Achieving 'Net-Zero Carbon' at Salt Cross

5.27 As well as considering the resilience of the garden village to climate change, we need to consider how we can mitigate its future impact, in particular the amount of carbon emissions associated with the development including CO_2 - one of the main greenhouse gases that contribute to global warming.

5.28 Carbon cycles through our air, water, and soil in a continuous process that supports life on earth and CO_2 is naturally released into the atmosphere in a number of ways, including the exchange of carbon dioxide between the oceans and the atmosphere.

5.29 However, human activity including the use of fossil fuels (coal, natural gas and oil) releases extra carbon and other greenhouse gases into the atmosphere thereby tipping the natural balance out of sync and 'trapping' heat from escaping our atmosphere.

5.30 It is essential that we mitigate the impact of new development on climate change by addressing its 'carbon footprint'. In 2019, the UK committed to a legally binding target of net zero emissions by 2050. Reducing carbon emissions and supporting the transition to net zero, forms a central tenet of the NPPF, the Government's 25 Year Environment Plan and the Clean Growth Strategy.

5.31 Locally, it is embedded in the West Oxfordshire Local Plan and Council Plan, the Eynsham Neighbourhood Plan and the Oxfordshire Energy Strategy which sets a target of reducing countywide emissions by 50% by 2030 (compared with 2008 levels) and aims to set a pathway to achieving zero-carbon growth by 2050.

5.32 Given the significant weight of this issue, in support of the AAP, the District Council commissioned a consultant team led by Etude Elementa to clarify and assess the implications associated with meeting net-zero carbon for new buildings at the garden village.

5.33 Their report[1] (hereafter the 'net-zero carbon report') considers two main scenarios; the first a net zero carbon development scenario and second, a low carbon development scenario. adopts the industry consensus definition for zero-carbon developed by LETI[2] reproduced at Figure 5.4. Key elements include the need for **low energy use** in new buildings and a **low carbon energy supply** with no use of fossil fuels for heating and hot water and opportunities for on-site renewable electricity maximised.

[1] https://www.westoxon.gov.uk/media/hdnjcnnf/trajectory-for-net-zero-buildings-for-the-oxfordshire-garden-village.pdf Policy 2 Net Zero Carbon Development Evidence Base (March 2025)
[2] https://www.leti.london/

~~**Figure 5.4 – Definition of Net Zero Operational Carbon**~~

5.34 ~~The~~ Under the net zero carbon development scenario, all development at Salt Cross would be required to achieve net zero operational carbon on-site through the use of high-performance building fabric, efficient heating and hot water systems and on-site renewable energy generation. This scenario is based on the use of defined energy use intensity (EUI) targets and space heating demand indicators with predictive energy modelling required to demonstrate compliance. ~~net-zero carbon report considers four carbon scenarios including:~~

1. ~~Building Regulations compliance (current).~~
2. ~~A minimum 35% on-site reduction in CO2 emissions over Building Regulations compliance (current) with carbon offset.~~
3. ~~75-80% carbon emission reductions with fossil fuel free heating and hot water in line with Government's early proposals for a Future Homes Standard.~~
4. ~~Net-zero buildings.~~

5.35 ~~For each scenario, the report considers building fabric and specification, potential decentralised, heat network solutions, low- and zero-carbon energy technologies, viability and predicted annual running cost of energy to occupants.~~ Under the second, low-carbon scenario, all buildings would be required to achieve at least a 100% carbon reduction improvement of their respective Target Emission Rate (TER).

5.36 ~~Modelling was undertaken for a range of different development typologies using 12 different cases with varying fabric performance and systems. Predicted modelling was used to understand how these cases were then likely to perform in-operation, supported by an assessment of both capital cost and running costs to future occupants.~~ The aim of this scenario would be to reduce the carbon emissions attributed to regulated energy uses in all buildings to zero, achieved through a combination of high-performance building fabric, efficient heating and hot water systems and on-site renewable energy generation. Policy compliance would be demonstrated through the use of Part L modelling – SAP for domestic buildings and the National Calculation Methodology – NCM for non-domestic buildings.

