Commented [MG1]: Xx to check date before we send

Commented [MG2R1]: Checked for client version 16/06/23

Rutland Local Plan Review: Policy Options for Net Zero Carbon Development

A. Climate Change Legislation

16 June 2023

Rev 1.2

Written by: Marina Goodyear (Project Manager) and Alex McCann (Senior Analyst)
Checked by: Lewis Knight (Head of Sustainable Places)

Introduction

Bioregional has been appointed to provide Rutland County Council (RCC) with an assessment of options available within the local planning system to achieve net zero carbon development in Rutland to inform the emerging RCC Local Plan review.

Local planning authorities (LPA) have a legal duty to deliver carbon reductions through the planning process in line with the Climate Change Act. The Act includes both the 2050 goal for a net zero carbon UK, and sharply-declining five-yearly carbon budgets between today and 2050.

To aid RCC's decision-making for the Rutland Local Plan Review, this piece of work explores:

- Defining 'net zero carbon' at different scales (the planet, the UK, the District or County, and individual development applications) – and how these fit together
- The trajectory of the UK and Rutland to net zero carbon, including necessary measures for net zero carbon buildings and other sectors relevant to the local plan
- Planning duties to support this trajectory
- Planning powers to make the changes needed for the UK's pathway to zero carbon, including precedents of how those powers have been wielded to date
- How potential policies may be justified in terms of necessity, feasibility and viability

In the course of this exploration, we acknowledge instances where those local plan powers may be imperfectly suited to deliver the interventions needed for the UK's transition to net zero carbon, yet seek creative ways to wield the available powers to best effect.

Our suite of reports for the RCC Local Plan Review consists of four key parts:

A. Climate Change Legislation

- LPA duties to address carbon, as per the NPPF and Climate Change Act
- LPA powers, alongside their limitations, to address carbon and energy granted or not by key piece of national legislation, policy and official guidance
- Existing and emerging precedents of local plan policies
- Existing and emerging examples of how planning duties in carbon and climate have been weighed against other duties
- Defining 'net zero carbon'
- Appendices: additional guidance and advice

B. Carbon Reduction and Policy Risks

i. Carbon footprint of Rutland

- Review any existing carbon footprint work relevant to the area
- Undertake regional specific analysis of each sector
- Assessment of future desirable carbon and energy targets
- Appendix: feasibility and viability

ii. Risk matrix

- Assessing various climate and planning risks against policy approaches

C. Policy Recommendations

- Recommending ways forward to pursue net zero carbon in the RCC Local Plan Review, in ways that are consistent with national government policy and powers, and demonstrably effective.

This document is Task A: Climate Change Legislation.

Glossary of Terms and Acronyms

BREDEM	Buildings Research Establishment Domestic Energy Model. A methodology for estimate calculations of the energy use and fuel requirements of a home based on its characteristics. BREDEM is the basis for SAP (see elsewhere in this glossary) but BREDEM retains more flexibility by allowing the user to tailor some assumptions made in the calculations to better reflect the project.
Carbon, or carbon emissions	Short for 'carbon dioxide' but can also include several other gases with a climate-changing effect, that are emitted to the atmosphere from human activities.
Carbon budget	Amount of greenhouse gas that can be emitted by an individual, organisation or geographic area. Usually set to reflect a 'fair share' of the global amount that can be emitted before reaching a level of atmospheric carbon that causes severely harmful climate change.
CO_2	Carbon dioxide. Often shortened to 'carbon'.
CO_2e	Carbon dioxide equivalent. The sum of a mixture of gases, in terms of their climate-changing impact in a 100-year period expressed as the amount of CO_2 that would have the same effect. Often shortened to 'carbon'.
Embodied carbon	Carbon that was emitted during the production, transport and assembly of a building, infrastructure, vehicle or other product, before the product is in use. As opposed to 'operational carbon' which is emitted due to energy use when operating the building / infrastructure / vehicle / other product.
EUI	Energy use intensity, a measure of how much energy a building uses per square metre of floor. Expressed in kilowatt-hours per square metre of floor space per year.
GHG	Greenhouse gas (CO_2 and several other gases: methane, nitrogen dioxide, and fluorinated refrigerant gases). Often collectively referred to as 'carbon'.
Part L	Building regulations section that sets basic legal requirements regarding buildings' energy and CO_2.
Performance gap	The 'energy performance gap' is the difference between the amount of energy a building is predicted to use during design, versus the actual amount of energy it uses. The gap is due to poor prediction methodologies, errors in construction, and unexpected building user behaviour.
PV	Photovoltaics: solar panels that generate electricity.
PHPP	Passivhaus Planning Package – a tool to accurately calculate a building's energy use. It is used to design buildings that seek Passivhaus certification, but can be used without pursuing certification.
Regulated energy or carbon	Carbon emissions associated with energy uses that are 'regulated' by Building Regulations Part L. This covers permanent energy uses in the building, (space heating, space cooling hot water, fixed lighting, ventilation, fans and pumps).
SAP	Standard Assessment Procedure – the national calculation method for residential buildings' energy and carbon, used to satisfy building regulations Part L. SAP is based on BREDEM model, but with fixed assumptions and thus less flexibility.
SBEM	Simplified Buildings Energy Model – the national calculation method for non-residential buildings' energy and carbon, used to satisfy building regulations Part L.
Sequestration	Removal and storage of carbon dioxide (or other GHGs) so that it cannot perform its harmful climate-changing role in the atmosphere. Currently only achieved by trees/plants and soil. May be achieved by technologies in future.
Space heat demand	Amount of energy needed to heat a building to a comfortable temperature. Expressed in in kilowatt-hours per square metre of floor space per year.
TER	Target Emission Rate – a limit set by Part L of building regulations on CO_2 emissions per square metre of floor, from regulated energy use in the building.
TPER	Target Primary Energy Rate – limit set by Part L of building regulations on 'primary energy' use per square metre of floor. Unlike metered energy, 'primary energy' takes into account energy lost to conversion inefficiencies during power generation and distribution.
TFEE	Target Fabric Energy Efficiency – limit on space heat energy demand per square metre of floor, set by Part L of building regulations. Based only on fabric performance; not affected by building services like heating system, lighting, ventilation[i].
TM54	A method to accurately calculate buildings' energy use. Devised by Chartered Institution of Building Services Engineers (CIBSE).
Unregulated energy or carbon	Carbon associated with energy use in a building or development but which is not covered by Building Regulations Part L. Includes plug-in appliances, lifts, escalators, external lighting, and any other use not covered by Part L.

Contents

Table of Figures

Commented [AM3]: ENSURE FIGURES ARE ALL IN TABLE AND ARE CORRECTLY NUMBERED

Commented [MG4R3]: Checked for client version 16/06/23

Executive Summary

About the local plan and what it does

A local plan is a land use or spatial plan that responds to identified issues and needs. Preparation of a local plan must conform with specific legal requirements and national planning policy. It must be evidence-based and informed by community engagement, and co-operation with prescribed partners and organisations.

The local plan sets out policies for change in the type, quality and location that will be considered acceptable for land uses in the area, and includes a strategy for delivering future required growth. It includes policies that are used to determine planning applications. It identifies appropriate areas and sites for development, such as new homes, offices, shops, and community facilities. It also identifies circumstances where development is not appropriate, and it can set certain conditions around changes to existing buildings or other land uses.

The local plan is separate from Building Regulations. Building Regulations apply nation-wide and define the national minimum standards that new buildings must meet in order to be legal. These standards cover a wide range of technical topics including quality of materials, structural design, drainage, contaminants, fire and electrical safety, acoustics, ventilation, sanitation, water efficiency, overheating, electric vehicle charging, and energy efficiency/carbon emissions. Building Regulations apply not just to new developments, but also to extensions and alterations.

The local plan must be in accordance with the National Planning Policy Framework (NPPF), which is set by central government (most recently in 2021). The NPPF sets out principles and aims that the planning system should aim to fulfil. After a local plan is drafted and consulted upon, the local authority must then submit the draft plan to the Planning Inspectorate for independent examination before it is adopted and becomes part of the development plan for the County. The Planning Inspectorate will assess the draft local plan to see if it is 'sound'. The NPPF's four 'tests of soundness' are:

- The plan must be positively prepared: It should respond to objectively assessed needs (in particular, needs for housing), and should deliver sustainable development.
- The plan must be justified: Its approach should be appropriate based on evidence and consideration of reasonable alternative approaches
- The plan must be effective: It should be based on effective joint working on cross-boundary strategic matters (cooperation between local authorities), and 'deliverable in the plan period' (e.g. the policies should not make it impossible to deliver the required amount of housing).
- The plan must be consistent with national policy: This means it is in accordance with the other policies in the NPPF and other relevant statements of national policy.

Some decisions about development in the area are out of scope for the local plan. For example, large infrastructure projects – such as major road/rail, major renewable energy and airports – are considered 'nationally significant'. Such projects require national rather than local consent. The local plan's influence on existing buildings and other existing land uses is also limited, as the local plan cannot force changes to existing buildings where none have been proposed, and there are many typical changes to existing buildings or land use that do not require planning permission.

About the local plan

- **Has a duty to deliver 'sustainable development'** that meets environmental, social, and economic needs – especially housing delivery targets
- **Separate from Building Regulations** (which set minimum technical standards for buildings nationwide)
- **Has powers to require new development to do better than some of the standards set by Building Regulations** – including for energy efficiency and carbon emissions
- **Must be based on proportionate evidence** showing that the plan policies are justified, effective, deliverable, and consistent with national policy aims
- **Must pass an examination by the national Planning Inspectorate** – who will check it is in accordance with the National Planning Policy Framework, including that it proactively enables 'sustainable' development.

About Building Regulations Part L

- **Sets basic targets for new builds' energy and carbon:**
  - Fabric Energy Efficiency in kWh/m^2/year – this is a measure of the building's need for space heating
  - Carbon emissions in kgCO^2/m^2/year
  - Primary Energy Demand in kWh/m^2/year
- **Building must use specific calculation methods to fulfil these targets:** SAP for homes; SBEM for other buildings. However, these do not accurately reflect actual performance.
- **New requirement for 'energy forecasting' in non-residential buildings** – which can use CIBSE TM54 method

Why must the RCC Local Plan take action towards net zero carbon?

The Planning & Compulsory Purchase Act 2004 imposes a legal duty for every local development plan to have "policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of … climate change".

Mitigation of climate change means reduction in the impact of human activity on the climate[ii] by reducing greenhouse gas in the atmosphere[iii,iv]. It therefore cannot just mean 'minimising the additional emissions from *new* development' – rather it requires on overall reduction in the net amount of emissions from all activities in Rutland. This has two parts: reduction of emissions, and increase of sequestration (removal and storage of carbon by trees, other natural features, or future technology).

The National Planning Policy Framework clarifies the extent of mitigation, i.e. the local plan should:

- Take a proactive approach in line with the Climate Change Act 2008
- Shape places in ways that contribute to radical reductions in greenhouse gas emissions
- Support the transition to a low carbon future
- Provide a positive strategy to increase the use and supply of renewable and low-carbon energy.

The Climate Change Act 2008 contains the following legislated carbon reduction targets for the whole UK, therefore in order to be in line with the Act the local plan would need to be designed to take the necessary local action to achieve these:

- Net zero carbon by 2050
- Steeply reducing 'carbon budgets' for each five-year period up to 2050 (see Figure 1: UK legislated carbon budgets under the Climate Change Act. From Committee on Climate Change (2020), The Sixth Carbon Budget: The UK's Path to Net Zero. to right)

The budgets place a limit on the amount of carbon that can be emitted before the net zero goal. This is a vital action towards the UK's commitment to the international Paris Agreement 2015, in which 174 countries worldwide agreed to limit climate change to no more than a 2C rise on pre-industrial temperatures – above which the global impacts would be catastrophic due to 'tipping points'. For context, the world has already passed a 1C rise and is on track for a 3-4C by the end of the century.

These carbon budgets are devised by the Committee on Climate Change, before being legislated every few years by Parliament as per its duties in the Climate Change Act. The Committee also identifies the necessary sectoral changes to deliver those carbon budgets, of which most relevant to the local plan are:

- All new homes from 2025 to have low carbon heat (not gas), and very low space heat demand
- Rapid and large-scale roll-out of heat pumps to existing homes, and expansion of heat networks
- No installation of new fossil fuel boilers from 2033
- Fully decarbonise the electricity grid by 2035 (to be 80% renewable and 20% nuclear by 2050)
- Reduce travel mileage by car, and ensure all new cars/vans are electric from 2032
- Increase woodland cover to 18%, up from today's 13%, and restore peatlands
- All sectors net zero carbon by ~2045 except aviation, waste, & agriculture (most or all of the UK's capacity for carbon removals will be needed to balance these sectors' remaining emissions).

Committee on Climate Change analysis[v] shows that national government plans are not sufficient to deliver all of these necessary changes. The government's Net Zero Strategy was recently found unlawful[vi] because it fails to deliver on the Climate Change Act obligation to produce sufficiently detailed policies that sh… …d of national go…

The legal and policy mandate

- **Planning & Compulsory Purchase Act 2008** establishes that the local plan has a legal duty to mitigate climate change (reduce carbon)
- **National Planning Policy Framework (2021)** states the mitigation should be in line with the Climate Change Act 2008
- **Climate Change Act 2008** sets the 2050 net zero carbon goal, and also interim 'carbon budgets' that reduce every 5 years
- **Committee on Climate Change analysis and a High Court Ruling (2022)** shows that national government's current policies & plans will not deliver the Climate Change Act goals – so the local plan would need to take further action to fulfil its duty to mitigate climate change in line with that Act.

