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OXFORD CITY COUNCIL

Carbon reduction and net zero carbon development

Oxford Local Plan 2040

BACKGROUND PAPER 10

This topic addresses carbon reduction in new development and how the Local Plan will support the city's transition to net zero carbon.
SA Objective(s): *1. To achieve the city's ambition to reach net zero carbon emissions by 2040*
SEA theme(s): *Climatic Factors, Air*

1. Introduction

1.1 The Council has a legal duty[1] to ensure that the new Local Plan includes policies that, taken as a whole, have been designed to secure action on climate change. This is reflected in national policy, which sets out that the planning system should help to: 'shape places in ways that contribute to radical reductions in greenhouse gas emissions', and that Local Plans should take a proactive approach to mitigating climate change. In recognition of the need to take action on climate change, the Council declared a climate emergency in 2019 and has committed to achieving net zero carbon emissions as a city by 2040[2].

1.2 Alongside the transport network, the built environment is a primary contributor to Oxford's carbon dioxide emissions, a potent greenhouse gas which is causing global climate change. The power used to heat and operate buildings as well as the resources used within the construction process all have a role in these emissions. In order to meet national and local commitments on mitigating climate change, it is essential that new development being built in the city is designed for a net zero carbon future, and that existing development is retrofitted to reduce its carbon footprint. This paper sets out the background context and analysis which has principally informed the formulation of the following policies in the new Local Plan:

- Policy R1: Net Zero Buildings in operation
- Policy R2: Embodied carbon in the construction process
- Policy R3: Retrofitting existing buildings

1.3 The paper firstly sets out key context in the form of existing policy analysis, current situation in the city and the likely situation without a new Local Plan. It then goes on to discuss the key topics that have informed the policy approaches, making reference to other key documents where applicable.

2. Policy Framework

Local authorities' plan-making has been subject to varying levels of uncertainty in recent years as to the ambition that can be set in local policies (e.g. the extent to which local policies can go beyond national standards such as the former Code for Sustainable Homes in

[1] As set out in Section 19(1A) of the Planning and Compulsory Purchase Act 2004
[2] https://www.oxford.gov.uk/news/article/1781/council_sets_out_action_plan_to_bring_about_a_zero_carbon_oxford_by_2040_or_earlier

setting energy efficiency standards). This has been due to a variety of factors such as inconsistency with national policy statements and consultation proposals coming from central government (e.g. the 2015 ministerial statement, proposals connected with Building Regulations/Future Homes Standard updates); and inconsistent application of national policy in planning inspectorate decisions (e.g. Salt Cross Area Action Plan decision). We flag below the key legislative/policy factors which clearly support the Oxford Local Plan setting the strong net zero carbon policies that it includes, as well as more general context of relevance to these policies.

Climate Change Act 2008 (as amended)
This is a set of statutory targets for reducing national carbon dioxide levels below 1990 levels at intervals up to 2050. The targets set out in the Act have been amended since to reflect updated goals for climate mitigation, such as in response to the Paris Agreement, most recently setting out a target of net zero emissions by the year 2050. A further amendment to achieve a 78% reduction in carbon emissions by 2035 was subsequently set into law.

Planning and Compulsory Purchase Act 2004
Sets out the current structure for the English Local Planning framework and includes, within section 19 (as amended by the Planning Act 2008), the legal duty to ensure that, taken as a whole, planning policies contribute to climate change mitigation and adaptation.

Planning and Energy Act 2008
The Planning and Energy Act (2008) makes provision within Section 1 for a local planning authority to include policies within its development plan that require development in their area to comply with energy efficiency standards that exceed the energy requirements of building regulations, provided these policies are reasonable, not inconsistent with national policies, and compliant with usual provisions around plan making as set out in section 19 of the Planning and Compulsory Purchase Act 2004.

National Planning Policy Framework (NPPF) (revised 2023)
Paragraphs 152 to 158 of the NPPF set out the Government's approach to planning and climate change. In particular, paragraph 152 sets out the approach for the planning system as a whole. It states that *the planning system should support the transition to a low carbon future in a changing climate*, and *shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.*

Meanwhile, para 153 sets out that *plans should take a proactive approach to mitigating and adapting to climate change,* with footnote 53 clarifying that this should be in line with the *objectives and provisions of the Climate Change Act 2008,* which legislates for net zero carbon emissions by 2050 (and an 80% reduction by 2035).

National Planning Practice Guidance (PPG) including National Design Guide/National Model Design Code

National guidance supporting planning policy is set out for the topic of climate change on the Planning Practice Guidance webpage here, although much of the guidance now dates back to 2019 or earlier (with some sections dating to 2015). Whilst some of the guidance, including key legislation planners should take into account and general advice on climate change mitigation measures that could be applied through planning process are still of relevance, other sections appear to have been overtaken by recent policy developments (such as guidance around the 2015 Ministerial Statement as discussed below).

The National Design Guide (2019) which now forms part of the PPG includes guidance on what government considers to be 'good design' and breaks design down into 10 key topics. There is a section on "Resources" which sets out that "well-designed places and buildings follow the energy hierarchy" as well as containing some other general design guidance which can help local authorities with preparing more locally specific design guidelines.

2015 Ministerial statement on plan-making

In 2015 the Government introduced new national optional technical housing standards, intended to streamline and simplify the various standards for housing developments, replacing the Code for Sustainable Homes and other guidance. This set out the expectation that local authorities should not set energy efficiency standards with requirements above the equivalent to level 4 equivalent within withdrawn Code for Sustainable Homes[3].

Central government subsequently confirmed (as part of response Future Homes Standard consultation) that LAs could indeed still go beyond Building Regulations in line with the provisions of the Planning and Energy Act. More recently, the Inspector's report on the Cornwall development Plan Document examination (2021) set out their interpretation that the ministerial statement no longer has practical value in light of the update to Building Regulations during that same year, which has already superseded the old Code for Sustainable Homes standard.

Oxford Local Plan 2036

Policy RE1: Sustainable design and construction – Set out the Council's expectations regarding carbon emissions in new development. The policy requires new development to achieve reductions in carbon emitted beyond those set out in national Building Regulations. The targets are increased at intervals throughout the plan period, beginning at 40% reduction, before moving to 50% by 31 March 2026, and then zero carbon after 2030 (for residential development).

There are a variety of other policies in the adopted Local Plan that have a role in contributing to reductions in carbon emissions in the city. Such policies include those that encourage and enable sustainable/active travel and the transition to electric vehicles (policies M1 to M5), as well as policies relating to protecting and enhancing Oxford's green and blue infrastructure network (policies G1 to G8). The topics of green infrastructure and transport are addressed in depth in accompanying topic papers alongside this consultation.

[3] More detail can be found in Paragraph: 012 Reference ID: 6-012-20190315 of the PPG: https://www.gov.uk/guidance/climate-change

Other relevant plans and programmes/strategies

Zero Carbon Oxford Partnership Roadmap

In January 2019, Oxford City Council members unanimously declared a climate emergency and agreed to create a citizens assembly in Oxford to help consider new carbon targets and additional measures to reduce emissions. This was followed in February 2021, by signing the Zero Carbon Oxford Charter, and the creation of a new Zero Carbon Oxford Partnership (ZCOP) for the city along with the setting of a local target of achieving net zero carbon emissions as a city by 2040 (ten years ahead of the UK net zero carbon target).

The ZCOP have developed a Roadmap and Action Plan (published 2021[4]) for the city which identifies the primary sources of carbon emissions in city at present and the key milestones that are needed in relation to decarbonising different aspects of life in Oxford in order to meet the net zero target of 2040. The roadmap highlights the large-scale changes and the challenging nature of the transition to full decarbonisation which is needed across various sectors, such as expansive retro-fit of existing buildings to decarbonise heating and increase fabric efficiencies, large amount of micro-renewable installation on rooftops to increase clean energy generation as well as ongoing increases in EV charging infrastructure to support decarbonisation of transport.