5.37 The report demonstrates that both scenarios are technically feasible and have a relatively modest impact on costs (+6.1% for the zero carbon scenario and +7% for the low carbon scenario.) Importantly however, it demonstrates that the zero carbon scenario has a number of advantages, not least the fact that it takes account of unregulated energy use (i.e. the energy consumed by a building resulting from fixtures or appliances) which can account for 50% of energy in low-energy dwellings. ~~concludes that scenario 4 – zero carbon be pursued as this is the only scenario that achieves the level of energy efficiency and low- and zero-carbon energy generation required to meet climate change targets. It is also the only scenario that aligns with the aspirations of the Council and local communities. If any other scenario is chosen, the report estimates that buildings within the development would need to undergo energy retrofit before 2050 at a cost of up to £80 million.~~

~~**Figure 5.5 – Comparison of Scenarios 1 - 4**~~

5.38 In addition to the net-zero carbon report, a separate Energy Plan[3] for the Garden Village has been prepared by Oxfordshire County Council, in collaboration with EDF Energy R&D UK and the Energy & Power Group (University of Oxford) on behalf of the District Council. Oxfordshire County Council, EDF Energy R&D and the University of Oxford are partners within Project LEO (Local Energy Oxfordshire), one of four national Smart Energy Demonstrator projects funded through the Government's Industrial Strategy Challenge Fund (ISCF) Prospering from the Energy Revolution.

5.39 Project LEO aims to lay the foundations to scale up low carbon generation across Oxfordshire by creating a local energy system which develops opportunities to better match local energy supply to local demand (through increased storage or shifting energy demand) and to make better use of the energy generated to free up capacity within the existing infrastructure to support electrification of transport and heat.

5.40 Project LEO includes a number of 'plug in projects' which will provide real world pilots across Oxfordshire to trial a range of flexibility and energy services relating to electrical power, transport and heat. Project LEO has identified the new Park and Ride site at the Garden Village - with its planned solar generation and smart electric vehicle charging infrastructure – as a potential plug in project.

5.41 The Energy Plan emphasises the importance of achieving net-zero carbon in operation and establishes a number of key principles which align with the Council's net-zero carbon report including:

- Minimising the operational energy demand of new buildings
- Fit for the future - no fossil fuels burnt on site for heat or power
- Maximising the use of on-site renewable generation
- Energy positive – looking at opportunities to extend local renewables to generate more energy on or close to the site than required in the Garden Village
- Long-term stewardship - monitoring and management plans to be put into place to measure success

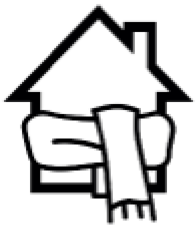
[3] https://www.westoxon.gov.uk/media/ekpcnzzl/oxfordshire-cotswold-garden-village-energy-plan.pdf

5.42 It also establishes the following vision:

> The Garden Village is an exemplar net zero carbon, energy positive development which meets the challenges of climate change head on.
>
> Successful collaboration between key stakeholders (including local community groups, Local Authorities, Developers) guides the development throughout planning, construction and lifetime of the site.
>
> Sustainable construction reduces embodied carbon throughout the Village, whilst best practice and use of innovative technologies minimise the energy needed to heat and power homes and businesses.
>
> Local renewable generation and smart energy management solutions meet the remaining energy demand and catalyse carbon reductions across the wider Eynsham area whilst contributing to the national decarbonisation and climate change response.

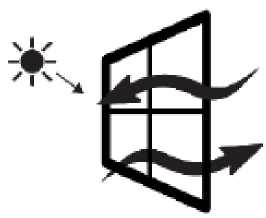
Low Energy Use

5.43 The associated uplift in capital cost to achieve net-zero carbon development is estimated at 6.1% on top of the costs of a baseline home. ~~5-7% above current Approved Document Part L (ADL) 2013 Building Regulations~~. The relative uplift in capital cost~~, over and above the current national benchmark,~~ will reduce significantly over time. ~~the closer we move to the proposed date for a Future Homes Standard (originally proposed by Government from 2025). The difference in capital cost between scenarios 3 and 4 is only marginal: a margin that is predicted to further reduce over time as green technologies evolve and design solutions become more commonplace in response to an increase in demand for higher standards.~~



5.44 The report concludes that in order to achieve net-zero carbon at Salt Cross, the energy use associated with the buildings must first be reduced as far as possible. ‘Ultra-low energy’ building fabric, designed to standards comparable to those achieved through Passivhaus, is recommended, with a view to ensuring that space heating demand for both residential and non-residential developments is less than 15 – 20 kWh/m^2.yr.