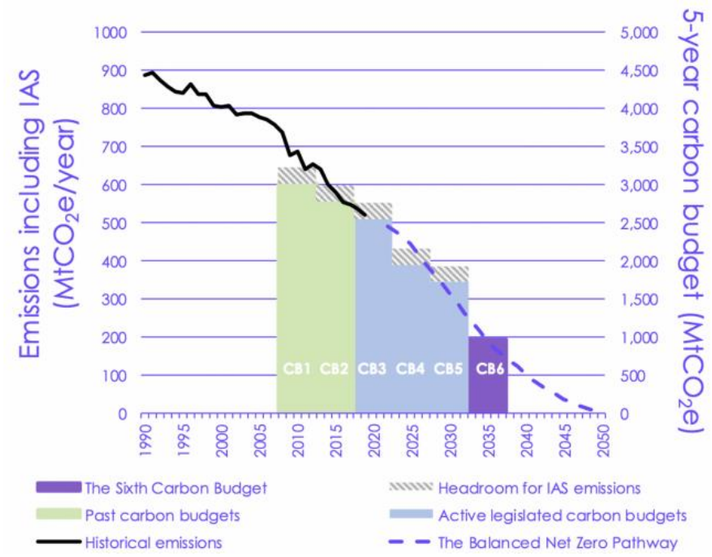

Figure 1: UK legislated carbon budgets under the Climate Change Act. From Committee on Climate Change (2020), The Sixth Carbon Budget: The UK's Path to Net Zero. "IAS" = international aviation & shipping.

How can the RCC Local Plan take action towards net zero carbon?

The main sources of emissions (and removals) that a local plan can affect are:

- New buildings – energy efficiency, renewable energy, and embodied carbon
- Transport – enabling the right type and location of new development to reduce new and existing communities' car dependence, and bringing forward sustainable transport infrastructure
- Existing buildings – encouraging carbon-reducing renovations where permission is needed
- Renewable energy – encouraging new large-scale renewable energy generation and distribution
- Land use – protecting and expanding natural green features that capture and store carbon
- Using the planning permission process to raise funds for the measures above where lacking.

Transport and land use are mainly best addressed through the spatial strategy, For this executive summary, we focus on the planning powers towards net zero carbon in the *buildings* and *energy* sectors.

The Planning and Energy Act 2008 gives the local plan the power to set 'reasonable requirements' for:

- Energy efficiency standards higher than those set by building regulations
- Renewable or low-carbon sources to supply a proportion of energy used at the development.

The Act defines 'energy efficiency standards' as ones that are set out or endorsed by the Secretary of State. This may imply only the methodologies used in Part L of Building Regulations (SAP or SBEM), despite their aforementioned shortcomings. However, the new non-residential Part L 2021 endorses the more accurate TM54 method, for energy forecasting. Thus it appears the local plan could require energy efficiency standards based on TM54, which accounts for *total* energy use, not just regulated (glossary).

The Act does not define 'reasonable requirement', nor does it define the term 'energy used at the development'. It therefore appears to empower the local plan to set requirements for renewable energy to meet a proportion of the new building's *total* energy, not just 'regulated' energy (glossary). In that case a method would need to be chosen to account for that unregulated energy, ideally in a way that works alongside the calculation for regulated energy. Several methods could be used: TM54 (as above), BREDEM, and SAP Appendix L. PHPP could also be used but may not be compatible with SAP/SBEM.

The Town & Country Planning Act 1990 gives two key powers often used for carbon reductions:

- Section 106[vii] enables the local plan to require payments from new development. These must be reasonable, proportional to the development, and necessary to make the development acceptable. This has sometimes been used as a mechanism to offset new developments' carbon.
- Section 61[viii] enables creation of Local Development Orders. This is a tool used to achieve specific objectives by granting certain types of development fast-track planning permission (or at least certainty of permission). These have been used to promote renewable and low-carbon energy.

The National Planning Policy Framework reaffirms ways the local plan can mitigate climate change:

- **Paragraph 154b**: "New development should be planned for in ways that … help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards".

Commented [MG5]: Could / should we put in the NPPF paragraph numbers?

- **Paragraph 155a and 155b**: "Plans should … provide a positive strategy for energy from [renewable and low carbon] sources … [and] consider identifying suitable areas for [these], and supporting infrastructure".
- **Paragraph 190**: "Plans should set out a positive strategy for the conservation and enjoyment of the historic environment, including … putting [heritage assets] to viable uses consistent

Local plan powers for net zero carbon development

- **Energy & Planning Act 2008: Local plan can require new builds to provide / use renewable energy and improved energy efficiency**
- **National Planning Policy Framework (2021)**
    - Policies should 'reflect national technical standards' – this may restrict the performance metrics or calculation methods that can be used in local policy around energy efficiency & renewables
    - It is appropriate to seek carbon reductions through new development's location, orientation and design, and to plan for renewable energy
- **New building regulations (2021) exceed the supposed previous limit on how far the local plan carbon and energy requirements could go** (the limit was expressed in Planning Practice Guidance and a 2015 Ministerial Statement),
    - Therefore it can be assumed that the limit is obsolete and that local plans can go as far as necessary to fulfil their duty to mitigate climate change
    - … so long as the requirement is shown to be 'reasonable' and does not stop the plan passing the four tests of soundness (justified, effective, consistent with national policy, and positively prepared to deliver development that meets needs)
- **Town & Country Planning Act 1990** allows the local plan to:
    - Seek payments from development (sometimes used to offset new developments' carbon emissions)
    - Make 'local development orders' to fast-track desirable development e.g. renewable energy

How hav

Most ado
- A
  Re
- Th
  of

However,
limits and

Reside re	
Scope o must	

Minimum reduction in on-site carbon emissions (vs Building Regulations Part L 2013)	35%	39% (19%, plus a further 20% by renewable energy)	n/a	n/a
Energy use limits	n/a	n/a	35-60 kWh/m^2/year (EUI) 15 kWh/m^2/year (space heating demand)	40 kWh/m^2/year (EUI) 30 kWh/m^2/year (space heating demand)
On-site net zero?	No	No	Yes, through 100% renewable energy, but with exceptions for feasibility	Yes, through 100% renewable energy

Offset price	Recommend £60-£95/tCO_2, but decision by borough (e.g. Lewisham, £104/tCO_2)	£200/tCO_2	£5-15k/dwelling, or direct provision of offsite renewable energy equivalent to dwelling usage	£373/tCO_2 (BANES) 10p/kWh (Cornwall)
Years' worth of emissions to be offset	30	1	n/a	30

The cost per tonne of carbon is set by various rationales. London's £95 rate matched a previous national carbon value, set annually by BEIS (as of 2023 this national value has risen to £378).

Some precedents require energy efficiency to deliver a certain amount of the carbon savings, as this is the first step of the 'energy hierarchy' (list of measures in order of most to least preferred):

- London Plan 2021: Energy efficiency measures should deliver the following minimum improvements in the carbon emissions rate (within the overall minimum 35% on-site):
  - Residential: 10%
  - Non-residential: 15%.

  These levels were set to reflect the technically feasible energy efficiency improvements identified by analysing the Building Regulations Part L figures of recent development.

Some precedents require a minimum contribution of renewable energy, either as a percentage of the building's energy use, or as a percentage reduction on the carbon emissions rate. For example:

- Milton Keynes (2019): Renewable energy to contribute a further 20% reduction in the carbon emissions rate, *after* an initial 19% reduction has been made by other measures.
- Solihull (Emerging): Provide at least 15% of energy from renewable or low carbon sources.
- West Berkshire (2012): Renewable/low carbon energy to achieve net zero total carbon emissions (regulated and unregulated) from 2016 for homes, or 2019 for other buildings, unless demonstrated unviable/ unfeasible. We note that this requirement was upheld by the planning inspector at appeal in 2022, although other parts of the same policy that were based on the now-withdrawn Code for Sustainable Homes were deemed inapplicable.

Some key new precedents have now been achieved that require absolute energy use limits and on-site renewable energy generation capacity to reach net zero carbon. These policies are inspired by LETI and UKGBC net zero carbon buildings definitions (previously explained). Key examples include:

- Bath & North East Somerset (B&NES) Council and Cornwall Council (2023):
  - 40 kWh/m^2/year (EUI) and 30 kWh/m^2/year (space heating demand) limits.
  - On-site renewable energy generation requirement to match total energy use.
- Central Lincolnshire Council (2023):
  - Residential: 35 kWh/m^2/year (EUI) and 15-20 kWh/m^2/year (space heating demand) limits.
  - Non-residential: 70 kWh/m^2/year (EUI) and 15-20 kWh/m^2/year (space heating demand).
  - Residential and non-residential development: on-site renewable energy generation to at least match total energy demand.

There are also several other local authorities that aim to follow this net zero carbon development approach by not relying on the Building Regulations Part L carbon emissions rate as the basis for the improvements that must be made. Examples include:

- Greater Cambridge Emerging Local Plan
- Bristol City Council Emerging Local Plan
- London Borough of Merton Emerging Local Plan
- Leeds City Council Emerging Local Plan
- Winchester Emerging Local Plan

Common features of these emerging pioneering plans include performance targets identified by the Committee on Climate Change to be necessary in new builds to help deliver the UK's legislated carbon budgets:

- Limiting space heat demand to 15-20kWh/m^2/year (sometimes up to 30kWh where this is found to be more cost-effective).
- Limiting total energy use intensity in kWh/m^2/year – the target varies by building type but is always set to a level that rules out gas boilers and requires a heat pump or other efficient low carbon heat (as heat pumps use about one-third of the energy of gas boiler or direct electric).
- Use of an accurate energy prediction calculation to demonstrate the building's compliance with these metrics, such as PHPP or TM54 (glossary), not the methods used in Building Regulations.

The policies also require on-site renewable energy generation equal to the building's energy use. The aim is that although the building may use grid energy at times when its own renewable generation is not sufficient, there will be other times when it generates more than it is currently using and exports the excess to the electricity grid, resulting in a net 'zero energy balance' over the year.

These emerging policies are all supported by evidence bases showing feasibility and viability in new building types typical to the local area, using highly accurate specialist energy modelling and analyses of build cost uplift compared to the existing building regulations.

'Energy offsetting' (rather than 'carbon offsetting') is permitted in the case of technical non-feasibility, in these emerging policies. Developers would have to pay an amount per kWh of energy use not matched with on-site renewables. Funds would be used to install renewable energy elsewhere in the local plan area, and priced accordingly per kWh. The aim is to simplify the offsetting process by avoiding the need for complicated calculations about the changing amount of carbon related to use of different fuels and electricity over time linked to grid carbon reductions.

It must be noted that not all plans following the energy-based net zero approach are receiving positive reactions from the Inspectorate at examination. While Cornwall, B&NES and Central Lincolnshire have now adopted such policies, West Oxfordshire and Lancaster City Council have been forced to remove similar policy requirements. In the case of the West Oxfordshire Salt Cross AAP, the Inspector removed the absolute energy requirements to instead suggest them 'as guidelines only'.

Further innovative precedents on local plan carbon reductions in transport and green infrastructure are also given in the full report. These approaches mostly rest on spatial choices to reduce car use and protect the carbon-sequestering ability of green landscapes. Although still emerging, it is anticipated that their success at examination will rest on their use of careful and robust

evidence bases that reveal and justify the carbon impact of these decisions in relation to the scale of the climate change mitigation duty.

Full Report

Why must the RCC Local Plan take action towards net zero carbon?

National and international commitments to address climate crisis

The UK is a signatory to the international Paris Agreement 2015, brokered via the United Nations. This commits all signatories to ensure global average temperatures rise is limited to 2˚Celsius on pre-industrial levels, and to pursue a limit of 1.5˚C. This would require very fast and drastic cuts to global carbon emissions, as there is a limited 'carbon budget'[ix] to be emitted before the 1.5C and 2C limits will be reached – and a rise of 1 ˚C has already happened. If the 1.5˚C or 2˚C limits are breached, climate change impacts will be devastating worldwide, and the world is currently on track to breach 3˚C by the end of the century[x].

The Paris Agreement also commits that the extent of each country's carbon reductions is related to wealth and technological ability. As a rich and technologically advanced country, the UK is responsible for faster and deeper cuts. Given the speed and scale of carbon cuts needed in existing buildings, transport and other energy use, we cannot afford for new buildings to add to the burden.

In 2019 the UK Government declared a climate emergency and updated the legally binding carbon reduction goal for 2050 enshrined in the Climate Change Act 2008. The new goal is to achieve a net zero carbon UK by 2050, rather than the original goal of an 80% reduction on the carbon emissions of 1990. The Act also comes with interim 5-yearly carbon budgets that are devised by the independent Committee on Climate Change (CCC) and then passed into law by Parliament.

The latest five-yearly carbon budgets[xi] mean that compared to the 1990 baseline, the UK must achieve a 78% reduction by 2035 (this would be roughly equivalent to a 65% reduction compared to current levels, which would require an average drop of about 4.3% a year[1]).

The carbon budgets also show that the sectors of buildings, energy and land transport should all achieve steep and rapid reductions and reach zero or near-zero emissions on their own terms (see Figure 4), not relying on offsetting.

[1] For context, the UK's carbon emissions fell by 9.5% in 2020 due to the COVID pandemic but have since rebounded by about half that figure in 2021, while global carbon emissions fell by about 5% in 2020 but have now rebounded to even higher levels than before COVID.

The Committee on Climate Change explains that "a little more or a little less may be achieved in any area, or alternative low carbon options could be used, but the overall level of ambition and delivery must match" the proposed carbon budgets.

Given that all sectors face a huge challenge in achieving their own required reductions, this means there is very little room to offset emissions in one sector by reductions or removals in another sector (for example, even highly ambitious levels of tree planting would barely be enough to offset unavoidable emissions from agriculture – see

Figure 4 - therefore the buildings and energy sectors should not rely on tree planting to make up for insufficient reductions in their own energy use and emissions).

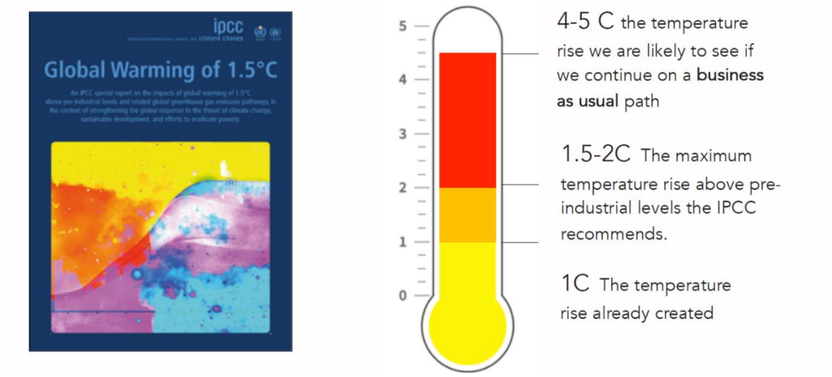

Figure 2: Special Report on 1.5C by IPCC, and diagram of the potential range of climate change to 2100 (Diagram credit: Etude, 2021).

