Former Woodside Conference Centre, Kenilworth

Vistry Homes West Midlands

Energy and Sustainability Statement

AES Sustainability Consultants Ltd

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Rev0	Chris MacDougall	23.03.2023	Initial issue
Rev1	Chris MacDougall	20.09.2023	Amendments to specification
Rev2	Chris MacDougall	22.02.2024	Amendments to ensure development aligns with Net Zero Carbon DPD
Rev 3	Lisa Chaplin	23.02.2024	Change wording to Table 6 & 7 to explain the difference between the two tables.

This statement has been commissioned by Vistry Homes West Midlands to detail the proposed approach to energy and CO_2 reduction to be employed in the development of the Former Woodside Conference Centre, Kenilworth. 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. Written by AES Sustainability Consultants on behalf of Vistry Homes West Midlands, this Energy and Sustainability Statement has been prepared in support of the application for development of the Former Woodside Conference Centre, Kenilworth.

Development Description

1.2. The development site is located in the market town of Kenilworth, Warwickshire, south of Crew Lane and adjacent to the A46. The development lies within the administrative boundary of Warwick District Council.

1.3. This Energy and Sustainability Statement is in support of a full planning application for the erection of up to 55 dwellings.

1.4. The proposal would deliver 55 dwellings across a mix of one to five bed detached, semi-detached and terraced houses and two bed apartments. Affordable dwellings are designated across the site. The proposed site layout is shown in Figure 1.

Purpose and Scope of the Statement

1.5. This statement demonstrates that by following a 'fabric first' approach and with the implementation of renewable technology, the development will reduce carbon emissions over a Part L 2021 baseline, which in itself presents a 31% reduction over previous regulatory standards. The carbon reductions and use of renewable technologies will accord with Overarching Policy SC0 of the Warwick District Council Local Plan 2011-2029 (Adopted September 2017), as well as Policies CC1 and CC2, relating to Climate change and Policy FW3, relating to water efficiency.

1.6. Additionally, the statement acknowledges emerging policy relating to zero carbon development, specifically the Warwick District Council Net Zero Carbon DPD, drafted July 2021 and updated June 2023. The development will accord with emerging policies NZC1, NZC2, NZC3 and NZC4.

Figure 1. Proposed Site Layout

2. Planning Policy

Local Planning Policy

2.1. The Warwick District Local Plan 2011-2029 (Adopted September 2017) contains the following key policies relating to sustainable development:

> Policy SC0: Sustainable Communities
>
> New development should be high quality and should ensure that it is brought forward in a way which enables strong communities to be formed and sustained. It is also important that new development protects and enhances the historic, built and natural features that make Warwick District a great place. To achieve this the development should:
>
> a) deliver high-quality layout and design to integrate with existing communities;
>
> b) be brought forward in a comprehensive way and where development sites are adjacent, layout, design and infrastructure provision should be carefully co-ordinated;
>
> c) ensure good quality infrastructure and services are provided and where this cannot be provided on site, provision should be made through contributions to off-site provision;
>
> d) ensure access and circulation are inclusive and provide for a choice of transport modes, including public transport, cycling and walking;
>
> e) take account of community safety, including measures to prevent crime and road accidents;
>
> f) provide good access to community facilities including meeting places, local shops, transport services, health facilities and open space;
>
> g) minimise energy and water consumption and take account of opportunities to promote renewable energies where appropriate;
>
> h) ensure proposals are adaptable to climate change;
>
> i) have a focus on healthy lifestyles, including measures to encourage walking and cycling, to provide access to open space, play areas, playing fields and sports facilities and to encourage healthy diets;
>
> j) protect and where possible enhance the natural environment including important landscapes, natural features, and areas of biodiversity;

> Policy SC0: Continued…
>
> k) protect and where possible enhance the historic environment and particularly designated heritage assets such as listed buildings, registered parks and gardens and conservation areas; and
>
> l) manage flood risk to ensure that proposals do not unduly increase the risk of flooding

2.2. The Warwick District Local Plan 2011-2029 (Adopted September 2017) contains the following key policies relating to Climate Change:

> Policy CC1: Planning for Climate change Adaptation
>
> All development is required to be designed to be resilient to, and adapt to the future impacts of, climate change through the inclusion of the following adaptation measures where appropriate:
>
> a) using layout, building orientation, construction techniques and materials and natural ventilation methods to mitigate against rising temperatures;
>
> b) optimising the use of multi-functional green infrastructure (including water features, green roofs and planting) for urban cooling, local flood risk management and to provide access to outdoor space for shading, in accordance with Policy NE1;
>
> c) incorporating water efficiency measures, encouraging the use of grey water and rainwater recycling, in accordance with Policy FW3;
>
> d) minimising vulnerability to flood risk by locating development in areas of low flood risk and including mitigation measures including SuDS in accordance with Policy FW2;
>
> Applicants will be required to set out how the requirements of the policy have been complied with including justification for why the above measures have not been incorporated.

Policy CC2: Planning for Renewable Energy and Low Carbon Generation

Proposals for new low carbon and renewable energy technologies (including associated infrastructure) will be supported in principle subject to all of the following criteria being demonstrated:

a) the proposal has been designed, in terms of its location and scale, to minimise any adverse impacts on adjacent land uses and local residential amenity;

b) the proposal has been designed to minimise the impact (including any cumulative impacts) on the natural environment in terms of landscape, and ecology and visual impact;

c) the design will ensure that heritage assets including local areas of historical and architectural distinctiveness are conserved in a manner appropriate for their significance;

d) where appropriate, the scheme can link in with proposals being brought forward through the Council's Low Carbon Action Plan and any other future climate change strategies;

e) the scheme maximises appropriate opportunities to address the energy needs of neighbouring uses (for example linking to existing or emerging district heating systems);

f) for biomass, it should be demonstrated that fuel can be obtained from a sustainable source and the need for transportation will be minimised; and,

g) for proposals for hydropower the application should normally be accompanied by a flood risk assessment.

Also, for wind energy proposals, planning permission will only be granted if:

h) the development is in an area identified in either the Local Plan or a Neighbourhood Plan as being suitable for wind energy; and,

i) following consultation, it can be demonstrated that the planning impacts identified by local communities affected by the proposal have been fully addressed and that the proposal has the backing of those communities.

2.3. The Warwick District Local Plan 2011-2029 (Adopted September 2017) contains the following key policy relating to Water Efficiency:

Policy FW3: Water Efficiency

The Council will require new residential development of one dwelling or more to meet a water efficiency standard of 110 litres / person / day. This includes five litres / person /day for external water usage.

2.4. The Warwick District Council Net Zero Carbon DPD aims to minimise carbon emissions and ensure all new development should be net zero carbon in operation. The following key policies contained within the DPD relate to net zero regulated operational energy and how this can be achieved through an improved fabric specification and the implementation of low-carbon renewable energy generation.

Policy NZC1: Achieving Net Zero Carbon Development

New development of one or more new dwellings (C3 or C4 use class) and/or 1,000sqm or more of new non-residential floorspace, hotels (C1 use class) or residential institutions (C2 use class) should achieve net zero operational regulated carbon emissions by implementing the energy hierarchy.

Proposals should demonstrate application of the energy hierarchy through submission of an energy statement which identifies:

i. For new dwellings, a minimum 63% reduction in carbon emissions is achieved by on-site measures, as compared to the baseline emission rate set by Building Regulations Part L 2021 (SAP 10.2).

ii. ii. In non-residential buildings, hotels and residential institutions at least a 35% reduction in carbon emissions through on-site measures compared to the rate set by Building Regulations 2013 (or equivalent percentage reduction on Building Regulations 2021).

iii. Compliance with the energy efficiency and renewable energy provisions set by policies policy NZC2(A) & (B) and by presenting the carbon savings achieved across each step of the energy hierarchy (demand reduction, efficient supply, renewable and other low-carbon technology).