5.45 With improved building-fabric performance, comes the need to ensure appropriate levels of thermal comfort in order to avoid the risk of overheating. At the outline planning stage, broader overheating considerations will need to be addressed such as orientation, massing, passive-design considerations. At the detailed planning stage, overheating modelling will be required to demonstrate compliance with Part O of the Building Regulations for residential uses and CIBSE TM52 for non-residential uses. ~~in line with Chartered Institution of Building Services Engineers (CIBSE) guidance to demonstrate that buildings are~~



~~not at risk of overheating and are compliant with established standards including TM59 for residential and TM52 for non-residential.~~

5.46 In addition to the space heating standard outlined above, the net-zero carbon report ~~provides~~ identifies a number of Energy Use Intensity (EUI) targets – essentially a budget for how much energy different types of building are allowed to use annually, measured on a kWh/m^2.yr basis. The recommended EUI targets for Salt Cross are as follows:

- Residential: <35 kWh/m^2.yr
- Office: <70 kWh/m^2.yr
- Schools: <65 kWh/m^2.yr

5.47 ~~The recommended EUI targets for Salt Cross are shown in Figure 5.6.~~ The report identifies that for other uses (e.g. research and development and retail) it is very challenging to predict energy use and as such, suggests that energy targets for such uses should be developed and agreed as part of any pre-application discussions with the Council. This is reflected in Policy 2.

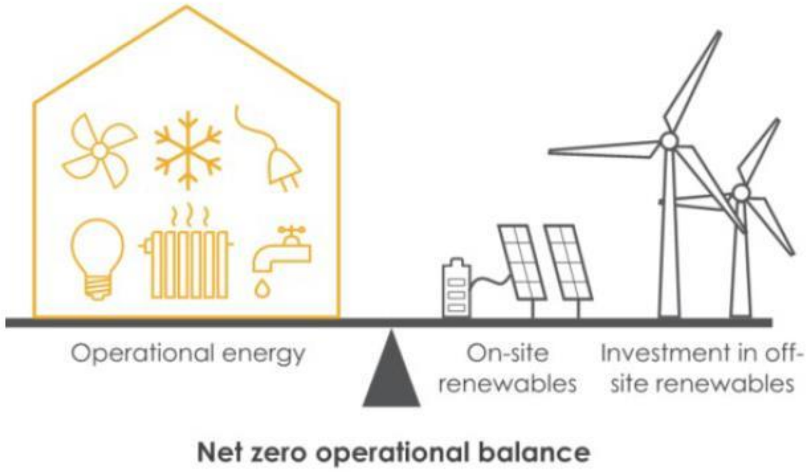
~~**Figure 5.6 – Recommended EUI Targets**~~

Low and Zero-Carbon Energy Supply

5.48 In addition to the energy use and efficiency of new buildings, the net-zero carbon report considers the other side of the net-zero equation – the use of renewable energy in preference to the traditional use of fossil fuels.

5.49 In simple terms, to meet net operational zero carbon, the amount of energy required on-site should be balanced by installing on-site renewables to supply the equivalent amount of energy across the course of a year.

Figure 5.4~~7~~ – Net Zero Operational Balance



5.50 The net-zero carbon report identifies the need for each building at Salt Cross to generate as much renewable energy as possible, the aim being to achieve a balance between predicted annual energy use and annual renewable energy generation. If this can't be achieved, then it must be achieved elsewhere on the site. ~~considers the potential for on-site renewable energy and concludes that photovoltaic (PV) panels that generate electricity are likely to be the most appropriate form of renewable energy generation at Salt Cross and that between 70%-100% of the electricity demand at Salt Cross can be generated on the roofs of the buildings, depending on orientation and massing. If not all PV panels can be accommodated on roofs, the remainder of the energy required will need to be supplied via other means, such as PV installed on empty fields or on top of car parking canopies.~~