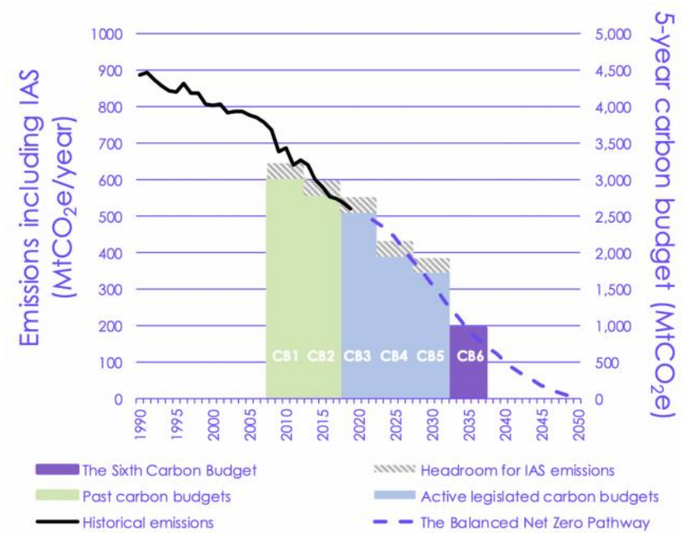

Figure 3: UK legislated carbon budgets under the Climate Change Act. From Committee on Climate Change (2020), The Sixth Carbon Budget: The UK's Path to Net Zero. "IAS" = international aviation & shipping.

The UK's five-yearly carbon budgets also come with progress reports detailing a combination of actions necessary to stay within the budgets[2]. These include wide-reaching and ambitious changes to buildings (new and existing), the energy system and transport, as well as agriculture/forestry, industry and waste. Most relevant to local planning are:

- No new homes connected to the gas grid from 2025 at the latest[xii] (and ideally be zero carbon[xiii]), instead using low-carbon heat such as heat pumps or gas-free heat networks
- New homes to have a very low space heat demand of only 15-20kWh/m²/year (a 60-70% reduction on a new home that just complies with current building regulations[xiv])
- Accelerate and scale-up rollout of low carbon heat to existing buildings, with 3.3. million heat pumps installed in existing homes by 2030, expansion of low carbon heat networks in the 2020s, and a limited role for hydrogen in the existing gas grid in some locations after 2030
- End the installation of any fossil fuel boilers by 2033 for all existing buildings including homes, commercial and public buildings, unless in hydrogen gas grid areas
- Rapid rollout of insulation and other energy efficiency measures to existing buildings, so that all existing homes for sale from 2028 have EPC rating of C or better, and 15 million homes to receive insulation to their walls, floors or roofs by 2050, to include by 2025:
    - Loft insulations to reach 700,000 per year (from current level of just 27,000/year)

[2] It is important to note that the CCC carbon budgets, while challenging, are really the minimum we must do to play our fair role in preventing catastrophic climate change. Other expert analysis of the UK's true 'fair share' of the global carbon budget has found[2] that the carbon budgets should be about half the size of the budgets that the CCC permits. These experts (at the Tyndall Centre) argue that if the UK does not stick to that fair share, it would be failing in its commitment to the Paris Agreement. These experts (at the Tyndall Centre). Beyond the 'fair share' question, the CCC budgets also include future carbon removals through technologies that do not yet exist, and also 'carbon allowances' through emissions trading schemes. Tyndall Centre experts find it wiser to exclude both of these in case the technologies fail to emerge and because the emissions trading schemes are based in economy, not the science of global carbon budgets.

    - Cavity wall insulations to reach 200,000/year (current level: 41,000/year)
    - Solid wall insulations to reach 250,000/year (current level: 11,000/year)
- Construction materials to be used more efficiently and switching to low carbon materials (e.g. timber and low-carbon cement) – although this has only a very small role overall
- Fully decarbonise the electricity grid by 2035, by:
    - Scaling-up renewable electricity to represent 80% of generation by 2050 – primarily wind power but also solar, with much of the wind power being offshore – in step with greater electricity demand as buildings and transport switch away from fossil fuel
    - Add energy storage to the system, including batteries, hydropower, and hydrogen
    - Maintain or restore the existing nuclear power capacity by building new capacity in the 2030s to replace existing plants that are being retired in the 2020s
- Reduction in travel mileage by car, and phase out of new fossil fuel cars and vans from 2032 in favour of fully electric vehicles – and relatedly, decisions on investment in roads should be contingent on analysis justifying how they will contribute to the UK's pathway to net zero and not increase emissions[xv]
- Increase woodland cover to 18% of UK land, up from 13% today, and restore peatlands.

Committee on Climate Change analysis found that the government's policy plans are insufficient to deliver the full suite of necessary actions for the carbon budgets[xvi]. The 2021 building regulations do not rule out gas (and many buildings granted under the 2021 regime will actually be completed post-2025). The Future Homes Standard (2025) is expected to deliver gas-free new homes, but will not deliver a low enough space heat demand[xvii] nor make buildings net zero carbon from first operation, nor include any regulation around low-carbon materials or material efficiency.

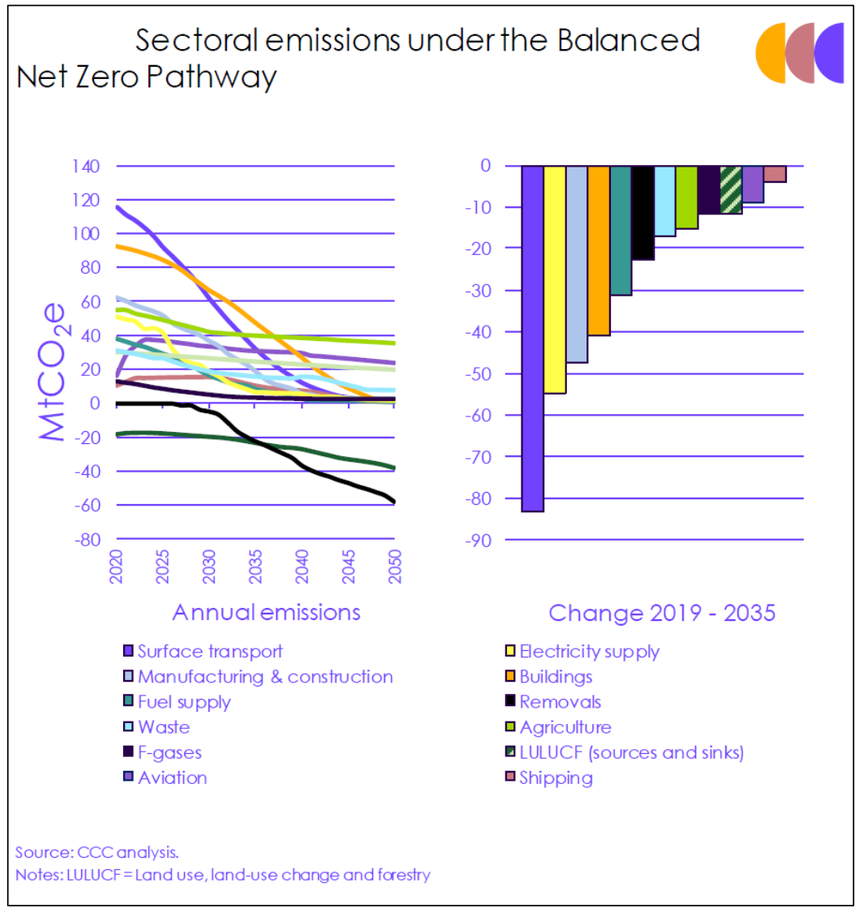

Figure 4: Committee on Climate Change Diagram showing how the carbon emissions of each sector must fall to achieve the 'balanced' pathway towards net zero carbon in 2050 and meet carbon budgets. From Committee on Climate Change (2020), *The Sixth Carbon Budget: The UK's path to net zero.*

The role of and commitments of Rutland

While the UK's carbon budget represents a share of the global carbon budget, expert analysis by the Tyndall Centre has also revealed a fair carbon budget for each UK local authority area to pull their weight towards fulfilling the international Paris Agreement to limit climate change to 2°C. The Tyndall Centres' recommended pathway to net zero within the Rutland carbon budget is represented in *Figure 14*. To avoid exceeding the carbon budget, Rutland's emissions would need to fall as follows starting from the 2018 baseline, which corresponds to a required annual 13% reduction to energy-related CO_2:

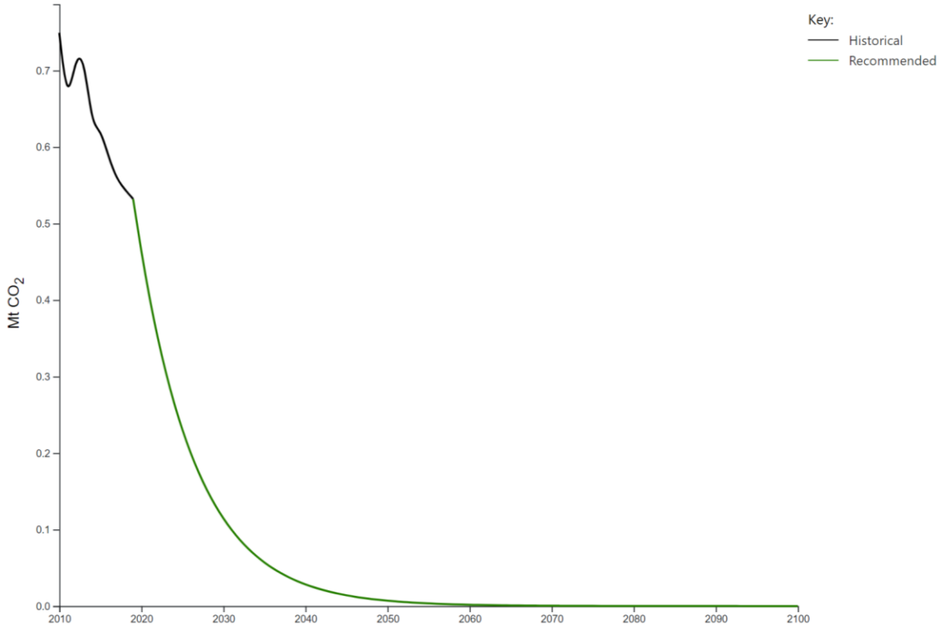

Figure 5: Emissions reduction pathway for energy-only CO_2 emissions to fulfil carbon budgets for Rutland from 2018 to 2100 compatible with the Paris Agreement. Tyndall Centre (2023).

Recognising the global and national urgency of the climate crisis – and in particular the need[xviii] to cut global emissions by 2030 – Rutland County Council has pledged to make the area net zero as soon as viable before 2050.

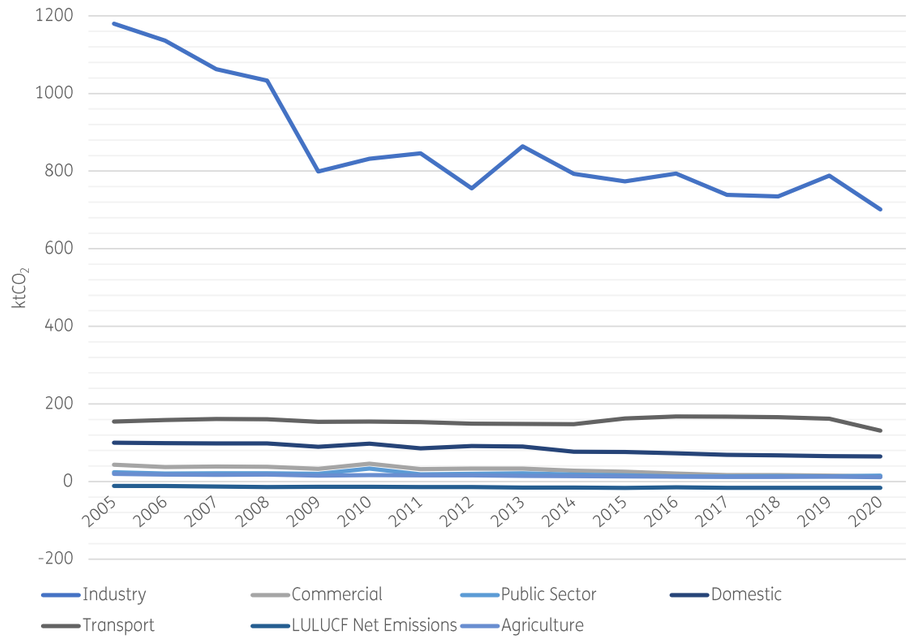

Figure 6: Rutland's sector emissions trajectories from 2005 – 2020 BEIS subnational CO_2 data.

As seen in *Figure 15*, industry emissions have proportionally reduced the most significantly due to grid decarbonisation and a reduction in industrial activity, whilst transport and domestic building emissions show modest decreases. Much of the emissions reductions can be attributed to the decarbonisation of the grid, due to a larger proportion of renewable energy generation compared to fossil fuel energy. Localised decarbonisation efforts will be needed to increase to keep on track with the Tyndall Centre carbon budget for Rutland, which requires a 13% annual emissions reduction. Local plan policies can play a significant role towards achieving this, particularly to ensure that new development does not increase the burden of reaching net zero. Further information on emissions trajectories for Rutland is set out in Task C of this evidence base.

The challenge of bringing forward net zero carbon new buildings, scaling up retrofit of existing buildings, and decarbonising transport and the wider energy system, will not be possible without the support of the local plan. By shaping what kind of development happens and where, the local plan can help to realise Rutland's ambitions, especially in transport, buildings and energy.