Policy NZC1: Continued...

iv. Any residual operational regulated carbon emissions (over the course of 30 years) will be calculated and offset to zero in accordance with policy NZC2(C). Offsetting will only be considered an acceptable solution to net zero carbon requirements if it can be demonstrated that carbon reductions achieved via on-site measures (and near-site renewables) are demonstrably unfeasible or unviable.

Where full compliance is not feasible or viable, proposals must demonstrate through the energy statement that carbon reductions to the greatest extent feasible have been considered and incorporated through applying the energy hierarchy. In applying the energy hierarchy, proposals are expected to implement fabric energy efficiency and low carbon heating before incorporating renewable electricity generation and then offsetting.

A condition will be applied to planning permissions requiring as built SAP or SBEM calculations to be submitted prior to occupation and demonstrating that the finished building meets the standard set in Policy NZC1.

Alternatively, applications may demonstrate the requirements of Policy NZC1 are met through the Passivhaus standard with accompanying PHPP calculations submitted within the energy statement (without the use of fossil fuels on site including gas). A condition will be applied requiring Passivhaus certification prior to occupation.

Policy NZC2 (A): Making Buildings Energy Efficient

New development of one or more new dwellings (C3 or C4 use) are expected to demonstrate a 10% improvement on the Part L 2021 Target for Fabric Energy Efficiency.

New developments of 1,000sqm or more of new non-residential floorspace, hotels (C1 use class), or residential institutions (C2 use class) are expected to demonstrate that they achieve a 19% reduction in carbon emissions compared to Part L 2013 through energy efficiency measures (fabric efficiency, efficient services and efficient energy supply; steps 1 and 2 of the energy hierarchy).

Where full compliance is not feasible or viable having regard to the type of development involved and its design, proposals must demonstrate through the energy statement that carbon reductions to the greatest extent feasible through energy efficiency measures have been considered and incorporated.

Policy NZC2 (A): Continued...

All energy statements must also lay out the U-values and airtightness of the proposed building in comparison to the notional values in the Future Homes Standard or Future Building Standard (indicative specification, or final, as available at time of application).

Policy NZC2 (B): Zero or Low Carbon Energy Sources and Zero Carbon Ready Technology

New development of one or more new dwellings (C3 or C4 use class) and/or 1,000sqm or more of new non-residential floorspace, hotels (C1 use class), or residential institutions (C2 use class) should demonstrate through an energy statement that additional renewable, zero and low carbon energy technologies have been provided on-site* to achieve the carbon reductions required by Policy NZC1 and achieve on-site net zero regulated operational carbon.

Where full compliance is not feasible or viable having regard to the type of development involved and its design, proposals must:

- demonstrate through the energy statement that additional renewable, zero and low carbon energy technologies have been provided to the greatest extent feasible and viable.

- incorporate 'zero carbon ready' (as opposed to immediately providing 'low/zero carbon') technologies.

Policy NZC3: Embodied Carbon

New major development should demonstrate in the energy statement or design statement how the embodied carbon of the proposed materials to be used in the development has been considered and reduced where possible, including with regard to the type, life cycle and source of materials to be used.

Proposals for development of 50 or more new dwellings and/or 5,000sqm or more of new non-residential floorspace should be accompanied by a whole-life assessment of the materials used.

National Planning Policy Framework

2.5. In December 2023, 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.

2.6. 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.

2.7. 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.

Current National Policy Standards

2.8. The government introduced the next revision in Building Regulations, known as Part L 2021 in December 2021, to come into effect for buildings where construction is commenced after 15th June 2023. The new standards will require a 31% reduction in CO_2 emissions compared with the current Building Regulations standard.

Proposed Strategy

2.9. This statement is intended to establish the proposed approach to sustainable construction, energy, and water demand reduction to be delivered at the development.

2.10. Following review of government policy, it is considered that the Building Regulations standards for energy efficiency are the appropriate baseline energy performance requirements. The development will be designed to meet national standards with respect to Part L 2021 requirements as a minimum, and deliver carbon reductions in line with local adopted and emerging policy.

2.11. It is proposed that the development will be constructed following a 'fabric first' approach to exceed the current Building Regulations, with insulation standards, thermal bridging and air leakage all improved beyond the minimum compliance levels.

2.12. In addition, consideration will be given to building design, passive solar design and energy efficient site-layouts where possible.

2.13. The following sections of this statement set out the sustainable design considerations which will be applied to the dwellings in order to deliver low energy, comfortable and affordable housing.

2.14. There are many other aspects of sustainability which relate to new housing development and will be considered further within this statement, including water use and the environmental impacts of materials, construction and household waste.

2.15. The development also considers the changing future climate and seeks to build resilience through appropriate construction techniques and materials to avoid future risks of overheating.

3. Climate Change Resilience

3.1. 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 resilient to future climate change impacts such as increases in temperature, rainfall, wind and sea level. Climate resilience is important to homeowners against a backdrop of increasingly extraordinary weather events.

3.2. Passive design measures will be considered and incorporated to enhance resilience to climate change impacts throughout the lifetime of the development.

Rising Temperatures and Overheating

3.3. With the risk of potentially higher summer temperatures and longer hot spells in the future, it is important to consider the thermal comfort of the dwelling. Passive design measures are proposed in order to mitigate future overheating.

Approved Document O

3.4. In order to address overheating risk more robustly, the Government has introduced a new Approved Document, 'Part O', into the Building Regulations.

3.5. This document requires a more in-depth assessment of the risk of overheating, considering site location, dwelling orientation, glazing proportions and openable window areas for natural ventilation.

3.6. This assessment will be undertaken at the start of detailed design and any mitigation measures that may be required will be built in.

Addressing overheating risk

3.7. 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 night-time hours, effectively smoothing out temperature fluctuations within the property.

3.8. 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.

3.9. All dwellings 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.

4. Energy Consumption and CO_2 Emissions

4.1. 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.

4.2. 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.

4.3. As shown in Table 1, the CO_2 standards contained within Part L were increased in 2010 and 2013, reducing the TER by approximately 25% and a further 6% (9% for non-residential) respectively.

4.4. Part L 2021 mandatory from June 2023, constitutes a much larger step change of a 31% reduction in emissions.

Table 1. CO_2 Emissions improvements from successive Part L editions

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

Energy Reduction Strategy – Fabric First

4.5. The proposed construction specification and sustainable design principles to be applied to the development will ensure that each dwelling meets the CO_2 reductions mandated by Part L1 of the Building Regulations through fabric measures alone.

4.6. 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.

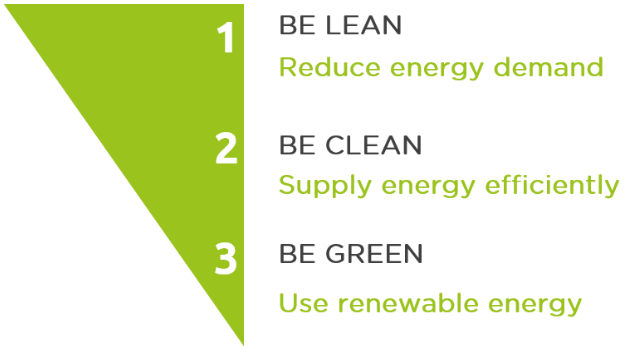

Figure 2. The Energy Hierarchy

Be Lean – reduce energy demand

4.7. The design of a development - from the masterplan to individual building design - will assist in reducing energy demand in a variety of ways, with a focus on minimising heating, cooling and lighting loads. Key considerations include:

- Building orientation – maximise passive solar gain and daylight
- Building placement – control overshading and wind sheltering
- Landscaping – control daylight, glare and mitigate heat island effects
- Building design – minimise energy demand through fabric specification

Be Clean – supply energy efficiently

4.8. 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

4.9. Low carbon and renewable energy systems form the final stage of the energy hierarchy and can be used to directly supply energy to buildings, or offset energy carbon emissions arising from unavoidable demand. This may be in the form of:

- Low carbon fuel sources – e.g., biomass
- Heat pump technologies
- Building scale renewable energy systems
- Small-scale heat networks
- Development-scale heat networks

4.10. As this hierarchy demonstrates, designing out energy use is weighted more highly than the generation of low-carbon or renewable energy to offset unnecessary demand. Applied to the development, this approach is referred to as 'fabric first' and concentrates finance and efforts on improving U-values, reducing thermal bridging, improving airtightness, and installing energy efficient ventilation and heating services.