Future Homes/Buildings Standard – Building Regulations reforms

Outside of the planning system, a review of national Building Regulations has also been ongoing with staged plans from government to implement the Future Homes Standard (dealing with residential development) and Future Buildings Standards (non-residential development). These reforms to the technical requirements within Building Regulations are intended to ensure that the development of new buildings is net zero ready through higher standards of energy efficiency and carbon reduction across all new buildings. The first stage of these reforms came into effect in 2022 and was presented as an interim uplift to Building Regulations that would result in homes producing 31% less CO2 emissions compared to current standards. It also included updates to other technical standards such as on ventilation, the performance gap, overheating and EV charging.

The outcome of the consultation on the full Future Homes Standard was published at the start of 2021 and sets out the government's proposed approach towards implementation in 2025. These further changes will result in new homes producing at least 75% lower CO2 emissions than those built to previous Building Regulations standards, as well as being 'zero carbon ready' – whereby even if they are still emitting some emissions, these should reduce to zero over time (e.g. with the continued decarbonising of the energy supply sourced from the national grid as fossil fuels are phased out of the system). As is discussed further in section 4, the reforms only affect the performance standards of buildings that are addressed by Building Control (e.g. regulated energy systems), which leaves some uncertainty as to their contribution to full net zero development.

Recently examination decisions on other Local Plans

[4] Full Roadmap and Action Plan available here: https://www.oxford.gov.uk/downloads/download/1241/zero_carbon_oxford_partnership_roadmap_and_action_plan

A number of case studies are emerging (and continue to grow) of Local Authorities successfully including net zero carbon policies of a similar nature to those being proposed in the Oxford Local Plan 2040. These energy efficiency/carbon reduction policies go beyond national standards set out within Building Regulations or the old Code for Sustainable Homes. Recently adopted local Plans/development plan documents of relevance include:

- Cornwall **Climate Emergency Development Plan Document**[5] (Adopted 21 February 2023)
- Bath and North East Somerset (BANES) **Local Plan Partial Update**[6] (Adopted 19 January 2023)
- Central Lincolnshire **Local Plan**[7] (Adopted 13 April 2023)

3. Current situation

Primary sources of greenhouse gas emissions in the city

3.1 Analysis of the greenhouse gas emissions that are generated for the entire city is challenging and estimates can vary based upon methodology and data sources used. The Department for Energy Security and Net Zero (formerly BEIS) publish statistics on per capita emissions yearly and these show an overall trend of reducing per capita emissions for Oxford since 2005 as can be seen in Figure 1.

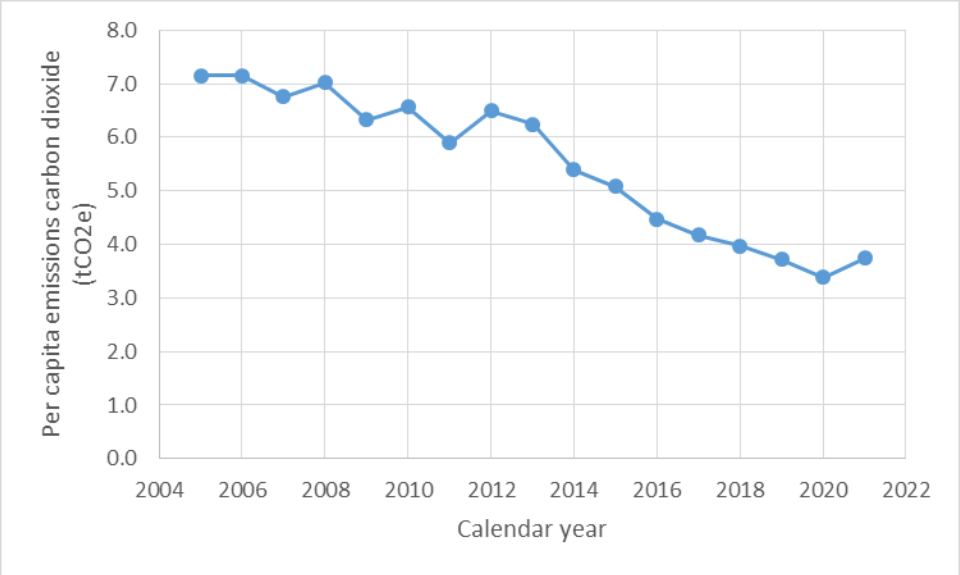

Figure 1: Per capita emissions of carbon dioxide (tCO2 equivalent) for Oxford according to Local Authority Greenhouse Gas Emissions statistics (2005-2021)[8]

3.2 The statistical release highlights that this national pattern has been due to reductions in emissions from power stations and industrial combustion. The reduction from

[5] Available here: https://www.cornwall.gov.uk/planning-and-building-control/planning-policy/adopted-plans/climate-emergency-development-plan-document/
[6] Available here: https://beta.bathnes.gov.uk/local-plan-partial-update-lppu-public-examination
[7] Available here: https://www.n-kesteven.gov.uk/central-lincolnshire
[8] https://www.gov.uk/government/statistics/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics-2005-to-2021 - updated statistics published July 2023

power stations is driven by change in the fuel mix used for electricity generation with a large reduction in the amount of coal, which is a carbon intensive fuel, and increasing use of renewables. There was a small increase in emissions noted in 2021 for the majority of Local Authorities (358 of 374) including Oxford, which the Department for Energy Security and Net Zero note is consistent with the increase in overall UK emissions of 5% largely due to COVID-19 restrictions easing and colder temperatures in that year increasing the use of heating in buildings.

3.3 The Zero Carbon Oxford Partnership's Roadmap and Action Plan[9] identified the key sources of emissions in Oxford as part of its work in defining a roadmap to net zero by 2040. This was an assessment of all greenhouse gas emissions across the city (not just carbon, as is highlighted in the BEIS figures above) and drew upon data from both BEIS and from the SCATTER cities tool as well as local sources, to produce a sector-by-sector breakdown of emissions in the city. Whilst the baseline data informing the analysis is now a few years old (2018 was the baseline year), the sector-by-sector profile as shown in Figure 2 helps to clearly highlight the major impact of the built environment on emissions, with buildings being the primary source of emissions resulting from the city. Transport was the second largest contributor though this is a much smaller proportion of emissions as a whole.

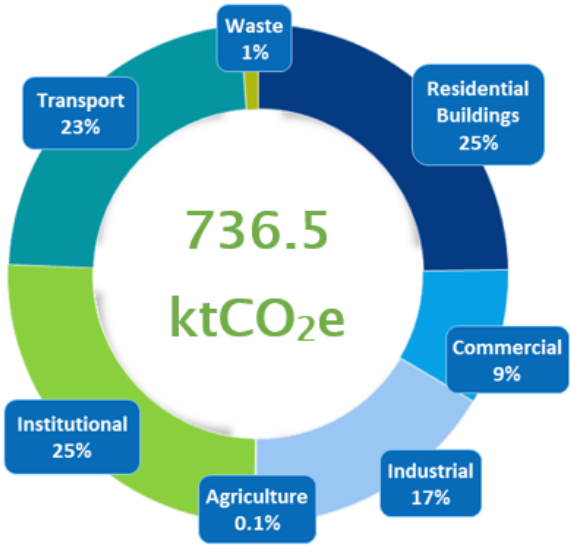

Figure 2: Sector-by-sector greenhouse gas emissions in Oxford (2018 baseline year as used in the Zero Carbon Oxford Partnership Action Plan)

3.4 As the ZCOP work notes, the primary reason for the major contribution buildings are making to Oxford's carbon footprint is through the use of fossil fuels for heating. However, emissions are attributed to other sources within buildings such as gas used for cooking, as well as emissions associated with electricity use (where this is not sourced from renewables). The majority of these emissions are coming from buildings that are already in existence. This flags a significant need for retro-fitting to happen alongside ensuring that new development does not exacerbate the problem.

[9] Full Roadmap and Action Plan available here: https://www.oxford.gov.uk/downloads/download/1241/zero_carbon_oxford_partnership_roadmap_and_action_plan

Increasing use of electric solutions and grid capacity

3.5 Across the UK, there are national trends in new sustainable technologies which are of increasing popularity and that also form important context to the new Local Plan's policies. The uptake in electric vehicles is growing notably, leading to increased demand for EV charging infrastructure. Equally, we are seeing increasing uptake in electric solutions for heating our properties instead of fossil fuel burning boilers, such as Air Source Heat Pumps. The uptake in these technologies is likely to continue and most likely speed up and will result in increasing demands for electricity and increased pressure on the national and local energy grid infrastructure.