5.51 The report concludes that no buildings at Salt Cross should connect to the gas network, or more generally use fossil fuels on-site and must use low carbon heating systems (e.g. heat pumps). ~~fossil fuels, such as oil and natural gas, should not be used to provide space heating, hot water or used for cooking in both residential and non-residential developments. A development cannot be zero carbon without eliminating the use of fossil fuels.~~

5.52 ~~It also concludes that 100% of the energy consumption required by buildings on-site can be generated using on-site renewables, for example through solar PV.~~ This ~~conclusion~~ is supported by the Garden Village Energy Plan with energy modelling undertaken by the Energy & Power Group (University of Oxford) and EDF Energy R&D UK demonstrating that with roof top solar PV alone, sufficient capacity could be installed to meet the modelled energy demand for the development.

Embodied carbon

5.53 Embodied carbon is the CO_2 emitted in producing raw materials and products including, for example, building materials and products associated with mechanical and electrical engineering. As the *operational* carbon of a building reduces, so the *embodied* carbon becomes a greater portion of the overall emissions. It is therefore important to measure and reduce embodied carbon where possible.

5.54 The net-zero carbon report highlights the importance of reducing embodied carbon and suggests that development proposals should demonstrate attempts to reduce embodied carbon to meet the upfront carbon limits in the UK Net Zero Carbon Buildings Standard, with calculations to be carried out at the outline and detailed planning stages supported by full lifecycle modelling. ~~recommends that embodied carbon calculations are carried in support of any outline and detailed planning submissions, reconfirmed pre-commencement and validated pre-occupation. The report identifies a specific target for upfront embodied carbon emissions for residential and non-residential buildings of < 500 kg CO2/m^2.~~

Measurement and verification

5.55 It is important that buildings designed to be net-zero operational carbon also perform to this standard when complete. This is to minimise the risk of a performance gap, when the as-built design does not perform to the standards of the original, designed performance submitted at planning stage. The net-zero carbon report recommends post-occupancy energy monitoring carried out every year for the first five years of use of each building to verify the energy consumption of the development in-use.

Policy 2 – Net-Zero Carbon Development

~~Proposals for development at Salt Cross will be required to demonstrate~~ All development at Salt Cross must achieve net zero operational carbon on-site through ultra-low energy fabric ~~specification~~, low carbon technologies and on-site renewable energy generation. ~~An energy strategy will be required with outline and detailed planning submissions, reconfirmed pre-commencement, validated pre-occupation and monitored post-completion demonstrating alignment with this policy.~~

Building Fabric

~~Proposals will need to use ultra-low energy fabric to achieve the KPI for~~ Buildings must meet a space heating demand of <15 – 20 kWh/m2.yr through ultra-low energy fabric, verified via predictive energy modelling at the detailed planning stage and monitored post-completion. ~~, demonstrated through predicted energy modelling. This should be carried out as part of any detailed planning submission, reconfirmed pre-commencement, validated pre-occupation and monitored post-completion.~~

Overheating

Thermal comfort must be considered from ~~and the risk of overheating should be given full consideration in~~ the earliest ~~stages of~~ design stages, prioritising passive cooling over mechanical systems. ~~to ensure passive-design measures are prioritised over the use of more energy-intensive alternatives such as mechanical cooling.~~ At the outline planning stage, mitigation should focus on orientation and massing. At the detailed planning stage, compliance with Part O of the Building Regulations (residential) and CIBSE TM52 (non-residential) must be demonstrated. ~~overheating should be mitigated through appropriate orientation and massing and at the detailed planning stage, a modelling sample proportionate to development density will be required to demonstrate full compliance with CIBSE TM59 for residential and TM52 for non-residential development, addressing overheating in units considered at highest-risk. Overheating calculations should be carried out as part of the detailed planning submission and reconfirmed pre-commencement.~~

Energy Efficiency

~~Energy budgets (EUI targets) must be demonstrated using predicted energy modelling. The following KPI targets will apply:~~

All buildings should achieve the following sector specific energy use intensity (EUI) targets:

- Residential <35 kwh/m2.yr
- Office <70 ~~55~~ kwh/m2.yr
- ~~Research labs <55-240 kwh/m2.yr*~~
- ~~Retail <80 kwh/m2.yr~~
- ~~Community space (e.g. health care) <100 kwh/m2.yr~~
- ~~Sports and Leisure <80 kwh/m2.yr~~
- Schools <65 kwh/m2.yr

EUI targets for other uses (e.g. research labs, retail, community space, sports and leisure) will need to be discussed and agreed with the Council as part of any pre-application discussions, drawing on relevant sources including the Net Zero Carbon Buildings Standard.