A local plan that achieves dramatic carbon reductions will help to avoid contributing to the risk of Rutland's residents being impacted by financial and health-related harms that would come with climate change. The Committee on Climate Change[xix,xx] has found (and UK central government has

Commented [AM6]: IS IT AN OFFICIAL PLEDGE? Only found one doc on it

Commented [AM7R6]: Roger to feedback

Commented [MG8R6]: I am not sure they formally have - I cannot find a formal climate emergency statement online at their website and they're not listed on the general independent web page monitoring all local authority climate emergency declarations. The closest Google search result I could find was a document titled "The climate crisis Summary statement - Future Rutland" but when I try to visit this I get an error message.

Roger, could you advise the best way to phrase the Council's county-wide carbon target commitments and what page or document we should cite for this? (Noting that we do later cite the Future Rutland vision document, although that's not quite a 'council commitment', and also the Corporate Strategy which acknowledges that ambition in the Future Rutland doc but doesn't seem to go quite as far as formally adopting that commitment by the Council itself.

Commented [AM9]: ANY SUPPORTING DOCS?

Commented [MG10R9]: Roger, as above - if there are any documents or web pages that formally make this pledge, let us know and we will cite them. Otherwise we will reword this sentence to soften the language.

recognised[xxi]) that the changing climate brings risks of harm to the UK population's health, wellbeing and economy in coming decades, all of which could affect Rutland's citizens. These include:

- Overheating – deaths, health-related productivity losses, additional energy cost for cooling
- Flood – danger to life, health and cost of damage to property and infrastructure
- Drought – perhaps risking the need for expensive solutions to maintain public water supplies
- Future contagious epidemics via disease vectors – ticks are becoming more abundant, and malarial mosquitoes may begin survive in the UK due to warmer winters
- Crop losses or soil damage via droughts, floods, heat and wildfires – impacting jobs in our fragile farming sector, and potentially the availability and affordability of healthy food.

All of the above are in addition to the impact on ecology/wildlife of the UK whereby freshwater ecosystems are already being harmed by over-abstraction of water[xxii], and whereby native UK wildlife may struggle to compete with invasive species that move in as our climate becomes milder.

If the local plan does not take all possible steps within its grasp to achieve rapid and drastic carbon reductions, it would arguably be failing to deliver not just on its carbon reduction duties, but also its duties to protect the natural environment and the wellbeing of its population. The local plan's duties and powers to address carbon are explored next.

Legal duties of the local plan to address carbon reductions in the local area and the UK as a whole

The local plan's impetus to facilitate dramatic carbon reductions and a net zero carbon future is not only a political choice and a scientific need, but also a legal duty.

This section will explain the key pieces of legislation and national government policy that impose this duty, providing context for the level of ambitious carbon reduction that the policies should pursue.

Planning and Compulsory Purchase Act 2004

This is the key foundational legislation that enshrines the local plan's duty to act on climate change. Section 19, paragraph 1a, states that:

> "Development plan documents must (taken as a whole) include policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of, and adaptation to, climate change".

Mitigation of climate change means reduction in the impact of human activity on the climate system[xxiii], primarily by reducing the level of greenhouse gas in the atmosphere[xxiv,xxv]. This has two parts: reduction of carbon emissions, and action to increase the sequestration of carbon (removal and storage of carbon by trees, grassland, other green infrastructure, or future technologies).

As outlined previously, if a 2°C global limit is breached, we will hit 'tipping points' where various natural systems will be damaged to the point where they begin to release even more greenhouse gases and result in runaway climate change that may be unmitigable after that point.

Therefore to truly "contribute to the mitigation of climate change", the local plan's policies should facilitate the required carbon budget that would be compatible with staying below a 2°C future. As previously noted, this essentially means there is no room for new development to add to the overall carbon emissions of the UK (given the existing vast challenge of reducing existing emissions). The RTPI and TCPA assert also that "This means that Annual Monitoring Reports should contain assessments of carbon performance against the carbon budget regime set out in the Climate Change Act".

National Planning Policy Framework (NPPF) 2021

This document[xxvi] is the framework by which the whole planning system is guided, and by which the soundness of local plans (and planning appeals) is judged by the planning inspectorate. Its following paragraphs reaffirm the duty of local plans (and whole planning system) to mitigate climate change:

- **152:** "The planning system should support the transition to a low carbon future … shape places in ways that contribute to radical reductions in greenhouse gas emissions … [and] encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure".
- **153:** "Plans should take a proactive approach to mitigating and adapting to climate change … In line with the objectives and provisions of the Climate Change Act 2008".
- **154:** "New development should be planned for in ways that … help to reduce greenhouse gas emissions, such as through its location, orientation and design".
- **155:** "To help increase the use and supply of renewable and low carbon energy and heat, plans should … provide a positive strategy for energy from these sources … consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development".

To comply with the above imperative for carbon reductions 'in line with the Climate Change Act' would have to mean taking action to achieve the intermediate 5-yearly carbon budgets that the Committee on Climate Change devises and parliament legislates, as well as the eventual net zero goal in 2050.

Planning Practice Guidance (PPG)

The National Planning Practice Guidance is an online resource that adds further context and interpretation to the NPPF. It is separated into a series of topics, including climate change, renewable energy, planning obligations and viability. It makes several points about the duty and expectation for local plans to address carbon reductions.

Its climate change section[xxvii] confirms that:

> "Addressing climate change is one of the core land use planning principles which the National Planning Policy Framework expects to underpin both plan-making and decision-taking. To be found sound, Local Plans will need to reflect this principle and enable the delivery of sustainable development in accordance with the policies in the National Planning Policy Framework. These include the requirements for local authorities to adopt proactive strategies to mitigate and adapt to climate change in line with the … Climate Change Act".

This section reiterates local plans' climate mitigation duty per the Planning & Compulsory Purchase Act 2004, and that plan makers should be aware of the Climate Change Act goal and carbon budgets.

The section on renewable and low carbon energy[xxviii] confirms that:

- All communities have a responsibility to help increase the use and supply of green energy, albeit not overriding other environmental protections
- Local planning authorities hold decisions over renewable energy development of 50 megawatts or less, and may soon hold decisions over onshore wind over 50MW[xxix]. (*Note: As of 2020, energy storage of over 50MW is now the domain of the local planning authority, except pumped hydro[xxx]).

Potential tension with other duties

These carbon reduction duties are often in tension with the local plan's other duties – e.g. to enable economic growth and delivery of government-mandated housing targets. It is often assumed or argued that these other objectives could be inhibited if the carbon reduction provisions are so onerous as to present technical challenges or put at risk the developers' anticipated minimum profit margin of 15-20%.

Nevertheless, the NPPF explicitly states that the goal of the planning system is '*sustainable* development' which it defines as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (as per the United Nations definition).

Given that the continued existence of human life across much of the Earth is at risk if the planet exceeds 2C of climate change (as previously discussed) – or at least a good quality of life – there is a strong argument to make that carbon emissions should be treated as the fundamental bottom line for what we can define as 'sustainable' development.

How can the RCC Local Plan take action towards achieving net zero carbon?

The local plan can minimise transport emissions by planning for growth in a way that actively reduces the need to drive, increase public transport viability, and reserve land for public transport, walking or cycling. This is crucial in Rutland where, apart from industry, transport is the largest emitting sector, responsible for 14% of the total CO_2[xxxi].

The powers afforded to the local plan to set policy requirements towards net zero carbon new buildings[3] flow principally from the Planning and Energy Act 2008. Further direction how these powers can and should be used is given in the National Planning Policy Framework (NPPF) and National Planning Practice Guidance (PPG). Additionally, formal ministerial statements and other official government policies can also affect interpretation of how those powers should be wielded.

Planning and Energy Act 2008

The Planning and Energy Act 2008 grants local plan the power to set "reasonable requirements" for:

- "energy efficiency standards that exceed the energy requirements of building regulations"
- and "a proportion of energy used in development in their area" to be from renewable or low-carbon sources "in the locality of the development".

Policies using these powers "must not be inconsistent with relevant national policies"; that is, those relating to energy from renewable sources, low carbon energy, or furthering energy efficiency.

The Act defines "energy efficiency requirements" as standards that are 'set out or referred to in regulations made by the [Secretary of State]' or 'set out or endorsed in national policies or guidance issued by the [Secretary of State']. This is also repeated in National Planning Policy Framework paragraph 154. The only 'energy efficiency standards' currently clearly set out or endorsed in this way are the energy and carbon calculation methodology used for Part L of the building regulations. Until recently, this was only SAP and SBEM, but the new Part L 2021 for residential also mentions CIBSE TM54 as a suitable method to fulfil the new requirement for energy forecasting.

This may be interpreted to mean that energy efficiency requirements must use SAP/SBEM or TM54 calculations. If SAP/SBEM, their scope will be limited to regulated energy only (heating, hot water, fixed lighting, ventilation). If TM54, total energy efficiency could be specified (including unregulated). However, several precedents have recently successfully been adopted that use PHPP as well as TM54.

The act does not define 'energy used in their area'. Therefore, it is probable that requirements for renewable energy could cover a proportion of the new building's *entire* energy use, not just the share that is 'regulated' by Part L and calculated using SAP/SBEM.

Most definitions and requirements for 'net zero carbon buildings' in local plans are based on Part L and the associated calculation methods (although some make a separate requirement for renewable energy). This means they are subject to the weaknesses that befall Part L in terms of inaccurate calculations of energy and carbon, and a lack of incentive to create an inherently thermally efficient building shape (see previous section on national and alternative definitions of zero carbon).

Town and Country Planning Act 1990

The key parts of this Act relevant to carbon reductions are:

- Section 106[xxxii], planning obligations – this enables the local plan to require payments for the purpose of making an otherwise unacceptable development into an acceptable one. Section 106 obligations are expected to be reasonable, proportional to the development, necessary to make the development acceptable. This has been used in several precedent local plans to require carbon offsetting payments from new development.
- Section 61[xxxiii] enables the creation of a Local Development Order. This is a legal tool used by local government to achieve specific identified objectives in the local plan by permitting certain types of development that would otherwise need to go through the planning permission process. These have sometimes been used to bring forward renewable energy or addition of low-carbon heat to existing buildings.

Infrastructure Act 2015

Section 37 of this Act[xxxiv] included provision for the Building Regulations to be amended to require provision for off-site carbon abatement measures. This was in relation to the erstwhile anticipation of the national net zero carbon building standard which was scrapped before coming into force. Nevertheless, this is where the concept of 'allowable solutions' to carbon emissions originated, in terms of allowing buildings to be legally accepted as 'net zero carbon' by delivering measures off-site to reduce carbon emissions or increase carbon sequestration, which could include paying others to perform those measures or purchasing carbon offset certificates through a national scheme.

Although the national net zero carbon buildings plan was scrapped and the government has not yet proceeded to enact the national 'allowable solutions' scheme envisioned by the Act, this is still the concept taken echoed in many subsequent local plans in the form of requirements for carbon offsetting either by payments or by direct delivery of projects that will reduce carbon emissions.

National Planning Policy Framework (2021 update)

This guidance document, updated in 2021[xxxv], is the framework by which the preparation of local plans is expected to be guided, and by which their soundness is judged by the planning inspectorate.

It expresses four key tests of soundness (all of which appear relevant to carbon):

- Plan should be positively prepared (responding to needs; delivering sustainable development)
- Plan should be justified (having considered alternatives and be based on evidence)
- Plan should be effective and deliverable over the plan period

[3] Please note that this document focuses mostly on the carbon impact of **buildings**. Beyond this, new development will often also have carbon impacts from the transport induced in the lifestyles of its residents, workers or visitors. This transport carbon would be part of Rutland's overall carbon emissions – and would therefore need to be reduced to zero in order to hit the national goal of net zero carbon by 2050 (or 2030 for the local target. Nevertheless the transport carbon is not considered part of the carbon that belongs to the building itself, therefore it is not part of the definition of 'net zero carbon buildings' for which we now explore the legal powers to regulate through planning. Transport and standalone renewable energy are briefly considered in the section entitled "beyond the building".

- Plan should be consistent with national policy (again delivering sustainable development and being in accordance with other statements of national planning policy, where relevant).

It reaffirms the ways in which the local plan (and whole planning system) can mitigate climate change, including that:

- **Paragraph 154**: "New development should be planned for in ways that … can help to reduce greenhouse gas emissions, such as through its location, orientation and design"
- **Paragraph 155**: "To help increase the use and supply of renewable and low carbon energy and heat, plans should … provide a positive strategy for energy from these sources … [and] consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development".
- **Paragraph 158**: "When determining planning applications for renewable and low carbon development, local planning authorities should not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions".
- **Paragraph 190**: "Plans should set out a positive strategy for the conservation and enjoyment of the historic environment, including heritage assets most at risk through neglect, decay or other threats … tak[ing] into account the desirability of sustaining [them] … and putting them to viable uses consistent with their conservation" – This may support a sensitive but permissive approach towards energy retrofit, where this keeps a heritage building fit for long term use.

The NPPF also includes points which could be taken to constrain the extent to which a local plan can require carbon and energy improvements in development, including:

- **Paragraph 154b**: "Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards."
- **Paragraph 157a** allows that new development should comply with local requirements for decentralised energy supply unless it is demonstrated to be not feasible or viable.

At present, the relevant 'national technical standards' would largely mean the building regulations Part L uplifts in 2021 and 2025, and perhaps also the electric vehicle charging requirements that are being introduced through the new Part S of building regulations.

National Planning Policy Framework Update Consultation (2022-2023)

The National Planning Policy Framework (NPPF) consultation[xxxvi] ran from 22 December 2022 to 2 March 2023, in the context of the Levelling Up and Regeneration Bill, to primarily seek views on proposed changes to the NPPF and the approach to preparing 'National Development Management Policies' (a completely new element in the planning system, which forms one of the proposals laid out in the Levelling Up & Regeneration Bill - see summary later in this document).