3.6 Oxfordshire Energy Strategy (2018) and associated delivery plan (2019)[10], supported by the Stage 1 work of the Oxfordshire Infrastructure Strategy (OXIS)[11], identifies that the electricity grid across the county, like many parts of the country is already constrained. The OXIS work concluded that annual electricity consumption across the county to 2040 is expected to increase due to three reasons: continued increase in the number of domestic and non-domestic buildings; the transition to electric vehicles; and the decarbonisation of heat. These factors will not only increase annual consumption but will also increase peak demand.

3.7 The Oxfordshire Energy Strategy has an objective of reducing countywide emissions by 50% by 2030 from a 2008 baseline and states that by 2030, 56% of total electricity demand (and 40% of heat) would need to be met from low carbon sources, the majority of this being solar energy. The OXIS stage 1 work reported that in terms of grid constraints, the Distribution Network Operators across county are trying to introduce network flexibility services, to avoid or reduce some of the costly reinforcement work normally required and allow additional generation capacity to be connected to the grid, though concluded that significant reinforcement and upgrades will continue to be required to meet expected electricity demand and renewables targets. Aside from the grid upgrades required, OXIS flagged that an additional method to alleviate some of the future burden on the distribution networks is introducing much more onsite and local energy generation and storage (e.g. roof top P.V. on domestic and non-buildings). This is supported by the Oxfordshire Energy Strategy which suggests the county needs to plan for a 'six-fold' increase in solar capacity.

Fuel poverty

3.8 The Oxfordshire Joint Strategic Needs Assessment[12] identifies that Oxford City is significantly worse than the Oxfordshire regional average on fuel poverty[13] whilst other

[10] Published by the Oxfordshire Local Enterprise Partnership, more info: https://www.oxfordshirelep.com/energystrategy

[11] https://futureoxfordshirepartnership.org/project_categories/oxfordshire-infrastructure-strategy-oxis-2/

[12] Available here: https://insight.oxfordshire.gov.uk/cms/joint-strategic-needs-assessment

[13] The Oxfordshire JSNA defines fuel poverty as the following: A household is considered to be fuel poor if: (a) they have a fuel poverty energy efficiency rating (FPEER) of band D or below; and (b) if

Oxfordshire districts are each significantly better than average (Figure 3). Three factors affect fuel poverty: household income, fuel prices and household energy consumption. Buildings that demand a lot of energy to heat and run, combined with high energy prices (e.g. as has been seen subsequent to global instability in face of crisis like war in Ukraine and covid recovery), and pressures on household incomes can serve individually and cumulatively to exacerbate fuel poverty.

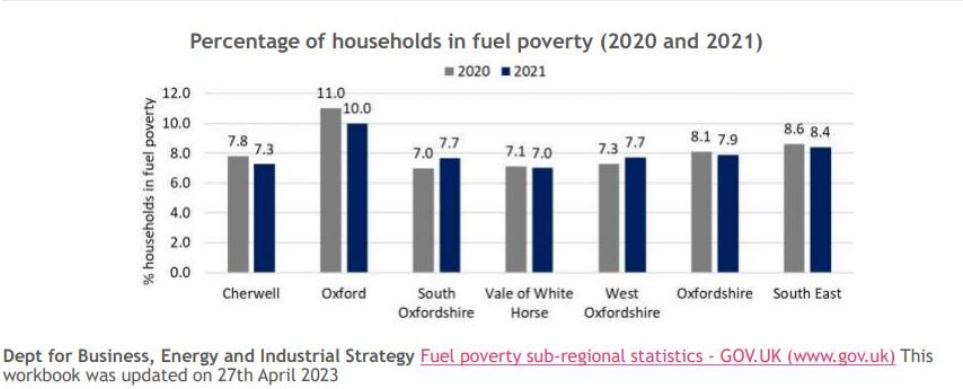

Figure 3: Percentage of households in fuel poverty across Oxfordshire in 2020 and 2021 (source: Joint Strategic Needs Assessment 2023)

3.9 Looking beyond Oxford, there is continuing national progress on net zero carbon targets such as decarbonising the energy grid, for which Government has a target of a net zero grid by 2035, however attaining this future target it seems reasonable to hold this target with some caution. Recent assessments (e.g. National Audit Office, 2023) highlight that the current pace and lack of investment puts the 2035 decarbonisation of grid in doubt. The Climate Change Committee' most recent update report on UK's progress with decarbonisation flags multiple uncertainties based on lack of strategy and direction which puts meeting existing targets for net zero in question[14]. The government has recently announced changes to various other targets likely to affect UK's progress on carbon reduction, such as petrol/diesel engine ban (from 2030 to 2035), delays to gas boiler ban from (2025 to 2035). Whilst these policy changes not only represent delays to ambitions across various sectors of society, they also represent additional points of uncertainty for businesses and people and makes planning for a net zero carbon future more challenging.

Feedback from previous consultations

3.9 Feedback from the 2021 Issues consultation was varied reflecting the broad scope of the issues consultation:

> **Historic England:** flagged that it needs to be recognised that historic buildings are likely to require different retro-fitting strategies and approaches than modern buildings.

they were to spend their modelled energy costs, they would be left with a residual income below the official poverty line.

[14] https://www.theccc.org.uk/publication/2023-progress-report-to-parliament/#key-messages

County Council: wished for more reference to the 'circular economy' and that Oxford needs to decide what the definition of net zero carbon looks like for the city. They also flagged that the issue of embodied carbon needs further consideration, and that methods to reduce it should be championed by the Plan.

A wide variety of other comments covering a broad range of issues and concerns including:

- Need to determine what zero carbon means for oxford (definition)
- Concern about balance between growth ambitions and climate consequences
- Need to consider embodied energy/carbon
- Need to address waste streams and encourage more recycling
- Need to consider adaptation measures including nature-based solutions
- Need to plan seriously for energy, local energy generation, EVs, renewables.
- Sensitive retrofit of heritage buildings (different strategy to modern)
- Policies need to be flexible to accommodate changing technologies

3.10 Feedback from the 2022 Preferred Options consultation again was quite varied and is summarised in detail in the consultation summary, however some key feedback included the following:

Historic England

- Support ambitious approach to addressing climate change must emphasise a need for clarity on conversions/extensions. Also support embedding energy hierarchy principles where these are alongside suitable retrofit policy. Feel requirements around renewables needs more explicit articulation e.g. regarding solar.
- Welcome embodied carbon option but want stronger wording that 'where possible'.
- Also support retrofit policy options but want to see added reference to traditional buildings, additional criteria that relate to demonstrating understanding of existing conditions of building (e.g. fabric). Range of material on HE website that can support implementation of policy.

Other comments – net zero buildings

- There was a range of support across the options provided, some expressed desire for an approach that addressed net zero total operational energy (regulated and unregulated energy sources) whilst others preferred only focusing on regulated components of energy use. Others wished to leave requirements to national policy.
- Concerns expressed with regard to net zero being too onerous for applicants, added complexity within planning process, difficulty monitoring/enforcing requirements, difficulty predicting unregulated energy use, cost impacts.
- Encourage policy to retain flexibility to adapt to changing technology over plan period, building regs, availability of equipment/suppliers.
- Encourage maximising of onsite renewable energy generation.
- Some accepted that there would be need for offsetting to meet requirements, others felt this should not be an option that is allowed.

- There was agreement from some that energy hierarchy was important, fabric first, and a move to EUI was sensible.
- More need for education and supporting bottom up action on climate change.
- Policy options need to be explored as part of viability testing

Other comments – Embodied carbon

- Some felt embodied carbon was not the priority at present, others supported the incorporation of a policy which at least set out high level principles.
- Flexibility to approach is important – needs to be considered as part of overall approach to sustainable design. One example given was how demolition may sometimes be of a wider benefit that retaining a building that cannot be used. Also care needed about how this could influence materials choice and knock on impacts, as well as avoiding hampering redevelopment of brownfield sites.
- Some felt that approach to embodied needs to align with updates to building regs/national policy – or should simply be left to national legislation.
- Some felt the proposed approach did not go far enough or was too 'thin'.
- Carbon sinks and peat reserves was mentioned as being of importance for policy to address.
- Again viability impacts and need for testing was flagged as needing to be factored in to meet NPPF requirements.