4.11. 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.

4.12. 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

4.13. 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/m²/year.

4.14. 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.

4.15. 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. The proposed approach and indicative construction specifications are set out in the following sections of this Strategy.

[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

Proposed Fabric Specification

4.16. In order to ensure that the energy demand of the development is reduced, the dwellings should be designed to minimise heat loss through the fabric wherever possible. Table 3 details the proposed fabric specification of the major building elements, with the first column in this table setting out the Part L1 limiting fabric parameters in order to demonstrate the improvements delivered.

Table 3. Proposed construction specification – main elements

	Part L1 Limiting Fabric Parameters	Proposed Specification
External wall – u-value	0.26 W/m²K	0.18 W/m²K
Party wall – u-value	0.20 W/m²K	0.00 W/m²K
Plane roof – u-value	0.16 W/m²K	0.09 W/m²K
Ground floor – u-value	0.18 W/m²K	≤ 0.12 W/m²K
Windows – u-value	1.6 W/m²K	0.85 W/m²K
Doors – u-value	1.6 W/m²K	1.00 W/m²K
Air Permeability	8.00 m³/h.m² at 50 Pa	4.00 m³/h.m² at 50 Pa
Thermal Bridging	Y = 0.20 (default)	Y = ≤ 0.021 (calculated)

Thermal bridging

4.17. 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.

4.18. The specification should seek to minimise unnecessary bridging of the insulation layers, with avoidable heat loss therefore being reduced wherever possible. Accurate calculation of these heat losses forms an integral part of the SAP calculations undertaken to establish energy demand of the dwellings, and as such thermal modelling will be undertaken to assess the performance of all main building junctions.

Air leakage

4.19. 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

4.20. Table 4 demonstrates that the dwellings will exceed the uplifted Fabric Energy Efficiency targets within Part L 2021 through the proposed specification and ensure compliance with Policy NZC2 (A) by demonstrating a minimum 10% improvement.

Table 4. Fabric Energy Efficiency of sample dwellings

	Target Fabric Energy Efficiency (kWh/m²/year)	Design Fabric Energy Efficiency (kWh/m²/year)	Improvement %
2 Bed Apartment	36.18	28.53	21.12
2 Bed Semi	35.96	28.31	21.28
3 Bed Detached	40.21	32.59	18.95
4 Bed Detached	43.06	35.66	17.18
5 Bed Detached	39.54	32.59	21.28

Provisions for Energy-Efficient Operation of the Dwelling

4.21. 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 houses will benefit from space and water heating provided via air source heat pumps, with apartments utilising hot water heat pumps and electric panel heaters to provide the space heating. Additionally, dwellings will benefit from fully insulated primary pipework, and controls including programmers, thermostats and Thermostatic Radiator Valves to avoid unnecessary heating of spaces when not required.

5. Apartment Block CO_2 Emissions

5.1. A CO_2 emissions comparison, between proposals to retain and renovate the disused conference centre and hotel and remove and replace with a new apartment block, highlights the significant reduction in emissions of a new apartment block over an existing building conversion.

5.2. It is currently proposed that a new apartment block will replace the disused conference centre and hotel, significantly improving the building fabric and CO_2 emissions in comparison to an existing building conversion.

Proposed Fabric Specification

5.3. Table 5 shows the proposed construction specification of the new apartment block, to both Part L 2021 and the proposed Future Homes Standard (FHS), and the likely target specification of a refurbishment based on the fabric constraints of an existing building, upgraded to meet the minimum standards within Part L 2021.

Table 5. Apartment Proposed construction specification – main elements

	Proposed New Build Specification	Proposed FHS Specification	Potential Refurbishment Standard
External wall - u-value	0.18 W/m²K	0.18 W/m²K	0.70 W/m²K
Party wall – u-value	0.00 W/m²K	0.00 W/m²K	0.00 W/m²K
Plane roof – u-value	0.09 W/m²K	0.11 W/m²K	0.70 W/m²K
Ground floor – u-value	≤ 0.12 W/m²K	≤ 0.12 W/m²K	0.70 W/m²K
Windows – u-value	0.85 W/m²K	0.80 W/m²K	1.40 W/m²K
Doors – u-value	1.0 W/m²K	0.25 W/m²K	1.40 W/m²K
Air Permeability	4.00 m³/h.m² at 50 Pa	4.00 m³/h.m² at 50 Pa	15.00 m³/h.m² at 50 Pa
Thermal Bridging	Y = 0.034 (Calculated)	Y = ≤ 0.039 (Estimated)	Default

Estimated CO_2 Emissions

5.4. Table 6 shows the estimated CO_2 emissions (Tonnes CO_2/yr) and EPC rating for a sample GF apartment from this development, comparing an existing conversion specification to the current proposed new build specification.

Table 6. CO_2 emissions and EPC rating of a new apartment compared to an existing building conversion

Specification	CO_2 Emissions (Tonnes/yr)	EPC Rating
New build apartment	-0.11	96 A
Existing building conversion	1.99	74 C

5.5. Table 7 shows the estimated CO_2 emissions (Tonnes CO_2/yr) and EPC rating for all apartments from this development, comparing an existing conversion specification to the current proposed new build specification.

Table 7. Estimated CO_2 emissions of a new apartment block compared to an existing building conversion

Specification	CO_2 Emissions (Tonnes/yr)	% Reduction
New build apartment block	-1.32	105.53
Existing building conversion	23.88	

5.6. The baseline CO_2 emissions and as-designed performance detailed in the subsequent sections of this report consider the estimated emissions produced from a new build apartment block, along with the remainder of the site.

6. Baseline CO_2 Emissions

6.1. 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.

6.2. Part L1 compliance is assessed through the Standard Assessment Procedure (SAP), which uses the 'Target Emission Rate' (TER) – expressed in kilograms CO_2 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.

6.3. Calculations have been undertaken to a representative sample of house types proposed to assess the carbon emissions of the development. The Part L1 2021 compliant calculated baseline carbon emissions are reported in Table 8.

Table 8. Part L compliant CO_2 emissions by house type

House type	CO_2 emissions ($kgCO_2/m^2/yr$)
2 Bed Apartment	12.87
2 Bed Semi	11.34
3 Bed Detached	10.96
4 Bed Detached	9.42
5 Bed Detached	7.71
2 Bed (Affordable)	11.34
3 Bed (Affordable)	10.96
4 Bed (Affordable)	9.42

6.4. Based on these calculations, the representative site-wide Part L compliance CO_2 emissions are shown in Table 9.

Table 9. Part L compliant baseline CO2 emissions for the site

	Part L Compliant CO_2 emissions ($kgCO_2$/year)
Site-wide emissions baseline	65,921

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7. Low Carbon and Renewable Energy Systems

7.1. A range of low carbon and renewable energy systems have been assessed for their potential to deliver suitable emission savings.