A validated predictive energy modelling approach (e.g., PHPP, CIBSE TM54) must be agreed with the District Council and applied consistently across building types.

~~To ensure best practice, an accurate method of predictive energy modelling, agreed in consultation with the District Council, will be required for a cross-section of building typologies (e.g. using Passive House Planning Package - PHPP or CIBSE TM45 or equivalent). This modelling should be carried out with the intention of meeting the target EUIs as part of the detailed planning submission, be reconfirmed pre-commencement, validated pre-occupation and monitored post-completion.~~

Fossil Fuels

The development ~~will be expected to~~ must be fossil-fuel free. No oil or natural gas should be used for space heating, hot water, or cooking. ~~Fossil fuels, such as oil and natural gas should not be used to provide space heating, hot water or used for cooking.~~

Zero Operational Carbon Balance

100% of the development's energy demand must be met through on-site renewable energy, such as solar PV. Where it can be shown that this is not technically feasible, it should be maximised on plot. ~~energy consumption required by buildings on-site should be generated using on-site renewables, for example through Solar PV. The quantum of proposed renewable energy for the whole site (outline planning) and each phase (detailed planning) should be shown in kWh/yr. The amount of renewable energy should equal or exceed the total energy demand for the development in order to achieve net zero operational carbon as a whole.~~

~~The energy strategy should state the total kWh/yr of energy consumption of the buildings on the site and the total kWh/yr of energy generation by renewables to show that the zero-carbon operational balance is met. An explanation should be given as to how these figures have been calculated.~~

~~Renewable energy contribution calculations should be carried out as part of the outline and detailed planning submissions, be reconfirmed pre-commencement, validated pre-occupation and monitored post-completion.~~

~~A detailed low- and zero-carbon viability assessment should be carried out in support of the energy strategy detailing the selection of on-site low- and zero-carbon energy technologies.~~

Embodied carbon

Development proposals will need to demonstrate attempts to reduce embodied carbon to meet the upfront carbon limits of the UK Net Zero Carbon Buildings Standard (Building Life Cycle Stages A1 – A5), including substructure, superstructure, MEP, façade and internal finishes and excluding on-site renewables. ~~following KPI:~~

Embodied carbon calculations should be carried out as part of the outline and detailed planning submission with full lifecycle modelling encouraged.

~~< 500 kg CO_2/m^2 Upfront embodied carbon emissions (Building Life Cycle Stages A1-A5). Includes Substructure, Superstructure, MEP, Facade & Internal Finishes.~~

~~As part of the submission of any planning application, a report should be prepared which demonstrates the calculation of the expected upfront embodied carbon of buildings. Full lifecycle modelling is encouraged.~~

~~Embodied carbon calculations should be carried out as part of the outline and detailed planning submission, be reconfirmed pre-commencement, and validated pre-occupation.~~

~~*Measurement and verification*~~ *Energy Strategy, Monitoring and Verification*

An energy strategy must be submitted at the outline and detailed planning stages, reconfirmed pre-commencement and validated pre-occupation. It should demonstrate compliance with net-zero carbon objectives, detailing energy consumption and renewable energy generation.

The energy strategy must specify:

- Total energy demand (kWh/yr)

- Total renewable energy generation (kWh/yr)

- Calculation methodology

The Energy Strategy must include metering, monitoring and reporting arrangements with post-occupancy energy monitoring expected to occur annually for five years and results to be centrally stored and shared among developers, designers and contractors.

~~**Applicants should confirm the metering, monitoring and reporting strategy as part of the detailed planning application. Post-occupancy energy monitoring should be carried out every year for the first five years of use of each building to understand the energy consumption of the development in-use. The results should be stored centrally and shared between developers, design teams and contractors on-site.**~~