The key points from the 2022-23 NPPF consultation relate to:

1. Onshore wind development

A positive amendment to text relating to the repowering of onshore wind states that LPAs should approve applications for the repowering and life-extension of existing renewables sites. This is however arguably the only helpful change on this topic, primarily because footnote 63 continues to take a negative stance to onshore wind development by treating it differently to other types of energy development. As per the current NPPF, this draft NPPF continues the uniquely negative treatment of onshore wind in that its acceptability depends on demonstrating through consultation that it has 'community support', and prior identification of suitable areas in the local plan or in an SPD. A lack of clarity remains over what constitutes sufficient 'community support'. For the purpose of enabling local plans to fulfil their legal duty to mitigate climate change, it could be argued that footnote 63 should be removed to relax barriers experienced by onshore wind development and so that the technology has equal opportunities for growth. Alongside the climate imperative there is also a socioeconomic argument for this especially in context of the recent energy price volatility, given that onshore wind is one of the cheapest forms of energy generation[xxxvii].

Other changes to footnotes 62 and 63 propose that onshore wind applications could be granted permission through Local Development Orders, Neighbourhood Development Order and Community Right to Build Orders. Additionally, it is suggested that supplementary planning documents could be used as a resource to identify suitable sites for onshore wind, instead of through a development plan.

2. Replacement of Supplementary Planning Documents

Currently proposed reforms to the planning system would replace supplementary planning documents (SPDs) with Supplementary Plans and existing SPDs would expire after a new-style plan has been adopted.

The replacement of SPDs is a concern for local authorities as they provide valuable supplementary information on parent policies and guidance on how to achieve them. SPDs enable a deeper explanation and description of policy wording within Local Plans, which can strengthen an overall policy approach towards improved delivery. The expiration of existing SPDs will increase plan-making complexity and place resourcing constraints on local authorities, particularly as proposed Supplementary Plans will be subject to an additional process of examination.

3. Increased weight given to energy efficiency improvements in existing buildings

The insertion of paragraph 161 is a positive move, since it emphasises the importance of that retrofitting existing buildings, which is a key necessary step towards staying within the bounds of the 6th carbon budget. Conservation areas and listed buildings will still be treated more cautiously however, due to the sensitive relationship between heritage and carbon-reducing alterations.

4. The removal of the need for justification to be demonstrated in plan making

A fundamental amendment to the NPPF, the potential removal of the need for policy justification, has created concern among those working in planning. The current requirement that plans must be justified is currently one of key four tests that must be demonstrated for a plan to be found sound.

The removal of the test could adversely impact the quality of housing delivery, particularly in sustainable places, because allocations will not necessarily need to be justified. If plans no longer must be justified, it has been recommended by the Town and County Planning Association that the test should, as a minimum, be replaced with a requirement for a robust evidence base and demonstrate that various policy options have been considered.

5. Insufficient reference to the 2008 Climate Act

In the context of climate change, a significant gap remains in the changes to the NPPF text, which is that there is insufficient reference to the legally-binding 2008 Climate Act and subsequent carbon budgets and the exact role that local plans can and must play towards achievement of those legally binding reductions. Without a clear direction set by the Act, policy informed by the NPPF will not necessarily be measurable against the UK 2050 net zero target.

Nevertheless, the draft NPPF update still retains the existing paragraph that confirms that plans' climate mitigation and adaptation should be "in line with the objectives and provisions of the Climate Change Act 2008", therefore the carbon budgets passed under the aegis of that Act should still form a good logical basis for development of local plan policy that brings forward the actions necessary to fulfil them. However, this argument may be weakened in concert with the proposed removal of 'justification' as a test of soundness – given that such policies are argued to be justified by evidence showing that they are necessary to fulfil the carbon budgets.

Planning Practice Guidance (PPG)

The PPG section on Climate Change[xxxviii] reiterates several powers relevant to carbon, and also constraints on how those should be exercised. It highlights several opportunities including:

- Reducing the need for travel and providing sustainable transport
- Providing opportunities for renewable and low carbon energy and decentralised energy
- Promoting low-carbon design approaches to reduce energy consumption in new buildings.

It confirms that appropriate mitigation measures in plan-making can be identified by:

- Using available information on the local area's carbon emissions [such as BEIS subnational carbon inventories referenced elsewhere in this appendix]
- Evaluating future emissions from different emissions sources, taking into account probable trends set in national legislation, and a range of development scenarios
- Testing the carbon impact of different spatial options, as emissions will be affected by the distribution and design of new development and each site's potential to be serviced by sustainable transport
- Noting that different sectors have different opportunities for carbon reductions, noting that "In more energy intensive sectors, energy efficiency and generation of renewable energy can make a significant contribution to emissions reduction".

For existing buildings, the PPG notes that many carbon-reducing measures may not require planning permission, but for those that do, "local planning authorities should ensure any advice to developers is co-ordinated to ensure consistency between energy, design and heritage matters."

It reiterates the Planning & Energy Act powers that the local plan can require developments' energy/carbon performance to be higher than those of national building regulations to an extent:

- For homes: up to the equivalent of Level 4 of the Code for Sustainable Homes
    - [We note that this limit should no longer apply, as it has been exceeded by several adopted precedent local plans and national building regulations Part L 2021, whereas that part of the PPG citing the Code was last updated in March 2019.]
- For non-residential buildings, the plan is not restricted or limited in setting energy performance standards above the building regulations.
- Requirements for new buildings' sustainability are expected to be set in a way consistent with the government's zero carbon buildings policy … adopt nationally described standards … and be … based on robust and credible evidence and pay careful attention to viability".

The PPG section on renewable and low carbon energy confirms that:

- Local planning authorities hold decisions on renewable energy development of ≤50MW [*the RTPI notes that onshore wind over 50MW is also now a local planning decision[xxxix]]
- Neighbourhood Development Orders and Community Right to Build Orders can be used to grant planning permission for renewable energy development.
- There are no concrete rules about how to identify suitable areas for renewable energy, but should consider the requirements of the technology and cumulative environmental impacts, and could use tools such as landscape character assessment to inform this.
- Identifying suitable areas gives greater certainty to where renewable energy will be permitted – and wind turbine development should only be approved in such identified suitable areas.

The PPG section on viability confirms that:

- Plans should set out the contributions expected from a new development, including for infrastructure, informed by evidence of need and viability-tested alongside other policies.
- The role of viability assessment is mainly at plan-making stage, and should not compromise sustainable development but should ensure that policies are realistic and deliverable.
- Once the plan is made, the price paid for land is not considered a valid reason for failing to comply with the relevant policies of that adopted plan.

The PPG section on planning obligations[xl] (such as Section 106 payments) notes that:

- The previous restriction on pooling more than 5 planning obligations towards a single piece of infrastructure has been removed – so LPAs can now pool as many S106 or CIL as they wish, subject to meeting the other tests (necessity, scale and direct relation to development).
- The Community Infrastructure Levy "is the most appropriate mechanism for capturing developer contributions from small developments".
- Planning obligations should not be sought for development that consists only of residential extensions/annexes.

Other government communications that have been interpreted to affect how local plans can wield powers

Written Ministerial Statement, 2015

In 2015, national government announced that it would update building regulations to deliver the same reduction in on-site carbon emissions that the withdrawn Code for Sustainable Homes Level 4 would have delivered (a 19% reduction on the emissions rate set by Part L 2013). It stated that when those changes were made, it would also remove local plans' Energy and Planning Act powers to require higher energy standards. It stated that in the meantime, local plans should not require more than that 19% reduction, and nor any other higher standards in construction, layouts or performance. It should however be noted that this was framed as *expectation* and not a *requirement*. Additionally the WMS only applied to existing policies and did not include emerging policies in the restrictive text.

This, along with the tension between the duties for carbon and viability/housing delivery, has caused many local plans to adopt 'zero/low-carbon' policies that stop far short of requiring new development to achieve a truly neutral climate impact to the extent that would have been technically feasible.

However, these changes to building regulations and the Energy and Planning Act were in fact never implemented. As a result, the 2015 statement appears to carry limited weight with the planning inspectorate, given that there has been successful adoption of several local plans that go well beyond the supposed limit of a 19% reduction on Part L 2013 (London 35%; Reading 35%; Milton Keynes 39%; Oxford 40%). The London Plan (among others) also requires achievement of other standards relating to 'construction, internal layout or performance' such as the Home Quality Mark or BREEAM, also contrary to the 2015 ministerial statement. Bath & North East Somerset Council, Cornwall Council and Central Lincolnshire Council have recently adopted ground-breaking new housing policies that require an on-site net zero energy balance. The Inspector's reports from the relevant examinations explicitly addressed the status of the 2015 WMS and subsequently found it to be no longer relevant. These policies were supported by evidence bases showing how these improvements were technically feasible and financially viable. Subsequently, developers in these locations have for many years proven able to consistently comply with these higher standards.

We note that the 'interim uplift' to Part L of building regulations in force since June 2022 (see 'Future Homes Standard consultation response') makes the 2015 Ministerial Statement obsolete, because the new Part L already delivers a carbon saving greater than the supposed 19% limit. Relatedly, a recent planning inspectorate appeal decision expressed the view that the 2015 Ministerial Statement is no longer the most relevant expression of national policy, as the Future Homes Standard and Climate Change Act net zero carbon goal are now quite clearly more relevant. Similar views appeared in the Inspectors' reports on several recent successfully adopted plans that go much further than the WMS2015 supposed limit, detailed later in this document (Cornwall, B&NES, Central Lincolnshire).

'Planning For the Future' White Paper 2020

In 2020 the government publicly consulted on a white paper proposing changes to the planning system. This contained various intents relevant to energy and carbon policy for buildings, including:

- **Easier planning permission for energy efficiency and renewable energy measures in existing buildings:** The government commits to update the planning framework for listed buildings and conservation areas to better enable "sympathetic changes to support their continued use and address climate change" because "We particularly want to see more historical buildings have the right energy efficiency measures to support our zero carbon objectives"
- **Different role for local planning authorities in carbon reductions, when the Future Homes Standard is in force**: The government intends that the FHS from 2025 will a 75-80% reduction in homes' (regulated) carbon emissions compared to the Part L 2013 rate, and will deliver homes that reach zero carbon when the electricity grid decarbonises, without further retrofit. Also from 2025, local planning authorities may be expected to "focus more fully on [monitoring and] enforcement" of the national standard, rather than setting different local standards.

Future Homes Standard Consultation Response, 2021

This document is the government's response to public consultation on the new Future Homes Standard, which will update building regulations in 2025 with tighter standards in energy and carbon. The document also lays out an 'interim uplift' titled Part L 2021, which is now in force as of June 2022.

The government had asked whether it should now enact the changes to Planning and Energy Act that would remove local planning authorities' power to require higher standards of energy efficiency and renewable energy, as per the 2015 Written Ministerial Statement. 86% of responses said no. The government's response confirms that "in the immediate term" it will not enact those changes and that local plans thus retain their existing powers. It notes the previous "expectation" set by the 2015 Ministerial Statement (that local plans enforce no more than 19% carbon reduction on Part L 2013), but does not say that this limit still applies, and recognises that many local plans exceed this limit.

The response document also lays out an indicative specification for the 'notional building' for the 2021 & 2025 Part L. This is the imaginary building which includes a range of energy efficiency and renewable energy measures, whose carbon emissions rate the proposed building must not exceed. It includes several new measures that were not in the 2013 notional building (see table below). It was later confirmed that the document forms a piece of official government policy.

Part L Interim uplift 2021 (changes vs 2013)	Part L Future Homes Standard 2025
Minor improvements to roof, windows, doors	Major improvements to walls, roof, floors, windows, doors
Solar PV panel m^2 equal to 40% of ground floor	Low carbon heat pump
Wastewater heat recovery system	Solar panels and wastewater heat recovery are not part of notional building spec
Still has gas boiler as basic assumption	
Result: 31% reduced target emissions rate compared to 2013	Result: 75% reduced target emissions rate compared to 2013 (low enough to rule out gas boilers)

Levelling Up & Regeneration Bill (2023)

The Bill has passed through the House of Commons and, as of 20 February 2023, has reached the Committee stage in the House of Lords. It will affect the planning system in a variety of ways, the most relevant of which for carbon are:

- **Section 106 & Community Infrastructure Levy to be largely replaced** by an 'Infrastructure Levy' set in relation to development value, not floor space. However, specifically Section 106 appears to not be entirely scrapped although its role is scaled back to limited applications[xli]. This may alter the ability to use Section 106 powers to collect carbon offset payments from developers. The charging schedule for the new Levy would still be set by the local authority. An infrastructure delivery strategy must outline how it will be spent. The new Levy may become applicable to permitted development as well as full plans[xlii].

- **New 'national development management policies'** with which local plan policies must not be inconsistent. The Bill's wording appears to grant the Secretary of State the right to decide whatever they will cover, with or without consultation. The consultation document suggests that a national development policy for carbon measurement and reduction could be set, yet this is unlikely to affect the ability of LPAs to set their own standards on carbon reduction and energy efficiency in new buildings.

- **A new 'Environmental Outcomes Report'** to replace the existing system of Sustainability Appraisals, Strategic Environment Assessments and EU Environmental Impact Assessment. The outcome topics are yet to be clarified but may conceivably include carbon.

How have existing local plan precedents used those powers?

Reductions on the building regulations baseline carbon emissions

Using powers granted by the Planning and Energy Act, most local plans lay out their 'low carbon' or 'net zero carbon' policy requirements in terms of a percentage reduction on the Target Emission Rate set by the current version of Part L of Building Regulations (Part L 2013 at the time of writing[4]).

This percentage reduction in on-site carbon emissions usually ranges from 19% to 40%. Some local plans also require the remaining Part L carbon emissions to be offset at a fixed cost per tonne, payable by the developer through a Section 106 payment, to be spent on local projects for carbon reductions.

Older precedent plans have sought a 19% reduction, because this reflected the national Code for Sustainable Homes which was previously seen as best practice – and because of a 2015 Written Ministerial Statement previously mentioned, which was taken to mean that 19% was the limit.

Later, requirements for higher percentage improvements in Part L carbon emissions were pioneered by the London Plan, justified by evidence assembled by the GLA and its consultants to show that new developments in preceding years had already been typically achieving 30 to 40% reductions[xliii]. Several other adopted local plans have similarly adopted similar requirements (see precedents box).