Combined Heat and Power (CHP) and District Energy Networks

7.2. A CHP unit can generate 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.

7.3. The economic and technical viability of a CHP system is largely reliant on a consistent demand for heat throughout the day to ensure that it operates for over 5000 hours per year. Heat demand from mainly residential schemes is not conducive to efficient system operation, with a defined heating season and intermittent daily profile, with peaks in the morning and the evening. For this reason, the use of a CHP system is considered unfeasible for this development.

7.4. 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. Due to these reasons, the provision for future connection to a district heating system is also not proposed.

Wind Power

7.5. Locating wind turbines adjacent to areas with buildings presents several 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.

7.6. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 5.0m/s [3]. Wind turbines at this site are therefore unlikely to generate enough electrical energy to be cost effective[4]. For these reasons wind power is not considered feasible.

Building Scale Systems

7.7. 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)

7.8. The advantages and disadvantages of these technologies are evaluated in Tables 10-14.

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

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

Table 10. 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. Air quality concerns in addition to increased transport emissions for fuel delivery mean that it is not a preferred technology for the development.	

Table 11. Solar Thermal systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Mature and reliable technology offsetting the fuel required for heating water • 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, however the contribution to carbon reduction is expected to be low and therefore it is not a preferred technology.	

Table 12. Solar Photovoltaic systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• The technology offsets 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 (fall protection 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 £1,300 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 and limited additional impacts mean that PV is considered a feasible option for this development.	

Table 13. 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	• 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, requires good system design
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 due to the high carbon saving potential are considered a preferred technology.	

Table 14. Ground Source Heat Pump systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle • Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 320% • Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings	• Low temperature heating circuits (underfloor heating) would be required to maximise the efficiency of heat pumps • A hot water cylinder would also be required for both space and water heating • 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+ • Estimated simple payback at circa 18 years (systems only) • Running cost linked to COP of heat pump, however likely to be 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.	

Summary

7.9. 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.

7.10. It is currently proposed that all dwellings will incorporate heat pump technology supplemented with solar PV to meet Part L 2021 standards and the net zero regulated operational carbon emissions in accordance with emerging policy NZC2 (B) of the Warwick District Council Net Zero Carbon DPD.

7.11. Air source heat pumps (ASHP) are considered the option with the most significant potential for the houses, delivering CO_2 reductions of circa 64-72%. Hot water heat pumps will be incorporated into the apartments, achieving similar CO_2 reductions. The implementation of heat pump technology shows the developments intention to significantly reduce CO_2 emissions.

7.12. It is provisionally assessed that dwellings will be specified with solar PV systems of between around 2.84 – 7.29 kWp, depending on the specific characteristics of the homes. Full PV system designs will be developed once full SAP calculations can be completed.

7.13. The addition of Solar PV systems will allow the development to achieve zero regulated emissions and accord with emerging policies contained within the Warwick District Council Net Zero Carbon DPD.

8. As-Designed Performance

8.1. By following the strategy described, the dwellings will reduce energy demand and consequent CO_2 emissions beyond the level of a Part L compliant development.

8.2. Table 15 demonstrates the CO_2 reductions achieved through the proposed fabric measures, additional PV and the implementation of heat pump technology.

Table 15. CO_2 emissions of sample dwellings

House type	Target CO_2 emissions ($kgCO_2/m^2/yr$)	Designed CO_2 emissions ($kgCO_2/m^2/yr$)	% Reduction
2 Bed Apartment	12.87	-0.33	102.56
2 Bed Semi	11.34	-0.24	102.12
3 Bed Detached	10.96	-0.17	101.55
4 Bed Detached	9.42	-0.27	102.87
5 Bed Detached	7.71	-0.21	102.72
2 Bed (Affordable)	11.34	-0.24	102.12
3 Bed (Affordable)	10.96	-0.17	101.55
4 Bed (Affordable)	9.42	-0.27	102.87

8.3. Table 16 demonstrates the total site wide CO_2 reductions achieved through the proposed fabric measures and low-carbon renewable technology.

Table 16. Estimated site-wide CO_2 emissions

	CO_2 emissions ($kgCO_2/yr$)	
Part L compliant	65,921	
After fabric measures and renewable technology	-1,528	
	$kgCO_2/yr$	%
Total savings	67,449	102.32

9. Overheating Risk and Passive Design

9.1. 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.

9.2. 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

9.3. 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

9.4. 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

9.5. 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

10. Resource Efficiency

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

Materials

10.2. 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.

10.3. 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

10.4. 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

10.5. 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.

10.6. Warwick District 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

10.7. 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., 5m^3 of waste per 100m^2 / tonnes waste per m^2.

10.8. 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

10.9. 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.

10.10. EV charging units will be installed to meet the requirements of Approved Document S: Infrastructure for the charging of electric vehicles.

11. Water Conservation

11.1. In line with Part G of Building Regulations 2021, water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.

11.2. 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 of limiting the use of water during the operation of the development.

11.3. Table 17 shows a typical water demand calculation, and shows how the development will achieve a result less than the required 125 litres/occupier/day calculated in accordance with Building Regulations 17.K methodology.

Table 17. Typical Water Demand Calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/occupier/ day
WC (dual flush)	Full flush (l)	4	5.84
	Part flush (l)	2.6	7.70
Taps (excluding kitchen taps)	flow rate (l/min)	5	9.48
Bath	Capacity to overflow (l)	181	19.91
Shower	Flow rate (l/min)	8	34.96
Kitchen sink taps	Flow rate (l/min)	10	14.76
Washing Machine	Litres/kg dry load	8.17	17.16
Dishwasher	Litres/place setting	1.25	4.50
Calculated Use			114.3
Normalisation Factor			0.91
Total Internal Consumption (L)			104
External Use			5.0
Building Regulations 17.K			109

12. Embodied Carbon

12.1. An Embodied Carbon Assessment had been undertaken for Vistry Homes West Midlands for four national housetypes and one apartment block.

12.2. The purpose of the analysis is to model the environmental impact of various material changes for the house types and apartment block in line with policy NZC3: Embodied Carbon of the Warwick District Council Local Plan 2011-2029 (Adopted September 2017).

12.3. Increasingly it is being demonstrated that as operational energy demand of buildings is being reduced through the energy efficiency provisions of the Building Regulations, in-use energy demand is accounting for a decreasing proportion to the overall Whole Life Cycle (WLC) energy and CO2 emissions. As such, the necessity for consideration of the embodied carbon of construction is becoming more apparent to continue to reduce the climate impacts of the built environment.

12.4. The full Embodied Carbon Assessment can be found within Appendix A of this report.

12.5. As part of the Embodied Carbon Assessment, Vistry Homes will aim to reduce the embodied carbon through consideration of the following principles in line with the Warwick District Council – Net Zero Carbon Supplementary Planning Document.