Other comments - Retrofitting

- Need to be careful to balance heritage and retrofitting objectives.
- Some felt it was a key issue that Local Plan should encourage; others felt no need for local policy.
- Concern about poor examples of retrofitting recently which Local Plan should be careful not to encourage.
- Some felt heritage sites should be left as they are – no support for retrofitting.

4. Likely trends without a new local plan

4.1 The previous section highlights that the scale of decarbonisation that is required in the city in order to achieve the city's ambitions of becoming net zero carbon by 2040 is significant. In the absence of a new local plan, the existing Oxford Local Plan 2036 policies would still apply up until 2036. Policy RE1: Sustainable design and construction would begin to require 100% reduction in emissions above Building Regulations from 2030; however, this target is only required of residential development and also only address regulated energy (so is not full net zero carbon homes). Beyond the plan period (past 2036), in the absence of an up-to-date local plan, the policies for planning would revert to national planning policy and would therefore be based upon the NPPF. This would mean that plans and decisions should apply a presumption in favour of sustainable development. There are however no specific requirements for net zero carbon development set out at the national policy level at present despite the national legislated target of being a net zero carbon country by 2050. In the short term at least, without additional mitigation measures in place to address emissions from new development, any additional growth throughout the Local Plan period can be expected to result in an increase in emissions.

4.2 As discussed in section 2, the Future Homes Standard/Future Buildings Standard are significant updates to the Building Regulations which, when fully implemented, are expected to deliver 'net zero carbon ready' buildings. Whilst on the face of it these updates will entail an important step change in the standards of new development and will bring about reductions in emissions, there are several weaknesses with the proposals which again necessitate more stringent Local Plan policy to fill the gap for the foreseeable future. These weaknesses largely stem from the way that compliance with Building Regulations is met through the Standard Assessment Procedure (SAP) and Simplified Building Energy Model (SBEM) calculations and the fact that the proposed revisions will not rectify these.

4.3 This analysis[15] undertaken for a number of London boroughs summarises these weaknesses, including that Building Regulations requirements do not cover unregulated energy, meaning they do not take into account the full carbon emissions from a building (potentially leaving up to half of a building's operational energy use and associated emissions unaccounted for). Also, the calculations are simply not meant to predict energy use for a building, meaning they are poor at estimating as-built energy performance. Effectively, the Building Regulations system is unable to effectively deliver net zero carbon buildings at present, and [16]OBJ (2021) notes, the broad consensus is that the proposed updates to standards do not go far enough in addressing this either.

5. Key issues addressed through the Local Plan

New development needs to be net zero carbon in operation

5.1 It is clear from the current situation that despite national and local targets for net zero carbon, Oxford has a significant challenge in terms of reducing existing carbon footprint. The major source of these emissions is from the built environment and more specifically the energy used to operate these buildings. National progress in terms of carbon reduction, such as ongoing national grid decarbonisation, will support the city achieving net zero carbon, however the pace of change is inconsistent at present and arguably not fast enough. The Local Plan's influence over carbon reduction is primarily about making sure new development does not add to the challenge of decarbonisation in the city, either by emitting additional emissions or by introducing costly retrofitting burdens for future occupiers. This means that the Local Plan 2040 needs to go further than existing policy and ensure that new development is net zero carbon.

5.2 At its simplest, a net zero carbon design essentially means ensuring that new buildings do not contribute net additional emissions into the atmosphere whilst in use. The Council has previously agreed a motion that adopts the UKGBC definition for net zero

[15] Delivering net zero - 20 minute summary report (2023): https://www.merton.gov.uk/system/files/delivering_net_zero_-_20_minute_summary.pdf

[16] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

development, which has two parts, dealing with operational energy and the construction process. The operational energy definition reads as:

When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance, after all efforts have been otherwise made, offset.

5.3 The predominant source of energy used in buildings over the last century has typically relied on burning of fossil fuels (e.g. direct burning of gas within boilers for heating and ovens for cooking, or relying indirectly on fossil fuel derived electricity via the grid). However, recent (and further planned) tightening of Building Regulations will make direct burning of fossil fuels for energy in new buildings more challenging in future. Policy R1 specifically sets out that these systems will not be permitted. Not only will ensuring that new buildings are constructed without reliance on fossil fuel burning help to ensure that they do not contribute further to climate change in the short term, but it will also help to avoid potentially costly retrofitting projects for occupiers at some point in the future. Furthermore, the Council's Source Apportionment Study[17] identified that domestic heating is currently responsible for 66% and 47% of all local emissions of Particulate Matter (PM2.5 and PM10) respectively in the city. Thus, removing this source of emissions from new development can help to mitigate against additional contributions of harmful pollutants like Particulate Matter (PM) and Nitrogen Dioxide (NO2) into local environment.

5.4 Beyond direct burning of fossil fuels in new development, there is an ongoing carbon cost to electricity use where this energy is sourced from the national grid that continues to rely on fossil fuels. Despite considerable progress with decarbonising the grid, the national target of net zero carbon energy is 2035, which allows for at least another decade of emissions associated with electricity use (and section 4 discussed how progress against that 2035 target leaves some uncertainty which should be considered). As such, significant work by a range of bodies such as Royal Institute of British Architects (RIBA)[18], the Committee on Climate Change (CCC)[19], the UK Green Building Council (UKGBC)[20], and the Low Energy Transformation Initiative(LETI)[21] indicates that net zero carbon development needs to also have a strong focus on energy use more generally. A growing consensus has developed around several metrics which relate to energy use in net zero carbon buildings in operation which have guided the formulation of policy R1:

- **A maximum energy allowance for total Energy Use Intensity (EUI)** – Encouraging energy efficient design by limiting the overall annual energy use needed to operate the building. Also important for addressing challenge of rising

[17] https://www.oxford.gov.uk/downloads/download/1185/oxford_source_apportionment_study
[18] https://www.architecture.com/about/policy/climate-action/2030-climate-challenge
[19] https://www.theccc.org.uk/
[20] https://ukgbc.org/resources/net-zero-carbon-buildings-framework/
[21] https://www.leti.uk/netzero

energy costs and fuel poverty by reducing energy costs for occupants. Targets for total EUI vary depending on type of development.

- **A maximum energy allowance for space heating** – As part of EUI, having a specific limit on energy used for heating - driving a focus on thermal efficiency (in line with a fabric first approach). Choice of heating technology will influence overall energy demands (some systems are more efficient than others) - and can also address cooling needs.
- **Requiring enough on-site energy generating capacity to match total EUI** – to be net zero carbon in operation energy demands need to be met renewably and ideally through on-site energy generation which matches the development's total EUI. Encouraging greater decentralised energy production through more onsite renewables (especially if coupled with energy storage) also reduces strain on the wider energy grid and increases energy security.

Addressing energy efficiency

5.5 Ensuring that energy performance is a key considerations in the design of new buildings, policy R1 requires that design of development is led by the principles of the energy hierarchy. These principles can be applied to various scales of development, from a simple extension up to a multi-building development and seek to guide energy efficient design through several different levels of action, which the National Design Guide summarises in the following way:

1. **Reduce energy need (be lean)** – through passive design measures
2. **Be efficient in energy use (be clean)** – use energy efficient systems such as heat networks for lighting, heating/cooling, operation etc.
3. **Source energy from renewables (be green)** – after energy use has been reduced as much as possible, source remaining needs from renewable technologies, including decentralised sources.

5.6 The policy also requires applicants to utilise an operational energy consumption metric as the way of demonstrating performance of the building in terms the amount of energy it requires to operate annually. Most simply this is through requiring a calculation of Energy Use Intensity (EUI), which sets out the total energy used by the development in a year as measured at the meter divided by the gross internal area (m2). The use of EUI as the key performance metric accommodates for both regulated and unregulated energy sources to address all operational energy uses in the building and also allows for easier verification of real world performance of the building as built because it can better represent how the building will perform in terms of energy use. This makes it a more appropriate method of assessing performance of a development in terms of net zero carbon than SAP/SBEM calculations associated with Building Regulations processes and also helps to address problems of the performance gap.