As of 2022, the building regulations Part L has been updated, resulting in a ~31% reduction in the carbon emissions rate compared to Part L 2013. And from 2025, it will be updated again to a 75% reduction. These reduction values exceed the 19% reduction limit referred to in the 2015 WMS.

Requirement to demonstrate implementation of the energy hierarchy

Some local plans divide their carbon and energy requirements into several steps prioritising the most effective and long-lasting carbon reduction measures first. This follows the **energy hierarchy**, generally accepted best practice across the building design sector.

The logic is that if energy demand is minimised first, this reduces not only the burden that the new building places on our limited energy resources in operation, but also the amount of new equipment needed to generate and distribute energy to meet that demand. This reduces the materials, carbon and cost involved in producing and installing that equipment (and lowers energy bills).

The energy hierarchy is as follows:

1. Reduce energy demand (also known as 'be lean')
2. Supply energy efficiently (also known as 'be clean')
3. Supply renewable energy (also known as 'be green').

A policy requiring minimum improvements in each stage of the energy hierarchy makes the developer demonstrate that they have applied the hierarchy before resorting to offsets to reach zero carbon. Local plans usually express this as a requirement for the developer to show that they have made a minimum % improvement in the building's carbon emissions rate by measures taken at each stage. Policy compliance is demonstrated in an energy statement submitted with the planning application.

Precedent local plans requiring percentage reduction on regulated carbon emissions compared to Part L 2013

London Plan 2016, Policy 5.2: 35% reduction on site via the use of the energy hierarchy (expressed at the time as 40% reduction on previous Part L 2010) in both homes and non-residential. To rise to zero carbon for homes from 2016 and other buildings from 2019.

Reading Local Plan 2019, Policy H5: 35% reduction on site and offset the rest to zero (major developments). All other new build housing to achieve 19% reduction on site.

Oxford Local Plan 2020, policy RE1: 40% reduction on site, rising to 50% in 2026, rising to zero carbon from 2030.

New London Plan 2021: 35% on-site emissions reduction, followed by carbon offset payment for the remainder of Part L regulated emissions.

Bath & North East Somerset Local Plan Partial Update 2023: 100% reduction to be met following a fabric-first energy hierarchy (major non-residential). Any residual on-site emissions to be offset.

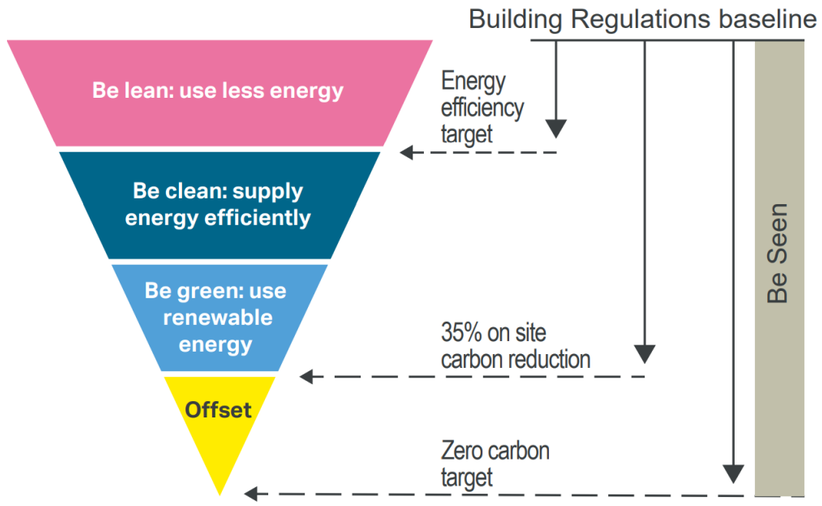

Figure 7: New London Plan (2021) Diagram of the energy hierarchy to reach 35% on-site reduction compared to baseline carbon emissions rate set by Building Regulations Part L 2013.

The following sections explore precedent local plan policies in each of these steps and how they were justified. Three more sections then look at offsetting, existing buildings and embodied carbon.

[4] These percentages will be outdated when new versions of Part L come into force in June 2022 and 2025

Reducing energy demand

To achieve legislated target of net zero carbon by 2050, we must reduce our total energy consumption as well as scaling up the supply of renewable energy. In the country's transition to net zero carbon, increased demand will be placed on the electricity grid as fuel sources are switched to electricity (e.g. electrification of heat in existing buildings, and EV charging). Upgrading the electricity grid and expanding renewable generation is already a huge but necessary challenge, involving a great deal of national cost and embodied carbon to produce that infrastructure. It is therefore vital to minimise the additional burden that new buildings place on our energy infrastructure, to ensure that it does not become technically or financially unfeasible to deploy the required amount of renewable energy to meet our demands.

Improving the energy efficiency of new homes (minimising their energy demand) is a very cost-effective way to minimise the new infrastructure that will be required to support them in a future zero-carbon energy system. New homes should therefore target reductions in energy demand to reduce the amount of total energy that must be supplied, both from the electricity grid and from other renewable energy sources. Put simply, optimising the efficiency of the building fabric is the starting point for the whole net zero journey.

It is critical to set higher fabric energy efficiency standards to ensure buildings do not need to be retrofitted expensively at a later date (e.g. if the Government proceeds with the recent Committee on Climate Change proposal that no home should be able to be sold unless it reaches EPC Band C by 2028). However, EPCs have recently been deemed 'not fit for purpose' by Lord Deben, the Chair of the Committee on Climate, since the grading system is primarily based on the *cost* of energy and not the actual *amount* of energy used. This statement is supported by research that shows the actual operational energy use of existing buildings differs significantly from values predicted through EPCs.

Fabric efficiency (insulation and airtightness) is particularly pertinent for housing schemes that use heat pumps and MVHR, as these will require highly insulated and draught-proofed buildings to operate efficiently. The previously referenced costs report also found that if very high thermal efficiency is reached, the whole construction can become more cost-effective because the developer can then save money on smaller-sized heating systems (pipes, radiators, heat pumps, etc.).

A further final justification for including a minimum improvement on energy efficiency is that it helps with the social needs of affordable living, fuel poverty and healthy homes. An energy-efficient home saves energy bill costs for the home occupiers and also often helps make the home interior more comfortable and conducive to good health (warmer, less draughty, and with less condensation on cold spots on walls or windows thus reducing the chance of respiratory harm from mould growth).

How can local plans set requirements for improvement at the *energy efficiency* stage?

The Planning and Energy Act 2008 grants Local Planning Authorities the power to require "energy efficiency standards that exceed the energy requirements of building regulations". It defines "energy efficiency requirements" as standards that are endorsed by national regulations, national policies, or guidance issued by the secretary of state. It defines 'energy requirements' as regulated energy only (the energy affected by Part L of building regulations – this does not include plug-in appliances).

Precedent adopted plans generally require a carbon saving to be achieved through energy efficiency ranging from circa 5-15% against the emissions rate set by Building Regulations Part L 2013. In the precedents we have examined, these targets were set according to the typical 'best practice' already being achieved in recent local new developments.

An apparently unprecedented alternative could be a percentage improvement on the 'Target fabric energy efficiency' (TFEE) set by Part L and SAP. The TFEE is the legal limit on how much heat a home needs per m^2, based on the *fabric* not the efficiency of the heating *system*. Part L sets the TFEE to reflect a home of the same size and shape to the proposed home, with a certain minimum standard of insulation, glazing and airtightness. The TFEE therefore varies by the size and shape of the proposed building. By law, new homes must not exceed the TFEE. An improvement on the TFEE would demonstrate effort at this stage of energy hierarchy. The requirement could be a % improvement on the Part L 2021 TFEE, or could be set as an absolute kWh/m2/year figure that the proposed home must achieve. The target may need to be updated when Part L 2025 (Future Homes Standard) enters force.

Potential targets for fabric energy efficiency	Justification
Homes: 10% improvement on the Target Fabric Energy Efficiency Rate set by Part L 2021 using SAP10.2 Non-residential: Energy efficiency measures (fabric and supply) to deliver 19% reduction in carbon emissions compared to Part L 2013 or equivalent vs Part L 2021.	As of June 2022, the new national baseline is Part L 2021. In 2025 it will be replaced again by the Future Homes Standard, which has upgrades to the building fabric. This 10% figure represents the approximate difference in fabric (average of all building element U-Values and airtightness) between Part L 2021 and Future Homes Standard 2025. Unfortunately, the Future Buildings Standard specification 2025 for *non-residential* buildings has not yet been released so no equivalent percentage can be calculated at present. Meanwhile, a 19% improvement on Part L 2013 has been demonstrated feasible and viable in Milton Keynes (see case study).
Homes and schools: 15-20kWh/m^2/year Fabric Energy Efficiency using Part L SAP10.2. Additional energy reporting with PHPP or TM54.	Homes: kWh limit shown to be necessary for the UK to stick to its carbon budgets between now and 2050, and reach the net zero goal by 2050. Schools & homes: kWh limit shown to be feasible in emerging precedent evidence bases (Greater Cambridge & Central Lincolnshire). However, this evidence used different energy modelling methods (PHPP or TM54) because SAP/SBEM are inaccurate at predicting energy usage.

Precedent: New London Plan (adopted 2021)

As part of its requirement for an overall 35% reduction in carbon emissions against the building regulations baseline, London requires that part of this carbon reduction is achieved through energy efficiency measures, as follows:

- *New homes: 10%*
- *Other new buildings: 15%.*

A topic paper on energy efficiency (within the New London Plan evidence base) explains the evidence that justified how this was set:

London's requirement for a total 35% reduction in Part L carbon emissions in major developments had been in place since 2013, but not much of this was being delivered through energy demand reduction. Instead, developers were showing the reduction through energy supply, expedited by grid carbon reductions.

The GLA commissioned a study of the carbon savings achieved through energy efficiency across major developments' energy statements submitted to the GLA in 2013-2017 to understand what was already possible with best practice:

- The average carbon saving achieved from energy efficiency alone was only 3.5% (in homes), 11.6% (non-residential) or 6.3% (mixed-use)
- But much higher performance was achieved in many cases (37% of new home projects achieved at least a 5% reduction, and 13% achieved a 10% reduction)
- New homes could technically achieve a 5 – 10% reduction, and other buildings could technically achieve a 15% reduction in many cases.

The GLA the commissioned a further detailed study of the implications of achieving an energy efficiency target of this sort for a set of typical development types. It found that homes could typically achieve a 10% improvement just through the then-current best practice. It also found that offices could achieve a 15% improvement and schools could get close to this.

These percentage improvements were tested and found to be viable for most development types. They were therefore adopted, with flexibility for certain non-domestic development types such as hotels which would struggle to meet the target due to high hot water demand.

The London Plan 2021 also requires action on *unregulated* energy use:

- Policy SI 2 (E): "calculate and minimise carbon emissions … that are not covered by Building Regulations, i.e. unregulated emissions".
- Supplementary guidance instructs that unregulated energy calculations should use "BREDEM (BRE Domestic Energy Model) 2012 methodology".

Precedent: Milton Keynes Local Plan 2019

Milton Keynes Local Plan 2019 Policy SC1 includes a requirement for a reduction of **19% on the building regulations carbon emission rate**, followed by a ***further*** **reduction of 20% through the use of renewable energy** and low/zero carbon technologies.

The latter 20% would fall under step 3 of the energy hierarchy ('be green'), implying that the **first 19% must be achieved through the first two steps of the hierarchy (reducing energy demand, and supplying energy efficiently)**[5]. Milton Keynes draft Sustainable Construction Supplementary Planning Document 2020 explains why the overall requirement is considered to be feasible:

> "We do not anticipate that the requirement to exceed the TER[6] by 19% will be unduly onerous for developers, as our analysis of BRUKL[7] data for consented schemes in Milton Keynes indicates that on average an improvement of 41% over the TER is already being achieved at the design stage."

[5] This is within reason. Bioregional recently worked on a mixed-use planning application in Milton Keynes whose homes achieved a carbon emissions reduction of approximately 26% using energy efficiency measures only. For the non-residential parts of the scheme this figure was 25%. The scheme then adds renewable/low carbon measures to achieve a further 20% site-wide carbon emissions reduction. The site-wide total carbon emissions reduction is 51.39%. Homes were flatted blocks. Non-residential spaces were office, retail and gym.
[6] Building regulations Target Emission Rate for carbon dioxide
[7] BRUKL is Building Regulations UK Part L: the energy data that must always be submitted in order to pass building control.

Efficient energy supply

This stage of the energy hierarchy is also referred to as ‘be clean’.

This step generally refers to measures to use heat networks to distribute heat efficiently and cleanly and with minimal losses.

Heat networks usually serve several buildings or sites from a common energy source, and can be expanded over time to serve more sites. Networks have variously included:

- Heat networks fed by local waste heat sources such as from waste incineration or data centres which generate a lot of heat as a by-product of their normal activity
- Heat networks fed by large-scale heat pumps (taking energy from air, ground or water sources) at a standalone energy centre that does not ‘belong’ to any individual new building
- Heat networks fed by CHP plant (combined heat and power), essentially a small-scale power station which burns fuel to generate electricity and heat at the same time. This was previously seen as ‘efficient’ because the CHP plant would be close enough to homes and businesses that the heat could be reused. This is generally no longer seen as a sustainable option because they almost always run on fossil gas which needs to be fully phased-out to meet net zero carbon goal and carbon budgets, unless carbon capture technologies emerge in future. The electrical grid now provides electricity at a lower carbon intensity than a CHP plant, and heat pumps are a more efficient and cleaner heat source which is ready to reach zero carbon as the electrical grid decarbonises, and avoids the negative air quality impacts that come with fuel combustion in CHP.

Because local waste energy sources are extremely geographically site-specific and because heat networks in general are dependent on a relatively high density of heat demand, it is not appropriate to seek a universal carbon percentage reduction that should be achieved at this stage of the energy hierarchy.

Because heat networks are often powered by waste incineration or fossil gas – neither of which currently has a path to zero carbon – there is a risk that a building connected to a heat network may not necessarily save carbon compared to a building with an individual heat pump other electrical heating combined with renewable electricity supply. One grey area is waste incineration, where the incineration may occur whether or not the heat is reused. A case-by-case treatment may be the most logical approach (considering the counterfactuals and embodied carbon of the new network).