- Vistry, where possible, will consider reusing and retrofitting existing structures on sites.
- Vistry will utilise recycled material content, a number of supply chain partners are selected on the basis of their own recycling initiatives as they seek joint innovative solutions to reduce the carbon output in the production of our homes utilising repurposed or recycled materials.
- Vistry will utilise low carbon materials, in particular timber, within the construction of their homes.
- Vistry will specify sanitaryware components with low carbon operational water use to meet Part G of Building Regulations 2021. Water efficiency measures will include the use of efficient dual flush WCs, low flow showers and taps and appropriately sized baths.
- Design for future deconstruction and reuse will be considered to ensure materials remain intact for future use.
- Passive design measures, including efficient building shape and form will be considered to ensure energy demands including the use of active cooling are reduced, whilst encouraging free heating.
- Carbon sequestering materials will be considered and utilised where possible, as an example Vistry will incorporate timber within their design.
- Vistry will, where possible, avoid unnecessary materials use, cost and disruption arising from the need for future adaptation works as a result of changing functional demands through careful design for durability and flexibility.
- Embodied and operational carbon reductions together form Whole Life Carbon, through completion of both the operational energy calculations and the embodied carbon assessment, Vistry will consider both to analyse key areas for improvement.
- As part of the Embodied Carbon Assessment, Vistry will assess construction materials over a 60-year lifespan. Vistry will specify materials, where possible, with a long lifespan to reduce the need for maintenance, replacement, and end of life.
- Vistry will source materials locally where possible, where this is not possible due to a consolidated supply chain base and geographical limitations, Vistry will use Blue Chip suppliers which hold circular delivery networks reducing miles travelled.
- Where possible, Vistry will minimise waste at source and at a design level basis to ensure designs are efficient in material use, and waste is kept at a minimum through Early Supplier Involvement (ESI) engagement,
- Vistry will consider using efficient and lightweight construction materials, for example precast materials, aerated block, increased recycled content to reduce embodied carbon emissions associated with the manufacturing and life span of the building.
- Vistry will use renewable energy and reuse materials where possible to transform our Circular Economy eliminating waste where possible.

12.6. This statement confirms that through a fabric first approach and with the implementation of renewable technology, the development will reduce carbon emissions over a Part L 2021 baseline, holistically reducing both embodied and operational carbon.

13. Conclusions

13.1. This Energy and Sustainability Statement has been prepared by AES Sustainability Consultants on behalf of Vistry Homes West Midlands to detail the proposed approach to sustainable construction to be employed at the Former Woodside Conference Centre, Kenilworth.

13.2. The statement is intended to demonstrate that, following a 'fabric first' approach to demand reduction, the proposed development will deliver a level of energy performance beyond the current Building Regulation standards whilst addressing a range of additional sustainable design considerations.

13.3. A review of National policy including 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, considering building design and site-layout to further reduce energy consumption.

13.4. This strategy focuses on a 'Fabric First' approach which prioritises improvements to the fabric of the dwellings to avoid unnecessary energy demand and consequent CO_2 production.

13.5. In 2021 Warwick District Council released a draft emerging Net Zero Carbon Development Plan Document which set out aims to minimise carbon emissions and ensure that all new development achieves net zero regulated carbon emissions.

13.6. The Net Zero Carbon DPD was updated in June 2023 and this statement shows how the development will accord with all relevant policies contained within this document.

13.7. The statement demonstrates that, by following a 'fabric first' approach, a minimum 10% improvement in fabric energy efficiency is achieved, in accordance with emerging policy NZC2 (A). Calculations to proposed dwellings show that dwellings will achieve fabric efficiency improvements of between circa 17 – 21% over a Part L 2021 baseline.

13.8. It is proposed that the disused conference centre and hotel will be removed and replaced with a new apartment block. The estimated emissions of a new build apartment, built to the proposed specification, are -0.11 TonnesCO_2/yr, as opposed to 1.99 TonnesCO_2/yr for an existing building conversion.

13.9. The estimated CO_2 emissions of a new build apartment block are -1.32 TonnesCO_2/yr, as opposed to 23.88 TonnesCO_2/yr for an existing building conversion, or a 105.53% reduction.

13.10. 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.

13.11. To further enable the transition to zero carbon development, heat pumps have been proposed to all units, presenting CO_2 emission reductions of between 64-72% over a Part L 2021 baseline.

13.12. The addition on Solar PV systems of between 2.84kWp – 7.29kWp will ensure that dwellings will achieve the minimum 63% CO_2 reductions contained within Policy NZC1 of the Warwick District Council Net Zero Carbon DPD.

13.13. Calculations undertaken to the proposed dwellings under the approved Standard Assessment Procedure demonstrate that, through following the energy efficiency approach described, with the addition of low-carbon renewable technology, the calculated as-designed emissions are reduced by 102.32% over Part L 2021 requirements.

13.14. It has also been determined that the calculated water consumption equates to a maximum water consumption of 109 litres/occupier/day, and therefore offers a significant improvement on the maximum of 125 litres/occupier/day allowable by Building Regulations 2021.

13.15. With the need to adapt to a shift in personal transportation to electric vehicles, the development will ensure the provision of EV charging points, in accordance with Approved Document S of Building Regulations.

13.16. An Embodied Carbon Assessment has been undertaken for four house types (2, 3, 4 and 5 bed national house type) and one apartment block. Carbon hotspots have been found in the substructure and external wall construction for all dwellings, with reinforced concrete, brick and blockwork contributing to over 50% of the total embodied carbon emissions.

13.17. To reduce the embodied carbon emissions, the choice of high recycled content concrete used for the construction of both the foundation and external wall construction is advised. Furthermore, sourcing materials more local to the project would reduce emissions associated with transport, and the use of timber construction frame would result in lower embodied carbon emissions over a dwellings entire life cycle.

14. Appendix A – Embodied Carbon Assessment

Vistry Group

National House Types

Embodied Carbon Assessment

AES Sustainability Consultants Ltd

Rev 00

	Author	Date	E-mail address
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Revision	Author	Date	Comment
Rev 0	Katie Townley	21.02.2024	Embodied Carbon Assessment (Version 1)
Rev 1			
Rev 2			
Rev 3			

1. Executive Summary

1.1. AES Sustainability Consultants Ltd. have been appointed to undertake an Embodied Carbon Assessment for Vistry Group and four national house types and one apartment block. The house types and apartment block have been analysed in accordance with Vistry 2023 Technical Specification for Low Rise Masonry Construction, and the proposed Part L 2025 Future Homes Standard uplift specification.

1.2. The purpose of the analysis is to model the environmental impact of various material changes for the house types and apartment block. There is a significant increase in the availability of accurate data on the carbon cost of materials and systems. Typically, Environmental Product Declarations (EPDs) are used where specified by the specifications and drawings received. EPDs are now widely available for different products by the manufacturer and cover a wide range of data including embodied carbon.

1.3. The embodied carbon assessment of a building is a methodology that is used to quantify the total carbon emissions associated with the construction materials used, in this case a domestic house. Considering the carbon emissions released during extraction, manufacturing, transportation and installation of building materials, this assessment provides valuable insights into the environmental impact of a house's construction process. The assessment involves a life cycle assessment associated with each stage of a building's life.

1.4. Increasingly it is being demonstrated that as operational energy demand of buildings is being reduced through the energy efficiency provisions of the Building Regulations, in-use energy demand is accounting for a decreasing proportion to the overall Whole Life Cycle (WLC) energy and CO_2 emissions[1]. As such, the necessity for consideration of the embodied carbon of construction is becoming more apparent to continue to reduce the climate impacts of the built environment.

1.5. The calculation methodology follows the RICS Professional Statement for undertaking detailed carbon assessments. The RICS Whole Life Carbon Assessment for the Build Environment (2017) follows the European standard EN 15978. The RICS Professional Statement outlines the building elements that should be included in a whole life carbon assessment. This study is an embodied carbon assessment accounting for building elements within the RICS Professional Statement applicable to the construction.

1.6. Modelling was completed using One Click LCA. Assessment method follows BS 15978:2011 Sustainability of Construction Works – Assessment Environmental Performance of Buildings.

1.7. The life cycle greenhouse gas emissions (kgCO2eq.) are reported for each element based on a 60-year building life.

1.8. Fabric elements have been entered as per the information provided by Vistry Group. Where information was not provided, baseline assumptions have been made.

1.9. Data for all materials in the analysis has been collated from the OneClick database, including manufacturer specific data (where available), as well as generic data which represents the industry average for the selected material.