5.7 Applicants are expected to demonstrate via an Energy and Carbon statement that their development does not exceed certain targets for total EUI. In addition, because the primary source of energy use in our buildings is the energy used for heating (and cooling), a specific target is set for how much energy can be used for space heating (as part of the overall EUI). A target for space heating seeks to promote a 'fabric-first' approach to design, encouraging more efficiently designed buildings that take less energy to heat and ensuring that the overall energy balance of the building is not overly dedicated to space heating alone.

5.8 Not only are targets for total energy use and space heating in line with the first steps of the energy hierarchy (reduce energy use and use energy efficiently), but they are also important for responding to other local contextual issues highlighted in section 3. Buildings with an inefficient layout or poor fabric efficiency, take more energy to keep comfortably warm (or cool), which is a particular issue when coupled with high energy prices which can increase risk of fuel poverty. When coupled with other design features, they can also help to reduce the risks of overheating by maintaining a comfortable temperature indoors all year round (reducing heat infiltration during summer). Equally, in the context of the known constraints on existing electricity infrastructure, more efficient design helps to reduce additional energy demand being imposed by new development and the carbon emissions associated with grid electricity whilst power plants still rely on some level of fossil fuels.

Renewable energy generation

5.9 Of course, the other factor intrinsic to net zero carbon design is ensuring that the energy needs which cannot be designed out through efficient design are being met through clean, renewable sources wherever possible. Policy R1 therefore sets out that the overall EUI figure for the development is matched through sufficient renewable energy generation which should ideally be installed onsite. Incorporating energy storage solutions like batteries would help to ensure this energy can be stored at times of low demand and high generation for use at times of higher demand but limited direct generation (e.g. in evening with limited sunlight in the case of solar panels), however, policy does not explicitly require this. Keeping operational energy demands as lean as possible by meeting the minimum targets referenced earlier helps to reduce the amount of onsite renewables needed and should make this achievable for most development, though there may be challenges for some types of development as will be discussed in the next section.

5.10 Not only does the requirement for matching EUI with renewable generation capacity help to avoid the emissions associated with grid electricity that remain until full decarbonisation of the network as referenced earlier, but it also supports resilience of the local grid in other ways that help address existing constraints already discussed. Onsite generation can help to alleviate peak demands when many people are relying on electricity supply, particularly when combined with battery storage. It also frees up central electricity capacity for demands elsewhere across the network, which will be of increasing importance as the city works to retro-fit existing buildings in ways such as electrification of heating

systems or installation of EV charging. Mitigating strain on existing grid through expanding renewables capacity to meet new demand of the development is as much an objective of this requirement as the carbon reductions. This is why the policy asks for installation of new renewable capacity to match EUI demands (ideally onsite but also allowing for offsite provision either directly by applicant on another site, or indirectly through payment into offset fund) - and it would not be acceptable for an applicant to simply demonstrate they are sourcing energy from the grid via a company that uses renewable sources.

Setting policy targets for the new Local Plan 2040

5.11 Whilst the last section sets out the overall considerations that have helped shape the net zero carbon buildings in operation policy, this section summarises how the Council has approached the specific performance requirements used in policy R1. The industry guidance that has helped shape the various components of the net zero carbon policy also includes recommendations for performance targets that should be met, such as in relation to EUI and space heating e.g. LETI recommend residential development to be no more than 35 kwh/m^2/yr[22]; the Committee on Climate Change recommended space heating energy demand be between 15-20 kwh/m^2/yr[23], whilst LETI and Passivhaus generally push for this to be at the lower end of this range (15 kwh/m2/yr).

5.12 Whilst these recommendations have been devised with engagement across industry and extensive research, the Council has sought to sense check these targets to understand whether these are feasible for Oxford. There is a growing range of technical studies on technical feasibility of net zero carbon from local authorities around the country with analysis which is directly applicable to the development we expect to see in the city. As such, we conducted an extensive literature review (this is presented separately) which looked at these studies through the lens of the expected development in Oxford in future in order to help formulate the specific performance targets local policy should seek to apply. A summary of the key observations and how these have led to the targets set out in policy R1 are set out below:

- The studies typically looked in greatest detail at feasibility of net zero in residential development. They generally found that meeting the best practice targets for EUI and space heating outlined above were feasible in majority of cases across typologies studied. Choice of heating technology does have an influence on overall EUI, with air source heat pumps allowing for more stringent EUI total because of greater efficiency than other systems (e.g. direct electric). Equally, certain typologies of residential such as flats and terraced housing were better able to meet stricter space heating target of 15kwh/m2/yr than other typologies such as semi-detached or detached housing.
- Greater variation in the design and uses of non-residential development makes standardised targets and feasibility analysis more challenging. Particular uses are naturally more energy intensive, such as commercial use classes with large

[22] LETI Climate Emergency Design Guide: https://www.leti.uk/cedg
[23] UK Housing Fit for the Future report, 2019

refrigeration needs or research laboratories with specialised equipment like vacuum fan extractors. Energy efficient design measures such as more fabric upgrades can only reduce the building's energy use so far before the specialised energy demands of these other systems prevent further limits. Whilst space heating targets similar to residential seem to generally be feasible for many types of non-residential, EUI targets will naturally require more flexibility when being applied to non-residential development as a whole.

- To be net zero carbon, the target should be for a building's total EUI to be matched through sufficient installation of renewable energy generation to meet average annual energy demands. Again, the feasibility work across the country indicates that alongside sufficient energy efficiency measures, for average low-rise development with sufficient roof space this should be achievable. However, there are likely to be particular instances where onsite provision will be more challenging:
    - higher rise development with limited roof space – though development continues to be limited by various design and heritage constraints which limits tall buildings.
    - the more energy intensive types of non-residential discussed above – again, as a proportion of overall development expected in the future these are unlikely to be particularly common.

5.13 The findings from the technical feasibility research indicate that whilst the recommended performance targets for net zero carbon buildings should be feasible for majority of development there will be instances where particular types of application are unable to meet these standards. The policy has been formulated in a way that recognises these challenges (and the potential for unforeseen challenges) and sets out a clear and consistent framework for decision making which provides a pragmatic but rigorous methodology to follow where certain elements cannot be met. This is provided in two ways:

1. An allowance for offsetting as a last resort where the particular challenge of providing enough onsite renewables to meet total EUI cannot be fully met. The specifics of how offsetting is expected to take place alongside the new Local Plan is set out in the appendix.
2. Where any other individual performance target cannot be met due to specific constraints of an application, the policy requires the proposal to demonstrate net zero carbon overall (in no circumstances will direct fossil fuel burning be a permitted solution to meeting needs). It also sets out a clear set of steps that an applicant should follow to meet the overall spirit of the policy.

5.14 Whilst policy R1 has a number of prescriptive targets which relate to the performance of the building as outlined above, it is also important to highlight that the approach continues the existing LP2036 one of being technology agnostic. In practice, this means that flexibility is retained for applicants to justify the most appropriate technologies for their site in order to attain the targets. In relation to heating/cooling, often air source heat pumps are likely to be most effective, particularly as these systems are much more efficient than other systems like direct electric heating, but larger development may wish to

utilise communal/district heat systems and other types of heat pump. In terms of renewables, the constrained nature of the city means that the most appropriate system is likely to be solar panels for energy generation but again this is not explicitly asked for. This flexibility also allows for resilience of the policy in terms of new technologies becoming available in future that may not be foreseen, which could be likely in this constantly evolving field as the market adjust to the large-scale and rapid changes needed across society to meet net zero carbon targets.

5.15 In practice, this should mean that policy R1 is pushing for the highest standards that are comparable to best practice for net zero carbon development today, whilst also recognising the particular difficulties evident in decarbonising certain types of development. In these instances, the policy provides a pragmatic route to making the development acceptable in terms of its impact on the city's carbon footprint.