Thus, it may be beneficial to design a policy so that heat network connection is only sought where the heat source is low- or zero-carbon and/or a lower carbon solution to individual electrical heating solutions per building. If the local plan also has a policy requiring on-site renewable electricity generation (see section), then it is likely that individual heat pumps run on this renewable electricity would be a lower-carbon solution than a heat network – unless in major mixed use development, in which case a communal heat sharing network driven by heat pumps could be the optimal solution as these can (if correctly designed) enable recycling of heat rejected from cooling systems at commercial uses at the scheme.

Local plan precedents (see overleaf) are therefore instead expressed as:

- A requirement to connect to an existing or planned heat network, if present
- A requirement to have an energy strategy that is compatible to connect to a future heat network, if the proposed development is within suitable area identified in a heat mapping exercise
- An acknowledgement that lower-carbon energy options may be available, in which case the heat network connection will not be required, and
- An acknowledgement that the requirement may be waived if there are unsolvable feasibility or viability obstacles which make heat networks unsuitable for the specific scheme.

Precedent: New London Plan 2021

Policy SI3: Energy Infrastructure

This policy requires that major development proposals within identified 'Heat Network Priority Areas' should have a communal low-temperature heating system, whose heat source should be selected according the following hierarchy:

a. Connect to local existing or planned heat networks
b. Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
c. Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
d. Use ultra-low NOX gas boilers (which must meet requirements of a separate air quality policy).

Where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.

Precedent: Milton Keynes Local Plan 2019

Policy SC2: Community energy networks and large scale renewable energy schemes

This policy requires that:

- Major development proposals should consider the integration of community energy networks in the development. This consideration should form part of development proposals and take into account the site's characteristics and the existing cooling, heat and power demands on adjacent sites
- All new developments in proximity of an existing or proposed combined heat and power (CHP), combined cooling, heat and power (CCHP) station or local energy network will be expected to connect to the network unless it can be demonstrated that:
    1. A better alternative for reducing carbon emissions from the development can be achieved; or
    2. Heating and/or cooling loads of the scheme do not justify a CHP connection; or

1. The cost of achieving this would make the proposed development unviable.

Summary: Options for Part L-based energy efficiency policy requirements (energy demand reduction and energy efficient supply)

Percentage reduction on Part L 2013 through energy efficiency (demand reduction and efficient supply)	Justification
10% in homes 15% in nondomestic buildings (except hotels and schools, to be considered case-by-case)	Shown to be feasible and viable across London in 2013–2017 via analysis of consented schemes; adopted as minimum policy across London. Although London's viability is different from Rutland's , this performance was achieved several years ago and should have disseminated to other regions via ongoing industry advances. Not ideal as Part L 2013 baseline becomes obsolete in June 2022 (therefore further analysis needed to update percentages).
19% in major residential proposals	Shown to be feasible in Milton Keynes via analysis of recent consented schemes' energy statements; evidently acceptable in planning terms via precedent of the adopted MK local plan. As above, 2013 baseline now obsolete.
Custom % reflecting typical best practice in RCC	Analysis of recent successful applications in Rutland (from building control) to ascertain and demonstrate that the target is feasible locally. Not recommended as it will not deliver much improvement on existing practice and would require additional analysis.

Renewable and low carbon energy at new buildings

The third step of the energy hierarchy is to decarbonise energy supply: both electricity and heat. The Committee on Climate Change 2019 report ('UK housing: Fit for the future') identified that grid decarbonisation is a vital component in the trajectory towards net zero. Onsite renewable generation at new buildings supports this in two ways. First, it drives investment in additional renewable electricity, and second, it can simultaneously reduce peak and annual demand on the grid.

Requirements for renewable or low-carbon energy supply can be expressed as:

- A further percentage reduction in carbon emissions against the building regulations baseline, in addition to the percentage achieved through fabric (*see precedent from Milton Keynes*), **or**
- A 'Merton Rule'[8]; where the proposal must include renewable energy generation equipment on-site or near-site, sufficient to meet a certain proportion of the building's own energy demand (see precedents below from Solihull and Oxford). This can be total energy, or regulated energy only. This uses the Energy and Planning Act power to require a 'reasonable' proportion of the development's energy use to be from renewable sources in the locality.

The value of onsite generation has long been recognised in local planning policy, but has not been without its critics. It has sometimes been argued that the prescriptive nature of such policies may not be applicable for all sites and can occasionally lead to the installation of inefficient onsite renewables[xliv]. Some sites may not be able to meet a very high requirement for renewables, such as if they are overshadowed (meaning solar PV panels would not work well), or if it is a tall building where there is a larger amount of internal floor space demanding energy but a relatively smaller roof space for PV.

We would therefore recommend including enough flexibility to accommodate unique site constraints, whilst still seeking an ambitious amount of appropriate onsite LZC technologies in all proposals. There is a growing number of adopted precedent policies that set specific targets for onsite renewable generation towards net zero carbon target. In practice, these policies are often applied flexibly if the developer can show how and why it was not possible to meet the required metric and that they have pursued renewable energy measures to the greatest reasonable extent. (See Oxford precedent).

Defining 'low and zero carbon technologies'

If setting a plan policy requirement under this stage of the energy hierarchy, it will be necessary to define the types of measures that will count as 'renewable / low and zero carbon technologies'. Some technologies, such as solar PV panels, solar thermal and turbines, always count. Other technologies – such as heat pumps – may need clarification on where to account for these in an energy statement.

Heat pumps are not automatically zero carbon – they still use mains electricity to run. But they can be a low carbon heating system provided they run at high efficiency (they can deliver about three times as much heat energy as they consume in electrical energy, because take ambient heat from outdoor air – thus there is a renewable element to the heat they deliver). To achieve this level of efficiency, they need to provide heat at a relatively low temperature. This becomes feasible if the heat pump is used in combination with improved thermal efficiency and reduced air permeability. (Read more)

The developer could make the heat pump zero carbon by supplying its electricity from a renewable source such as rooftop solar panels, so long as they are generating the renewable electricity at the same time the heat pump is running or if the building can store the solar electricity in a battery for later use. You will need less energy from your solar panels to run your 300% efficient heat pump, compared to using your solar panels to run direct electric heating which can only ever be 100% efficient – therefore you don't need as many solar panels, resulting in savings in embodied carbon.

Carbon savings from heat pumps are usually treated in planning guidance under the same step of the energy hierarchy as renewables – that is Step 3/'Be Green'. For example, London Plan draft energy guidance[xlv] asks that heat pumps be accounted for as a Step 3 measure, unless they are powering a heat network, in which case all heat from the heat network would be a Step 2 ('be clean') measure.

Counting heat pumps as a Step 3 / 'be green' measure' gives more flexibility in options for buildings to achieve carbon reductions at this stage even if the building is not suitable for solar panels due to shadow or orientation.

Precedent: Sutton Local Plan (adopted 2018) Policy 31

In Policy 31, All proposed development must apply the Mayor's energy hierarchy in the following order:

1. Being built to 'the highest standards of energy efficient design and layout',
2. Supplying energy efficiently (low or zero-carbon heat networks and cooling networks),
3. Using on-site renewable energy to achieve a reduction in total CO^2 emissions (regulated and unregulated) of 20% in major developments or 10% in minor developments.

Precedent: Milton Keynes Local Plan 2019 (adopted)

Policy SC1 (Sustainable Construction) includes that:

All proposals of 11+ dwellings or non-residential space over 1,000m^2 must apply the energy hierarchy to achieve:

1. A ≥19% reduction on Building Regulations 2013 carbon emissions,
2. A further ≥20% reduction through renewables (onsite or a local network),
3. The developer must then pay to offset remaining carbon emissions (regulated and unregulated – see 'carbon offsets' section further on in this brief).

[8] The original Merton Rule (introduced in 2003) required only 10%, but more recently adopted and emerging local plans aim higher.

Emerging precedent: Solihull Local Plan: Draft Submission Plan 2020

Policy P9, point 3, requires that:

At a site level, development must apply the 'energy hierarchy' to reduce energy demand for heating, lighting and cooling and minimise carbon dioxide emissions as follows:

- All new dwellings to achieve 30% reduction in energy demand/carbon reduction improvement over and above the requirements of Building Regulations Part L (2013) at the time of commencement up to March 2025.
- From April 2025 for all new dwellings to be net zero carbon.
- Minor non-residential development will conform to at least BREEAM Very Good and major non-residential development will conform to at least BREEAM Excellent.
- Provide at least 15% of energy from renewable and/or low carbon sources for all major housing developments and non-residential developments of 1000sqm or more

Standalone renewables

Allocating (or identifying suitable) sites for renewable energy generation, storage and distribution is a way in which a local plan can proactively facilitate the transition to net zero carbon, not just for new growth but for existing buildings and transport.

The National Planning Policy Framework actively encourages this:

- Paragraph 155: "To help increase the use and supply of renewable and low carbon energy and heat, plans should ... provide a positive strategy for energy from these sources ... [and] consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development".
- Paragraph 156: "Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans".
- Paragraph 158: "When determining planning applications for renewable and low carbon development, local planning authorities should not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions".
- Paragraph 158b: "Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas."

We again note that Planning Practice Guidance confirms that local planning authorities hold decisions over renewable energy development of 50 megawatts or less, and may soon hold decisions over onshore wind over 50MW[xlvi]. Also as of 2020, energy storage of over 50MW is now the domain of the local planning authority, except pumped hydropower[xlvii].

Growth of renewables, enabling the phase-out of coal in power stations, has been a key driver of the UK's carbon emissions reduction in the past 15 years. Renewables will next have to grow even faster to enable the phase-down of fossil fuel gas in power stations, and to keep pace with larger electricity demand as buildings and transport gradually switch from gas, petrol and diesel to electricity.

As previously cited, to meet the UK's legislated carbon budgets we should be planning to enable for wind and solar power to meet 80% of overall electricity demand by 2050 – which means a growth of 3 megawatts per year for both wind power and solar power respectively. Some of the wind power will be offshore, but not all. While some renewable energy installations can be a sensitive subject in some locations, if the UK's net zero carbon transition is to be equitable then all local areas will need to accept a fair share of renewable energy development. The RTPI notes[xlviii] that the process of planning for renewable energy can be supported by early and open processes to engage with communities to identify the most suitable sites and understand the need and potential additional benefits.

The RTPI notes[xlix] that alongside renewable generation, local plans should also aim to bring forward energy storage and smart systems to bridge gaps between production and demand. It stresses that the policy itself is not the whole answer – rather it is also essential to familiarise council members and planning officers with the likely issues in determining planning applications for energy storage.

As set out in the previous section on the recent NPPF consultation. Onshore wind continues to be treated differently to alternative energy generation technologies, whether renewable or not. Until onshore wind has equal opportunity to other energy development, it will become increasingly difficult for local authorities to meet net zero targets.

Precedent: Swindon Borough Council's use of Local Development Orders (LDO) to expand renewable and low carbon energy systems

Swindon Borough Council has used LDOs to promote the growth of renewable energy generation and use, both on specific sites and in borough-wide terms.

Examples include:

- A borough-wide LDO for district heating
- Identifying specific sites for solar photovoltaic arrays including solar farms. The LDO on solar farms has been particularly successful, by de-risking the process. It was created by issuing a 'call for sites' and then assessing these sites against various criteria.

Precedent: Cornwall Climate Emergency Development Plan Document

Policy RE1 enhances the potential for onshore wind development as the Policies Map identifies broad areas that may be suitable for onshore wind schemes, which is required by national policy for a scheme to be approved.

Notable criteria required for policy compliance include:

- 10% biodiversity net gain (ahead of national policy)
- Commercial led energy schemes over 5MW shall provide an option to communities to own at least 5% of the scheme

Setting absolute targets for energy use intensity, space heating and on-site renewable energy generation

There is a growing number of local authorities pursuing the industry-recommended approach to achieving genuine net zero new build development. The approach does not use baselines and % reductions based on previous iterations of Part L and instead sets threshold limits on energy use. A policy that follows this approach sets three key requirements:

1. Energy use intensity (EUI) – the predicted total amount of regulated and unregulated energy used.
2. Space heating demand – the amount of energy required to heat the building.
3. On-site renewable energy generation – must match total energy to be a net zero building.

Comparison of targets for residential development

Space heating demand (kWh/m²/year)	Energy use intensity (kWh/m²/year)	Target referenced
30	40	Cornwall Climate Emergency DPD
		Bath & North East Somerset Local Plan Partial Update
15-20	35	Central Lincolnshire Local Plan
		Greater Cambridgeshire Draft Local Plan
	n/a	Committee on Climate Change
15	35	London Energy Transformation Initiative
		CIBSE
		Good Homes Alliance

The EUI target includes all energy used by the building, importantly accounting for unregulated energy, which Part L does not. EUI does however exclude contributions from renewable energy generation and does not consider electric vehicle charging in the calculation. Reducing the energy used by the building is the primary aim of the EUI approach, which can then be supplemented to net zero by the renewable energy generation requirement that supplies the energy demand of the building.

Following an energy metric approach ensures more control over the fabric and systems installed in buildings. For example, high performance U-values are essential to achieve space heating demand targets set out above. Part L of Building Regulations does not however guarantee such high-performance since absolute energy targets are not set for certain building typologies. An additional benefit of this assessment is that EUI can be easily monitored and verified in practice from meter readings.

Additionally, the EUI target essentially bans the use of on-site fossil fuels, and more specifically, gas boilers for heating. Although explicitly stating the bans of gas boilers in policy wording may cause concern, the EUI target does this implicitly since gas boiler efficiency (c. 90%) will likely result in too large a contribution of overall energy use to result in a compliant EUI value. Contrarily, the superior efficiency of heat pumps makes achieving the EUI target significantly easier, as the technology can produce over 3 units of heat per 1 unit of electricity used.

Particularly for more stringent EUI and space heating demand targets, as proposed by Central Lincolnshire and Greater Cambridgeshire, more than just the installation of a heat pump and high fabric efficiency will be required to achieve such targets. To meet the more stringent targets, decisions must be made at an early stage of the development process to make appropriate decisions on form factor, glazing ratios and building orientation. These decisions will contribute towards the maximisation of energy demand reductions and the ability of the renewable energy generation system to create an on-site net zero energy balance.