[1] Sansom, M. and Pope, R., 2012. A comparative embodied carbon assessment of commercial buildings. The Structural Engineer

2. Project Data Sources and Assumptions

Project Scope

2.1. This embodied carbon assessment accounts for building elements within the RICS Professional Statement applicable to the construction.

2.2. Below is a summary the building elements that should be included in a whole life carbon assessment according to the RICS Professional Statement.

	Building parts/ element groups	Building elements
0	Facilitating works	0.1 Temporary/ Enabling works/ Preliminaries 0.2 Specialist groundworks
1	Substructure	1.1 Substructure
2	Substructure	2.1 Frame 2.2 Upper floors incl. balconies 2.3 Roof 2.4 Stairs and ramps
	Superstructure	2.5 External walls 2.6 Windows and external doors
	Superstructure	2.7 Internal walls and partitions 2.8 Internal doors
3	Finishes	3.1 Wall finishes 3.2 Floor finishes 3.3 Ceiling finishes
4	Fittings, furnishings and equipment (FF&E)	Building related non-building related
5	Building services/ MEP	5.1-5.14 Building related services non-building-related
6	Prefabricated buildings and building units	6.1 Prefabricated buildings and building units
7	Work to existing building	7.1 Minor demolition and alteration works
8	External works	8.1 Site preparation works 8.2 Roads, paths, paving's and surfacing's 8.3 Soft landscaping, planting and irrigation systems 8.4 Fencing, railings and walls 8.5 External fixtures 8.6 External drainage 8.7 External services 8.8 Minor building works and ancillary buildings

Material Quantities (A1-A3)

2.3. Material information, including materials, has been produced by Vistry Group and the wider design team.

2.4. Fabric elements have been entered as per the information provided by Vistry Group and the wider design team.

2.5. Data for all materials in the analysis has been collated from the OneClick database, including manufacturer specific data (where available), as well as generic data which represents the industry average for the selected material.

Building Material Transport Distances (A4)

2.6. Transport distances were estimated based on default transport distances based on material type provided by the calculation tool.

2.7. The OneClick LCA default values for distances travelled to site for the construction materials were used for each material item.

Construction site impacts (A5)

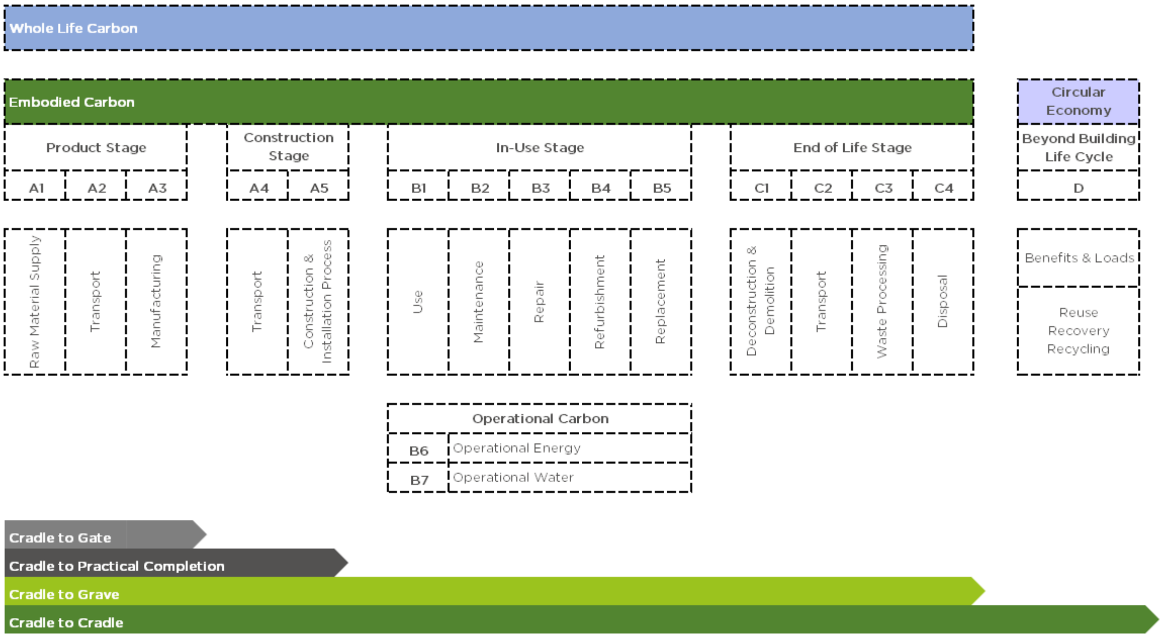
2.8. For the assessment of A5 Site operations emissions, the One Click Software default values have been used.

Exclusions

2.9. The following life-cycle modules are not assessed within OneClick LCA - B1, B2, B3, and B7, and the following are not in scope of this assessment – B1 to B6 and D.

2.10. Kitchen fittings, including upstands and worktops are not assessed due to the absence of quantitative information. Furthermore, external hard landscaping materials have not been assessed due to client request. Facilitating works, prefabricated buildings and building units, and work to existing buildings have also not been assessed due to the absence of information/ deemed not applicable to the development.

2.11. Below is a summary of Life Cycle Modules.



3. Summary of results

3.1. The following pages outline the total embodied carbon for each house type and apartment block, and the embodied carbon hotspots present.

3.2. For all house types and the apartment block, hotspots can be found in the substructure construction and the external wall construction, with reinforced concrete, brick and blockwork contributing to over 50% of the total embodied carbon emissions.

3.3. Below is a summary table of the results for each house type/ apartment block:

House Type	GIA (m2)	Total Embodied Carbon (kgCO2e)	Upfront Embodied Carbon A1-A5 (kgCO2e/m2)	Upfront Embodied Carbon A1-C4 (ex B6-B7) (kgCO2e/m2)
2 Bed House Type	79.06	68,022	605	900
3 Bed House Type	100.29	79,047	532	792
4 Bed House Type	127.31	92,639	505	743
5 Bed House Type	225.58	142,352	440	661
Apartment Block	590.85	424,872	536	720

3.4. It should be noted that as the gross internal floor area (GIA) of the dwelling increases, the total embodied carbon emissions increase due to the increased specification of construction materials.

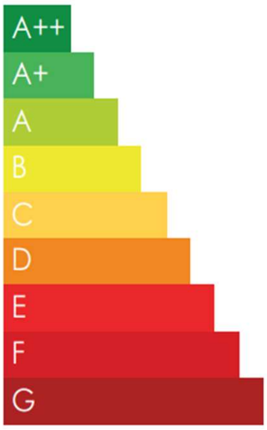
3.5. For upfront embodied carbon (A1-C4), and in particular for the assessed house types, the upfront embodied carbon emissions decrease as the GIA of the dwelling increases. This suggests that even though there is an increase in the amount of construction materials required, it is disproportionate to the GIA i.e. for a 4 bed house type that is twice the size of a 2 bed house type, you wouldn't necessarily require twice the amount of construction materials. Factors will depend on substructure from plot to plot, and house type, for instance, terraced, semi or detached.

3.6. For further improvements to reduce the embodied carbon emissions, we propose the choice of high recycled content concrete used for the construction of the foundation and external wall construction. Recycled concrete reduces the reliance on virgin materials, thus reducing its negative environmental impact associated with the extraction and transportation of the materials.

3.7. Furthermore, sourcing materials more local to the project would reduce the associated embodied carbon emissions (i.e transport distance).