Addressing embodied carbon in construction process

5.16 The carbon associated with buildings in operation is not the only source of emissions that need to be addressed as the city moves towards net zero carbon by 2040. There is an embodied carbon cost to the materials used in the built environment and the construction, maintenance, redevelopment and demolition processes. Carbon dioxide can be emitted in various ways as part of the processes but equally, carbon can be sequestered through careful design choices (e.g. use of natural materials like wood). As operational energy becomes zero carbon, the embodied carbon cost of new development will become the primary source of emissions that need to be addressed and this will be a growing area of focus in future years.

5.17 Addressing the issue of embodied carbon is closely tied with the concept of a circular economy (Figure 4). LETI, in its Embodied Carbon Primer, define the circular economy as a system that is 'restorative or regenerative by intention and design'[24]. In this regard, products, buildings and systems are designed in a way that considers not only how these can be repaired and reused easily, but also how the energy and materials used to construct them can be remanufactured and recycled at the end of their life. This approach enables reductions in the raw materials we extract from the environment over time, our energy demands and the impacts we have upon the wider environment, and by extension, carbon emissions associated with the construction process.

[24] https://www.leti.uk/ecp

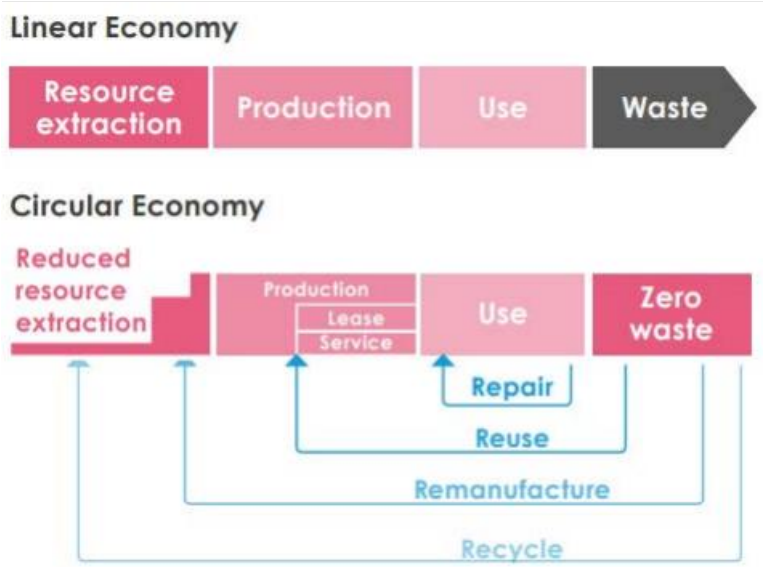

Figure 4: The stages of a linear economy versus a circular economy (source: LETI Embodied Carbon Primer[25])

5.18 But embodied carbon is an even more challenging and complex aspect of net zero carbon design to address than operational carbon. It is a topic that is subject of ongoing research and emerging guidance with varying levels of understanding at present in relation to the different stages of a building's life cycle. As UKGBC note, most of these embodied emissions occur early during the construction stage and this is typically the focus at present[26]. Perhaps reflecting the emerging nature of this topic, it is not currently addressed through a consistent set of national standards though this is something that has been repeatedly called for through an amendment to Building Regulations as highlighted in this recent House of Commons Committee report[27]. The emerging nature of our understanding of the topic and how to effectively address it makes formulating policy challenging, particularly because there are many difficult questions that the development management process must grapple with when considering embodied carbon and how it is balanced with other place-making objectives, and there are not always clear answers. For example:

- Is it more sustainable to retain an energy inefficient building or demolish to provide a highly energy efficient replacement?
- How should we balance out the benefits of long-life materials that may have a high carbon cost to produce, as opposed to shorter lived materials which will need replacement more quickly but have a low carbon cost to produce?
- How do we balance out issues of carbon reduction alongside other important choices in delivering high-quality design that contributes to making the places we wish to see in of Oxford?

[25] Available here: https://www.leti.uk/ecp
[26] https://ukgbc.org/resources/new-homes-policy-playbook/
[27] https://publications.parliament.uk/pa/cm5803/cmselect/cmenvaud/103/report.html#:~:text=There%20is%20no%20Government%20policy,emissions%20within%20the%20built%20environment.

5.19 Nevertheless, as the Local Plan 2040 pushes the standard of new development forwards from previous policy to requiring net zero carbon for buildings in operation, policy R2 also forms an important step forward from the existing position of having no policy on the topic of embodied carbon. It sets out that all new development should demonstrate how the design process has considered embodied carbon emitted during the construction stage via their Energy and Carbon statement and includes a set of principles which are intended to be used as a framework guiding applicants in how to do this. The principles have been formulated to tackle the key drivers of carbon emissions (mainly at the construction phase) though not all will be relevant for every application and will depend on the context of the site and the type of proposal.

5.20 On larger scale development, the policy also requires completion and submission of Whole Life Cycle Carbon assessment demonstrating how embodied carbon has been quantified and reduced through the design process. Whole life/lifecycle carbon assessment is a process which details the predicted carbon emissions associated with each stage of a building's lifecycle[28]. Whilst the Preferred Options consultation proposed requiring this more detailed assessment for all major applications, further consideration of the resource demands this would place upon applicants as well as case officers in assessing these submissions was deemed too onerous and a higher threshold has ultimately been set in policy.

5.21 It is acknowledged that policy R2 does not set specific targets for reduction in emissions unlike policy R1. The framing of the individual requirements set out above are however considered to be a pragmatic step forward driving development in Oxford to start seriously thinking about issues of embodied carbon alongside designing to net zero carbon in operation from adoption of the Local Plan. In this way, the policy is intended as a stepping stone which lays a foundation for more rigorous requirements in future iterations of the Local Plan that can be further developed as industry knowledge on the subject and best practice matures (and if national policy continues to fail to take action). The approach also allows for a degree of flexibility on an application-by application basis where the balance between embodied carbon savings and other important placemaking issues which could ultimately result in a more sustainable development cannot be resolved easily.

5.22 The intention is to expand on the guidance for addressing principles as part of a supporting Technical Advice Note to accompany the policy, this will also allow the Council to signpost various independent guidance and best practice and keep this list updated as new references become available.

[28] Typically, the lifecycle is broken down into various stages, from the production stage that covers sourcing of construction materials (including extraction of raw materials, transport and fabrication), to construction, then the period during which the building is in use (including maintenance, repair, replacement and refurbishment) to end of life.

Supporting retrofitting of existing buildings

5.23 Earlier it was established that because of the city's existing carbon footprint from the built environment, there is a significant need for retrofitting to install carbon reduction measures into buildings to meet net zero carbon goals. Many retrofitting measures, including installation of renewable energy generation technologies like solar panels, are classed as permitted development under the General Permitted Development Order (GDPO). This means that planning permission would not usually be required for such works – unless the buildings are listed or within a conservation area or if the works are more extensive than what is covered by the GPDO.

5.24 As these buildings have already gone through the planning process, the Local Plan has limited influence over them, except for where they come forward for planning permission associated with redevelopment in future. The Local Plan however can set out a clear signpost of support for applications that would require permission which involve retrofitting and policy R3 has been formulated in this way.

5.25 Oxford has a high preponderance of older and historic buildings (see the heritage background paper for more context) and many of these buildings will also likely require retrofitting in future but their particular qualities require additional consideration which policy R3 also makes clear. Whilst the Local Plan seeks to support decarbonisation across the built environment, the Council also has a statutory duty towards protecting the historic environment which the Local Plan must also balance. In the case of designated assets in particular, this means that solutions that can be applied to modern buildings may not always be suitable, especially where they conflict with the special features for which a building is protected. Yet, retrofitting can still be carried out sensitively. Feedback throughout the Local Plan preparation has made the Council aware of the significant challenges that owners of these buildings can face when trying to navigate planning requirements and how best to do this and policy R3 has been articulated to help address this within the limits of what is possible through the Local Plan.

