Litres/Person/Day.

8.9. The statement additionally details the proposed approach to addressing overheating risk and climate resilience, sustainable and responsible materials usage.

8.10. All dwellings will require solar PV systems to achieve Part L 2021 compliance, with some possible exceptions dependant on size and connotation, and It is provisionally assessed that dwellings will be specified with solar PV systems of between 0.5 – 4kWp, depending on the specific characteristics of the homes. Plot specific system sizes will be developed once the SAP calculations can be completed.