3.8. Timber construction frames also result in lower embodied carbon emissions over a home's entire life cycle.

Vistry Group
2 Bed House Type



Upfront Embodied Carbon
A1-A5

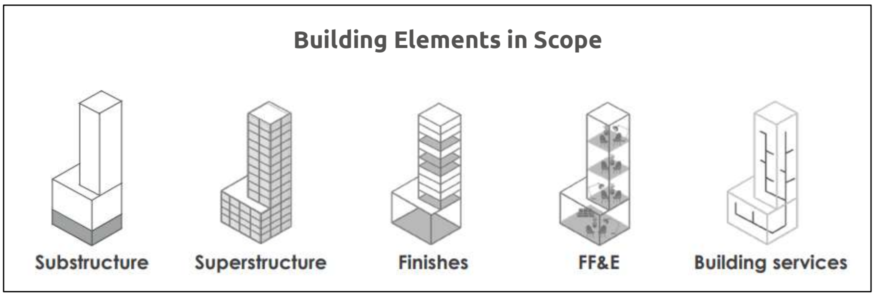
605 $kgCO_2e/m^2$

D

Upfront Embodied Carbon
A1-C4 (ex B6-B7)

900 $kgCO_2e/m^2$

C



1 LETI (2023) Embodied Carbon Case Studies

Building Type
Domestic Building

Gross Internal Floor Area
79.06 m^2

Location/Region
National House Type Range

RIBA Work Stage
N/A

Electricity Use
SAP 10

Study Period
60 years

Project Description
Semi-detached house with 2-storeys, masonry walls with brick, timber truss roof with solar PV and gas boiler.

Software
One Click LCA

Database Used
RICS

Life Cycle Stages
A1-C4

2 Vistry Homes – 2 Bed House Type

Assessment Objective

AES Sustainability Consultants Ltd. have been appointed to assess Vistry Group's National House Types based on their 2023 specification and proposed 2025 Future Homes Specification uplift to assess the embodied carbon emissions for a residential development.

Embodied Carbon Hotspots

By using IESVE and One Click LCA software, the Embodied Carbon Assessment has found that based on the provided specifications, the residual embodied carbon hot spots can be found in the substructure construction (15,472 kg CO2e) and the external wall construction (14,050 kg CO2e), with reinforced concrete, brick and blockwork contributing to 51% of the total embodied carbon emissions.

Improvements

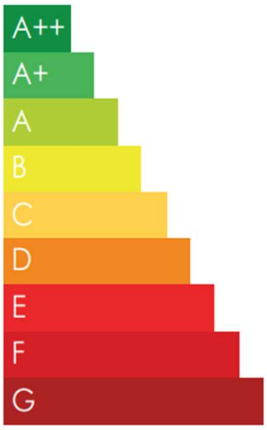
The choice of high recycled content concrete used for the construction of the foundation and external wall construction, sourcing materials local to the project, the specification of timber construction frames.

Exclusions

External hard landscaping and kitchen fittings, including upstands, cabinets, and worktops have been excluded from the assessment. Life cycle stages B5, B6 and D are also excluded.

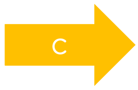
AES Sustainability Consultants

Vistry Group
3 Bed House Type



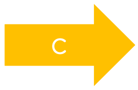
Upfront Embodied Carbon
A1-A5

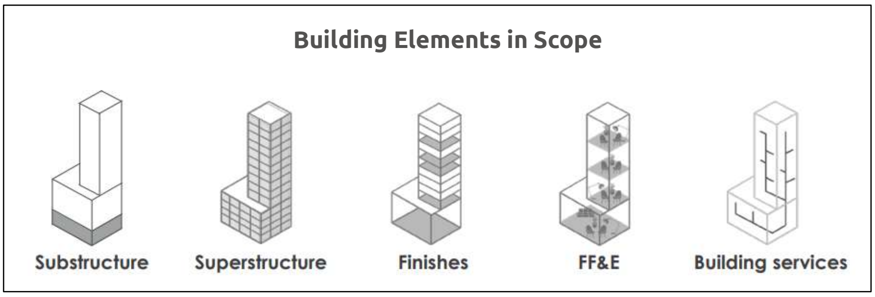
532 kgCO_2e/m^2



Upfront Embodied Carbon
A1-C4 (ex B6-B7)

792 kgCO_2e/m^2





1 LETI (2023) Embodied Carbon Case Studies

Building Type
Domestic Building

Gross Internal Floor Area
100.29 m^2

Location/Region
National House Type Range

RIBA Work Stage
N/A

Electricity Use
SAP 10

Study Period
60 years

Project Description
Detached house with 2-storeys, masonry walls with brick, timber truss roof with solar PV and gas boiler.

Software
One Click LCA

Database Used
RICS

Life Cycle Stages
A1-C4

2 Vistry Homes - 3 Bed House Type

Assessment Objective

AES Sustainability Consultants Ltd. have been appointed to assess Vistry Group's National House Types based on their 2023 specification and proposed 2025 Future Homes Specification uplift to assess the embodied carbon emissions for a residential development.

Embodied Carbon Hotspots

By using IESVE and One Click LCA software, the Embodied Carbon Assessment has found that based on the provided specifications, the residual embodied carbon hot spots can be found in the substructure construction (18,838 kg CO2e) and the external wall construction (14,169 kg CO2e), with reinforced concrete, brick and blockwork, contributing to 50% of the total embodied carbon emissions.

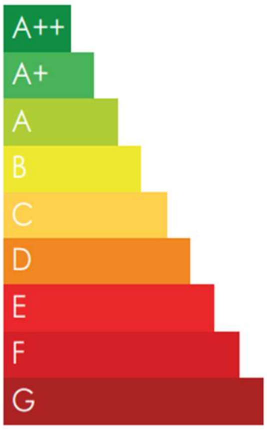
Improvements

The choice of high recycled content concrete used for the construction of the foundation and external wall construction, sourcing materials local to the project, the specification of timber construction frames.

Exclusions

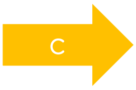
External hard landscaping and kitchen fittings, including upstands, cabinets, worktops have been excluded from the assessment. Life cycle stages B5, B6 and D are excluded.

Vistry Group
4 Bed House Type



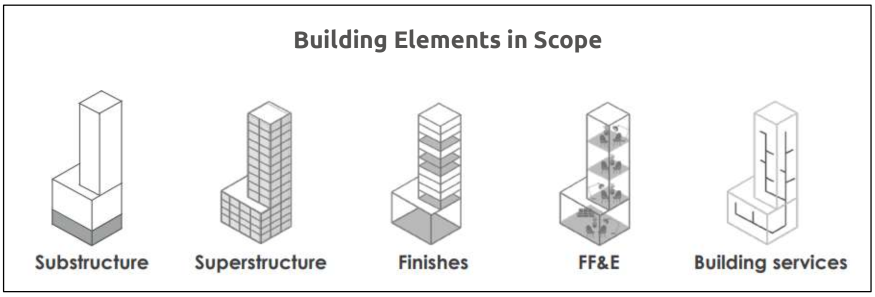
Upfront Embodied Carbon
A1-A5

505 kgCO$_2$e/m^2



Upfront Embodied Carbon
A1-C4 (ex B6-B7)

743 kgCO$_2$e/m^2



1 LETI (2023) Embodied Carbon Case Studies

Building Type
Domestic Building

Gross Internal Floor Area
127.31 m^2

Location/Region
National House Type Range

RIBA Work Stage
N/A

Electricity Use
SAP 10

Study Period
60 years

Project Description
Detached house with 2-storeys, masonry walls with brick, timber truss roof with solar PV and gas boiler.

Software
One Click LCA

Database Used
RICS

Life Cycle Stages
A1-C4

2 Vistry Homes - 4 Bed House Type

Assessment Objective

AES Sustainability Consultants Ltd. have been appointed to assess Vistry Group's National House Types based on their 2023 specification and proposed 2025 Future Homes Specification uplift to assess the embodied carbon emissions for a residential development.