5.26 In particular, officers have had extensive discussions with legal advisors as to the extent to which policy can go beyond the guidance that is set out nationally. The difficulty is that every historic building is different, and solutions that may be acceptable in some cases will be much more harmful in others. This variation in harm occurs even at the building scale, with certain facades being more sensitive than others. Policy R3 sets out a stronger position than the existing Local Plan by specifically stating that the Council will recognise the public benefit of retrofit measures, however, in every case this will need to be balanced out against potential for harm. This is an important caveat which reflects our responsibility towards preserving Oxford's unique heritage and ensuring change is managed in the right way for these features. To aid applicants, the policy includes some general principles which proposals should demonstrate have been addressed in the design rationale for any intervention to aid in securing the most successful application.

5.27 In addition, we have undertaken engagement with members of Historic England on initial drafting of the policy which has led to some helpful refinements including more explicit reference to the need for taking a Whole Building Approach to retrofitting traditional buildings (including designated buildings). This is a way of ensuring that alterations to buildings are informed by a careful and methodical understanding of the context of the asset, its surroundings and how it performs so that the correct interventions are selected for the sustainability of the structure and the health of occupants. This is particularly important for traditional buildings that often rely on passive processes to facilitate ventilation and moisture movement (essentially allowing the building to breathe) - meaning that improper retrofit such as excessive fabric interventions to strengthen ait tightness can lead to unintended consequences like damp build up. Again, by showing that a proposal has been informed in this way, the applicant will be better positioned for a successful application.

5.28 The Local Plan policy is but one tool that the Council is using to help encourage retrofit of existing buildings. A separate technical advice note is intended to be published to help elaborate on the policy requirements with additional guidance and useful resources which we intend to keep updated whenever new guidance becomes available.

6. Conclusions

6.1 The analysis set out in the above has led to the formulation of three key policies addressing carbon reduction in the new Local Plan, which are as follows:

Policy R1 – Net Zero buildings in operation

All new buildings should be net zero carbon in operation. This must be demonstrated through submission of an Energy and Carbon Statement that details how all the criteria below have been met:

1. **Developments have been designed in accordance with the energy hierarchy. Applications should demonstrate how design has methodically followed the steps in the hierarchy, firstly through reducing energy use; using energy efficiently; and then, meeting all energy needs through renewables sources, ideally generated onsite, or else offsetting as a last resort.**

2. **A total Energy Use Intensity (EUI) figure for the development has been provided, calculated using an approved methodology as set out in supporting text. Developments will not be permitted where they exceed the following Energy Use Intensity targets:**
    - **Residential: 35 kwh/m2/yr**
    - **Non-residential: 70 kwh/m2/yr**

3. **The proportion of the development's total EUI associated with space heating is no more than 20 kwh/m2/yr.**

4. **No fossil fuels are being directly utilised in the operation of the development (e.g., no gas used for heating and cooking).**

5. **All energy needs (matching the development's total EUI figure) will be met through onsite renewable energy generating technologies in the first instance, accompanied by energy storage where possible. Where the total energy need cannot be met onsite, the remaining energy balance should be met through installation of sufficient additional renewable generation at a location offsite. In these circumstances, it will need to be demonstrated in the Energy and Carbon Statement that offsite provision has been fully secured and will be in operation upon completion of the development.**

   As a last resort, where the above steps have been fully explored and net zero carbon still cannot be fully delivered, offsetting may be accepted to mitigate any remaining energy demand that cannot be sourced renewably either onsite or through an identified offsite location. The Council will accept payment into the Council's offsetting fund that can be shown to fully offset this remaining energy demand, and this will be secured through an appropriate legal agreement/S106.

6. **All new development must include information that specifies the approach to metering that will be adopted as well as proposed monitoring of the performance of the development to be undertaken post-completion (to ensure performance is in line with design specifications).**

Proposals for conversions, extensions and change of use (where they include works to the fabric of the building to facilitate this) that would require planning permission are only expected to demonstrate accordance with criteria 1 and 4, unless they would result in the creation of a self-contained dwelling or non-residential unit, in which case all criteria apply.

The City Council will expect that, having worked through requirements 1-6, Energy and Carbon Statements demonstrate compliance with the above criteria; however, a case for anything short of full compliance will be expected to be clearly justified as follows:

a. **Full details of where a criterion cannot be met will be provided and justified within the Energy and Carbon Statement with explanation of the reasonable attempts to meet it provided; and**
b. **clarification that all other criteria are met or exceeded; and**
c. **the proposal is overall net zero carbon in operation (meaning no reliance on fossil fuels and including use of offsetting only as a last resort).**

Policy R2 – Embodied carbon in the construction process

All developments are expected to demonstrate consideration of embodied carbon in the construction process and take actions to limit this as much as possible through careful design choices. Planning permission will be granted for proposals that demonstrate through their Energy and Carbon Statement that the following principles are embedded in design choices:

a. **Re-use of any existing buildings on a site has been robustly explored and demonstrated to be unfeasible before resorting to demolition.**

b. **Waste generation has been minimised and re-use and recycling of materials has been maximised in the construction process, including using any demolition materials.**
c. **The selection of construction materials has been informed by the carbon footprint associated with their sourcing and production (carbon footprint sought to be reduced wherever possible); use of materials that sequester more carbon than is produced in making them is prioritised where opportunities arise.**
d. **The ways that materials are transported to site and processed during construction have been chosen to minimise the associated carbon emissions wherever possible.**
e. **Design choices would allow buildings to be easily maintained, adapted and repurposed at the end of use/life.**

Proposals for large scale new-build development (developments of 100 or more dwellings, or 10,000m2 or more non-residential floorspace) will also need to be accompanied by details within their Energy and Carbon Statement that provide the following:

f. **a measurement of total embodied carbon associated with the construction process (including sourcing/selection of materials). A recognised methodology should be followed to determine these quantities, such as completion and submission of Whole Life Cycle Carbon Assessment.**
g. **details of actions taken to reduce this embodied carbon as much as possible and the specific reductions in embodied carbon that have been secured through design process.**

Where any future updates to Building Regulations (or other national policy) make embodied carbon requirements at a national level, the Energy and Carbon Statement should instead demonstrate how embodied carbon is being addressed in the context of that national legislation.

Policy R3 – Retro-fitting existing buildings

The Council will support retrofit measures to existing buildings where they secure energy efficiency improvements or adaptation to changing climate. The expectation is that the interventions are selected in accordance with the steps of the energy hierarchy (reduce energy use, use energy efficiently, source energy renewably) as set out in Policy R1.

A whole building approach should be taken to the retrofitting of traditional buildings, including heritage assets, whereby applications will need to demonstrate how the following principles have been embedded in the design rationale:

a. **choices on interventions have been informed by a whole building approach which includes methodical assessment of the building's heritage significance, its current performance in terms of energy efficiency and climate risk, its use (now and in future), its context, and the selection of suitable materials;**
b. **any harm to the heritage significance of the asset has been minimised and mitigated as much as possible through careful design choices and in line with requirements of policies HD1-HD6;**
c. **professional advice has been sought from historic environment and energy/climate experts to inform proposals where necessary/appropriate;**
d. **all required consents have been secured, or are in the process of being secured, such as Listed Building Consent or consent for works affecting TPOs.**

Measures that seek to deliver carbon reduction through energy efficiency or provide adaptation to changing climate will be considered as a public benefit in the balance against harm, although this will not automatically override any harm to an asset.

Appendix – Additional information on offsetting mechanism

Introduction

1. Policy R1 sets out that new development should be net zero carbon in operation and includes a set of criteria framed around the energy hierarchy principles (reduce energy demand, use energy efficiently and source energy renewably) for applicants to follow.

2. Whilst the Council considers net zero carbon development to be achievable in the majority of instances, it is acknowledged that there may be occassions where elements of the policy requirements may not be feasible. Some development typologies, for example, may be unable to feasibly incorporate sufficient onsite renewable energy generation to meet total energy demand. The policy allows for the use of offsetting to provide projects delivering energy savings or additional renewable energy generation elsewhere. The expectation as set out in the policy is that applicants should only consider offsetting as a last resort.