Embodied Carbon Hotspots

By using IESVE and One Click LCA software, the Embodied Carbon Assessment has found that based on the provided specifications, the residual embodied carbon hot spots can be found in the substructure construction (23,920 kg CO2e) and the external wall construction (17,338 kg CO2e), with reinforced concrete, brick and blockwork, contributing to 51% of the total embodied carbon emissions.

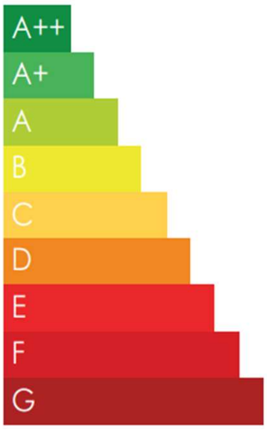
Improvements

The choice of high recycled content concrete used for the construction of the foundation and external wall construction, sourcing materials local to the project, the specification of timber construction frames.

Exclusions

External hard landscaping and kitchen fittings, including upstands, cabinets, worktops have been excluded from the assessment. Life cycle stages B5, B6 and D are excluded.

Vistry Group
5 Bed House Type

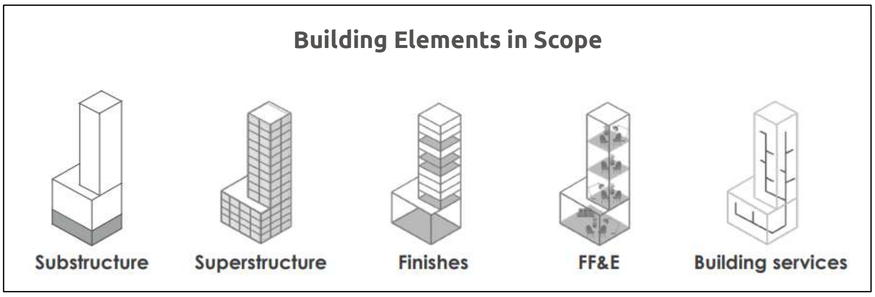


Upfront Embodied Carbon
A1-A5

440 kgCO_2e/m^2

Upfront Embodied Carbon
A1-C4 (ex B6-B7)

661 kgCO_2e/m^2



1 LETI (2023) Embodied Carbon Case Studies

Building Type
Domestic Building

Gross Internal Floor Area
225.58 m^2

Location/Region
National House Type Range

RIBA Work Stage
N/A

Electricity Use
SAP 10

Study Period
60 years

Project Description
Detached house with 2-storeys, masonry walls with brick, timber truss roof with solar PV and gas boiler.

Software
One Click LCA

Database Used
RICS

Life Cycle Stages
A1-C4

2 Vistry Homes - 5 Bed House Type

Assessment Objective

AES Sustainability Consultants Ltd. have been appointed to assess Vistry Group's National House Types based on their 2023 specification and proposed 2025 Future Homes Specification uplift to assess the embodied carbon emissions for a residential development.

Embodied Carbon Hotspots

By using IESVE and One Click LCA software, the Embodied Carbon Assessment has found that based on the provided specifications, the residual embodied carbon hot spots can be found in the substructure construction (41,106 kg CO2e) and the external wall construction (21,484 kg CO2e), with reinforced concrete, brick and blockwork, contributing to 50% of the total embodied carbon emissions.

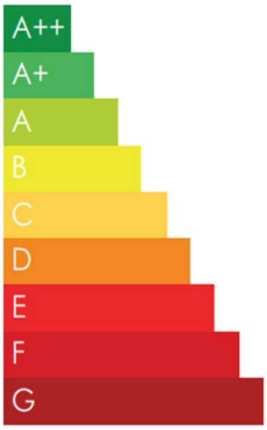
Improvements

The choice of high recycled content concrete used for the construction of the foundation and external wall construction, sourcing materials local to the project, the specification of timber construction frames.

Exclusions

External hard landscaping and kitchen fittings, including upstands, cabinets, worktops have been excluded from the assessment. Life cycle stages B5, B6 and D are excluded.

Vistry Group
Apartment Block

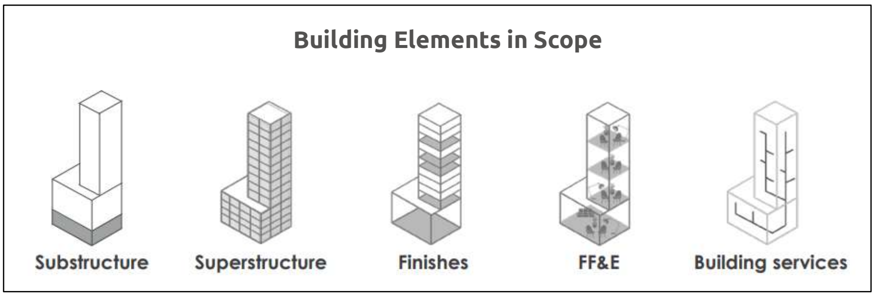


Upfront Embodied Carbon
A1-A5

536 $kgCO_2e/m^2$

Upfront Embodied Carbon
A1-C4 (ex B6-B7)

720 $kgCO_2e/m^2$



1 LETI (2023) Embodied Carbon Case Studies

Building Type
Domestic Building

Gross Internal Floor Area
225.58 m^2

Location/Region
National House Type Range

RIBA Work Stage
N/A

Electricity Use
SAP 10

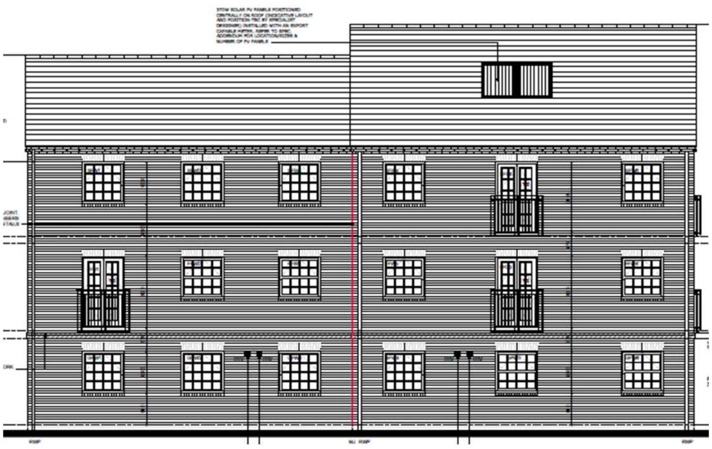
Study Period
60 years

Project Description
3 storey apartment block, masonry walls with brick, timber truss roof with solar PV and gas boiler.

Software
One Click LCA

Database Used
RICS

Life Cycle Stages
A1-C4



2 Vistry Homes – Apartment Block

Assessment Objective

AES Sustainability Consultants Ltd. have been appointed to assess Vistry Group's National House Types based on their 2023 specification and proposed 2025 Future Homes Specification uplift to assess the embodied carbon emissions for a residential development.

Embodied Carbon Hotspots

By using IESVE and One Click LCA software, the Embodied Carbon Assessment has found that based on the provided specifications, the residual embodied carbon hot spots can be found in the substructure construction (94,373 kg CO2e) and the external wall construction (93,518 kg CO2e), with reinforced concrete, brick and blockwork, contributing to 54% of the total embodied carbon emissions.

Improvements

The choice of high recycled content concrete used for the construction of the foundation and external wall construction, sourcing materials local to the project, the specification of timber construction frames.

Exclusions

External hard landscaping and kitchen fittings, including upstands, cabinets, worktops have been excluded from the assessment. Life cycle stages B5, B6 and D are excluded.