3. Whilst the full process for offsetting, including full offsetting costs, will be outlined in the Energy and Carbon Technical Advice Note, an indicative process and approach to pricing offset contributions is outlined below:

1. Applicants work through the policy criteria and clearly set out in their Energy and Carbon Statement how they have met this criteria.
2. Where any criteria cannot be met, applicants should set out robust justification for why the proposal is unable to meet the requirements. Justification should only relate to technical feasibility (e.g. site/design constraints).
3. The Energy and Carbon Statement should set out the total energy demand that needs to be offset (XXkwh/m2/yr) because it is unable to be met through onsite renewable energy generating installations provided by the applicant.
4. An S106/developer contribution will be agreed with the applicant as part of the planning application. The cost will cover the provision of an equivalent amount of renewable energy generation (or energy saving) elsewhere to match deficit onsite.

Price for offsetting

4. Policy R1 is focused on ensuring energy efficient development, meaning buildings designed to strict total energy use and space heating targets, as well as ensuring that all energy needs are then met through sufficient renewable energy generation. Offsetting is only to be relied upon where a development is unable to meet its full energy needs through onsite generation, as such, the offsetting funds are envisaged to be utilised to support alternative energy generation schemes (or potentially to reduce energy demands in existing buildings) elsewhere in the city. In this way, the net energy demand from the grid generated by the new development can be balanced out. The most practical way of delivering the offsetting requirement is likely to be the installation of rooftop solar elsewhere in the city, as such it is envisaged that the standard offset pricing is linked to the cost of providing comparable solar pv.

5. The majority of standard domestic properties are typically powered by a 0-4kw solar array[1]. Non-domestic installations will likely require larger amounts of solar PV. These arrays are usually made up of a number of smaller 250-350 watt panels along with an inverter (and potentially a battery). The Department for Energy Security and Net Zero publishes official statistics on the average cost for installing solar pv broken down per kW of solar PV[29]. Data is sourced from the Microgeneration Certificate Scheme (MCS) database and provides a month by month national average of costs each year. The cost excludes any extended warranty or any other material or works carried out on the solar equipment, as well as additional devices, such as battery storage. These statistics provide a transparent and easily referenced data source for the national average cost of solar pv installation at various scales.

6. The average cost for a pv installation rose in the last couple of years, driven up by inflation impacting on material and labour costs as well as a surge in demand for solar installations and other home improvements. The average per kW cost for a domestic installation based upon most up-to-date data is £2,365; the cost per kW reduces for installing larger scales of pv that may be more fitting for non-residential development (£2,100 per kW of 4-10kW installation and £1,351 per kW of 10-50kW installation). The data tables for the year 22/23 are set out in Figure 1 below.

Table 1a. Cost per kW, 0-4 kW installations (pounds per kW installed) [note 1]

Year	Month	Number of installations	Median	Mean	Lower CI	Upper CI
2022	4	7,481	1,875	2,069	2,049	2,089
2022	5	8,307	1,856	2,085	2,066	2,105
2022	6	8,461	1,875	2,094	2,075	2,113
2022	7	8,012	2,033	2,213	2,192	2,233
2022	8	8,818	2,056	2,219	2,200	2,238
2022	9	10,434	2,252	2,297	2,279	2,314
2022	10	9,743	2,187	2,345	2,325	2,364
2022	11	10,927	2,301	2,427	2,408	2,446
2022	12	8,171	2,451	2,496	2,474	2,518
2023	1	10,908	2,627	2,622	2,604	2,641
2023	2	11,638	2,591	2,620	2,601	2,639
2023	3	12,748	2,517	2,578	2,560	2,595
2022/23	**Total**	**115,648**	**2,237**	**2,365**	**2,359**	**2,371**

Table 1b. Cost per kW, 4-10 kW installations (pounds per kW installed) [note 1]

Year	Month	Number of installations	Median	Mean	Lower CI	Upper CI
2022	4	1,694	1,750	1,805	1,775	1,834
2022	5	2,049	1,753	1,794	1,768	1,819
2022	6	2,142	1,756	1,807	1,782	1,832
2022	7	2,444	1,878	1,920	1,895	1,944
2022	8	2,775	1,944	1,969	1,945	1,992
2022	9	3,175	2,000	2,023	2,002	2,045
2022	10	3,638	2,070	2,080	2,059	2,101
2022	11	4,155	2,140	2,137	2,117	2,157
2022	12	3,311	2,161	2,167	2,144	2,189
2023	1	4,583	2,206	2,220	2,201	2,239
2023	2	4,824	2,274	2,266	2,247	2,286
2023	3	5,364	2,304	2,313	2,293	2,332
2022/23	**Total**	**40,154**	**2,077**	**2,100**	**2,093**	**2,106**

Table 1c. Cost per kW, 10-50 kW installations (pounds per kW installed) [note 1]

Year	Month	Number of installations	Median	Mean	Lower CI	Upper CI
2022	4	192	1,077	1,185	1,121	1,249
2022	5	218	1,063	1,257	1,165	1,350
2022	6	221	1,095	1,222	1,154	1,290
2022	7	228	1,204	1,300	1,232	1,367
2022	8	249	1,138	1,257	1,192	1,322
2022	9	285	1,174	1,284	1,222	1,345
2022	10	270	1,191	1,310	1,247	1,374
2022	11	340	1,250	1,353	1,297	1,409
2022	12	259	1,319	1,390	1,327	1,453
2023	1	345	1,220	1,392	1,326	1,458
2023	2	447	1,363	1,454	1,396	1,513
2023	3	534	1,370	1,490	1,439	1,540
2022/23	**Total**	**3,588**	**1,226**	**1,351**	**1,332**	**1,369**

Figure 1: Small scale solar PV costs statistics - cost per kW of various scales of solar renewable energy installations in the year 2022/23[30]

[29] Available here: https://www.gov.uk/government/statistics/solar-pv-cost-data
[30] https://www.gov.uk/government/statistics/solar-pv-cost-data

7. As such, offsetting price for any unmet onsite energy demands is envisaged to be based upon the average cost per kW installation of pv using the most current average figures as set out by BEIS, proportioned into a price per kWh per year. *For reference, a 1 kw system is capable of producing on average about 850 kwh per year, so figures below are divided on this basis.* This figure will be set out on the website in the technical advice note and updated regularly to include most up-to-date costs that will apply to offsetting in order to reflect real world costs of installation. The costs to be offset based on current averages would be as follows:

- Applications for residential development: offset required level of kW installation offsite at average cost for 0-4kW system (currently £2,365 per kW, equating to £2.80 per kWh/yr);
- Applications for non-residential development: offset required level of kW installation offsite at average cost of 4-10kW system (currently £2,100 per kW, equating to £2.50 per kWh/yr); or
- Applications for non-residential development with energy offset requiring installation of more than 10kW of capacity: offset required level of kW installation offsite at average cost for 10kW-50kW system (currently £1,351 per kW, equating to £1.60 per kWh/yr)

8. Administrative costs of 10% the offsetting fee would be incorporated on top of the average solar pv installation cost as part of the overall offsetting payment. This is to account for the Council's time and resource in establishing the offset fund as well as identifying, developing and managing appropriate offset projects.

9. Payments for energy offsetting would be secured through Section 106 contributions. Offsetting payments will be paid directly into the Council's offsetting fund and subsequently used to contribute towards approved projects that will increase the renewable capacity elsewhere in the city (*or potentially reducing energy demands in existing development eventually*).

Worked example of calculating offsetting contribution

10. A worked example of how to apply the tariff to a proposed development where the renewable energy generation onsite falls short of the total energy use is included below:

1	Gross internal floorspace (m2)	95m2
2	Total EUI of building (assuming policy compliant)	35 kwh/m2/yr
3	Renewable energy generating capacity installed onsite	30 kwh/m2/yr
4	Energy deficit that is not being met onsite	(35-30 kwh/m2/yr) x 95m2 = 475 kwh/yr

5	Offsetting rate – use current average price for residential 1-4 kW system	£2,365 per kW/£2.80 per kwh/yr (*assuming 1kW system generates 850 kwh per year*)
6	Developer offset payment	475 kwh/yr x £2.80 kwh/yr = £1,330
7	Include 10% admin charge for using Council Offset mechanism	£1,330 + £133
8	**Offsetting payment to be made via S106 contribution to meet policy requirement**	**£1,463**