This remedies a key weakness in Building Regulations, which fail to incentivise applicants to design a building with an inherently thermally efficient form or orientation because all of the Part L targets are not fixed targets but are set in relation to a building of the same size and shape as the proposed building.

To further strengthen a policy informed by this approach, a robustly accurate energy modelling methodology will need to be used. SAP 10.2, used for Part L compliance, is currently unable to accurately assess unregulated energy since the relevant equation is based on 1998 appliances, which clearly does not reflect modern efficiencies. It is therefore more difficult to comply with an EUI target using SAP because the proportion of unregulated energy, which can be up to 50%, is severely overestimated. SAP also frequently underestimates space heat demand by up to 270%, and SBEM has also been shown to generally underestimate overall energy use.

To mitigate such inaccuracies, an alternative energy modelling methodology is required to ensure design-stage performance values correspond to the as-built performance of the building. The industry-recommended energy modelling method to minimise such a performance gap is Passive House Planning Package (PHPP), which is used for the leading Passivhaus standard. Contrary to common misconceptions, PHPP can be used without needing to pursue the stringent Passivhaus certification process.

An alternative accurate energy modelling calculation method, if used correctly, is CIBSE TM54. TM54 works by starting with the SBEM calculation and making adjustments to the inputs to reflect how the building will be used based on reasonable adjustments about occupancy and so on.

On-site renewable energy generation must match the EUI (multiplied by the floor space) to reach an on-site net zero energy balance. In the majority of cases, this has been shown to be technically feasible for EUI targets up to 40 kWh/m²/year. The taller the building, the less likely it is that there will be sufficient roof space to match EUI. However, even for such taller, more shaded buildings, façade-mounted panels and other ground-mounted renewable energy technology should be considered.

Several precedents are explored overleaf, which, although they take a similar approach, have received very different reactions from their respective Inspectors during examination.

Confirmed precedent: Salt Cross Area Action Plan

Proposed Policy 2 (Net Zero Carbon Development) opens by stating that:

> "Proposals for development at Salt Cross will be required to demonstrate 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 [policy compliance]".

The policy sets energy target metrics to be calculated using **PHPP or CIBSE TM54**:

- **Space heat demand** of 15kWh/m^2/year
- **Energy use intensity**:
  - Residential – 35 kWh/m^2/year
  - Office – 55 kWh/m^2/yr
  - Research labs – 55 –240 kWh/m^2/year
  - Retail, sports/leisure – 80 kWh/m^2/yr
  - Community space (e.g. healthcare) – 100 kWh/m^2/year
  - School – 65 kWh/m^2/year
- On-site renewable energy to match 100% of energy consumption.

The Inspectors' requested Main Modifications (26th May 2022) asks for the whole opening paragraph to be removed and replaced with text requiring only that proposals "demonstrate an ambitious approach to the use of renewable energy [and] … a high level of energy efficiency in new buildings. An energy statement will be required for all major development, which should include the consideration of the feasibility of incorporating the following principles". The Inspector then asks to "remove references to absolute requirements and KPIs that must be met and instead to reframe as standards for consideration as part of an energy statement".

These main modifications were implemented and subsequently altered the policy to one that is no longer net zero. The removal of all mandatory numeric targets means planning officers have no grounds to refuse a proposal that fails to comply.

The Inspectors' accompanying note[1] states that "we are not satisfied that Policy 2 is either consistent with national policy or justified". The full report was made available in March 2023 to explain why they reached this conclusion. Inconsistency with national policy and exceeding standards set out in the 2015 WMS were stated as primary reasons for rejection. The Inspectors added that a lack of detailed site-specific assessment for other policy options and explanation for the selected approach contributed to the final decision.

Although the AAP and its evidence base refer to global climate science and the UK's net zero carbon target, they do not explicitly clarify how these exact energy targets are necessary for the UK to meet its legislated carbon budgets, thus vital if the plan is to meet its duty to mitigate climate change in line with the Climate Change Act.

Confirmed precedent: Cornwall Climate Emergency Development Plan Document

The Cornwall Climate Emergency Development Plan Document (DPD) was adopted in February 2023 and retained all key elements of its net zero carbon policies.

Policy SEC1 (Sustainable Energy and Construction) includes that (paraphrased):

1. Major non-residential development (over 1,000m^2) to achieve BREEAM Excellent (or "equivalent or better methodology")
2. New residential development to achieve all of the following:
   i. Space heating demand of <30kWh/m2/year
   ii. Total energy consumption of <40kWh/m2/year
   iii. On-site renewable generation to match the total energy consumption, with a preference for roof-mounted solar PV.
   Where it is not feasible or viable to include enough renewable energy generation to match total energy consumption, the development should pursue the following:
   - Renewable energy generation to be maximised as far as possible
   - Connection to an existing or proposed district energy network
   - Offset the residual energy demand by a contribution to Cornwall Council's Offset Fund.

This is supported by evidence in the form of energy modelling analysis[1] by expert green building engineers. This analysis used accurate energy modelling method (PHPP) to identify a range of energy performance targets that are feasible in Cornwall and can reach the net zero carbon target in a variety of ways (different combinations of fabric / energy efficiency and renewable energy measures). This evidence piece also compared the proposed 'net zero carbon' building performance options against how a building would perform if it simply met the Future Homes Standard.

The analysis included cost information for each modelled building that was then used in the viability assessment for the DPD. That viability assessment found that most residential development scenarios remained viable with the policies applied, and that the majority of the cost uplifts over the 2013 building regulations will be incurred by developers anyway in order to meet the new 2021 building regulations, even without the local plan carbon policy.

Contrarily to the Salt Cross AAP, the Inspector's report positively stated that the 2015 WMS has clearly been overtaken by more recent events.

Confirmed precedent: Bath & North East Somerset Council Local Plan Partial Update

The Local Plan Partial Update (LPPU) was adopted in January 2023 and became the first local plan in the UK to set net zero energy standards for new housing.

Policy SCR6 sets identical standards to Cornwall for residential development and was informed by the same technical evidence base. As set out in the Sustainable Construction Checklist Supplementary Planning Document, PHPP is required for major development, whilst an option to use SAP with the Energy Summary Tool is available for minor residential development. The Energy Summary Tool adjusts outputs from SAP to reflect in practice performance. These options reflect the same approach as Cornwall. It is however important to note that the calculation approaches were not tested at examination as the requirements are set out in supplementary guidance.

A specific technical study for the Bath & North East Somerset (B&NES) area was not seen as necessary because Cornwall and B&NES share the same prominent housing typologies and climate patterns that influence the efficiency of solar PV to provide an on-site net zero energy balance.

A key piece of evidence that assisted B&NES to successful adoption was a letter received from DLUHC, which reiterated the fact that local authorities are able to set standards that exceed Building Regulations i.e. that exceed the standards set out in the 2015 WMS. The 2015 WMS was not explicitly stated in this correspondence from government, yet the clarification on exceeding Building Regulations all but confirms that the 2015 WMS is no longer relevant.

This view was directly stated in the Inspector's report:

"*The **WMS 2015 has clearly been overtaken by events** and does not reflect Part L of the Building Regulations, the Future Homes Standard, or the legally binding commitment to bring all greenhouse gas emissions to net zero by 2050.*

*I therefore consider that the **relevance of the WMS 2015 to assessing the soundness of the Policy has been reduced significantly**, along with the relevant parts of the PPG on Climate Change, given national policy on climate change. The NPPF is clear that mitigating and adapting to climate change, including moving to a low carbon economy, is one of the key elements of sustainable development, and that the planning system should support the transition to a low carbon future in a changing climate. Whilst NPPF154b sets out that any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards, for the reasons set out, that whilst I give the WMS 2015 some weight, any inconsistency with it, given that it has been overtaken by events**, **does not lead me to conclude that Policy SCR6 is unsound, nor inconsistent with relevant national policies**."*

The logical view provided by the B&NES Inspector appropriately summarises the context of local authority powers to set their own energy efficiency standards. In contrast, the West Oxfordshire Inspectors' views represent inconsistency in decision making on net zero policies at PINS. As more local authorities propose ambitious policies that will need to be weighted against consistency with national policy, increased consistency should become apparent.

Confirmed precedent: Central Lincolnshire Local Plan

The Central Lincolnshire Local Plan was adopted in April 2023[1]. The adoption of this plan is significant as the energy requirements for Policy S7 and S8 are aligned with recommendations from LETI and the Committee on Climate Change.

Proposed Policy S7 (Reducing Energy Consumption - residential) includes that:

> "Unless covered by an exceptional basis … all new residential development proposals must include an Energy Statement which confirms in addition to the requirements of Policy S6 that all such residential units:
>
> 1. Can generate at least the same amount of renewable electricity on-site (and preferably on-plot) as the electricity they demand over the course of a year, such demand including all energy use (regulated and unregulated), calculated using a methodology proven to accurately predict a building's actual energy performance; and
> 2. 2. To help achieve point 1 above, target achieving a space heating demand of around 15-20kWh/m^2/yr and a total energy demand of 35 kWh/m2/yr … No unit to have a total energy demand in excess of 60 kWh/m^2/yr [which means] the amount of energy used as measured by the metering of that home, with no deduction for renewable energy."

The policy also includes a clause to address the energy performance gap:

> "The Energy Statement must include details of assured performance arrangements. As a minimum, this will require:
>
> a) The submission of 'pre-built' estimates of energy performance; and
> b) Prior to each dwelling being occupied, the submission of updated, accurate and verified 'as built' calculations of energy performance. [This] should also be provided to the first occupier … Weight will be given to proposals which demonstrate a deliverable commitment to on-going monitoring of energy consumption … which has the effect … of notifying the occupier [if] their energy use appears to significantly exceed the expected performance of the building, and explaining to the occupier steps they could take to identify the potential causes."

Proposed Policy S8 (Reducing energy consumption – non-residential) replicates the clauses except with a higher permitted total energy demand of 70-90kWh/m^2/year. The assured performance clause is also mirrored.

If a non-residential proposal can demonstrate why the metrics are not achievable, it can instead source renewable energy from off-site, pay the local authority to deliver equivalent renewable energy or other offsite infrastructure to deliver the appropriate carbon saving, or connect to a decentralised energy scheme.

Alternatively, a non-residential proposal may demonstrate achievement of BREEAM Excellent or Outstanding, instead of complying with the energy metrics.

Carbon offset payments

Carbon offset payments are sometimes set as a Section 106 requirement in order to make a development's unavoidable carbon emissions acceptable through off-site actions to mitigate them.

Carbon offset payments from developers were pioneered by Milton Keynes in 2008 and later adopted by Ashford and Islington, then across London, and now also Reading. These funds are meant to deliver actions that will prevent or remove the same amount of carbon that the development is calculated to emit over a certain number of years. Several key differences arise in how this kind of policy is applied:

- Calculation and scope
- Pricing
- Collection and spending.

Calculation and scope

Key differences here are:

- Whether to offset only regulated carbon emissions as calculated by SAP or SBEM (national calculation methods), or also unregulated emissions (and how to calculate these if so)
- Number of years of carbon emissions that the developer should pay for
- When the calculation should be performed – i.e. at the time of planning application, or on completion or post-occupation to ensure the offset amount reflects reality.

In the London Plan 2021, only regulated emissions must be offset (as calculated by SAP/SBEM). Some local authorities in London and elsewhere also seek offsets for unregulated emissions.

Where local plans require offsetting to 'net zero' we have not found any examples that use a non-SAP / non-SBEM method to calculate the *regulated* portion of the carbon emissions that must be offset (although some seek offsetting of the *unregulated* portion using a different method).

Pricing

- Either tied to a nationally recognised 'carbon price' such as the BEIS carbon valuation,
- Or the cost of delivering local projects that would remove or prevent the same amount of carbon.

The recommended London offset price is based on a 2017 study by AECOM. This explored the range of costs to enact carbon-saving projects, minus the amount of 'copayment' that can be secured (e.g. if homeowners pay part of the cost towards insulating their home, and the fund pays the rest). These projects mostly consisted of retrofitting existing buildings with insulation or renewables. It concluded:

> "Given the wide variability in the costs and carbon savings for potential carbon offsetting projects combined with the uncertainty in the percentage copayments that could be secured, it would be difficult to assemble sufficient evidence … to analytically derive a robust [London-wide] carbon price based on the cost of offsetting projects. As such, the approach adopted in this study is to … base [offset] prices … on a nationally recognised carbon pricing mechanism".

The study then identifies a range of projects that could deliver carbon savings at no more than the same cost per tonne that would be set by the nationally recognised carbon price. Many of these projects would actually deliver carbon savings at a lower cost per tonne. This would enable some other projects to be pursued at a higher cost per tonne so that the fund delivers carbon savings at an average cost per tonne that is the same as the payment per tonne that would be received from developers at the nationally recognised price.

The study notes that offsetting must be considered in viability studies, and could be varied by the location in the same way that CIL zones differ. The London Plan 2021 lets boroughs set their own price, noting that "a nationally recognised non-traded price of £95/tonne has been tested as part of the viability assessment for the London Plan". The equivalent cost of offsetting based on the original £95/tCO_2 is now set at £378/tCO_2 (2023 price) to reflect a decrease in carbon intensity of the grid. 2018 Mayoral guidance notes some LPAs have based their price on the average cost of local projects to save carbon, e.g. Lewisham (£104/tonne), which is re-tested in a local viability assessment. We note that it is important that viability assessments must not 'double count' the cost impact of net zero carbon policy: that is, the viability assessment should firstly consider the cost of meeting policy requirements for carbon reductions on-site through improvements to the building, and then only apply the cost of offsetting the *remaining* carbon.

Collection and spending of offset payments

London mayoral guidance (2018) notes that offset payments should be collected via Section 106 agreements in the usual way and by the same team, and that:

> "LPAs generally choose to take **payment on commencement of construction** on site. Some choose to **split the payment**, with 50 per cent paid post-construction and 50 per cent prior to occupation. This is up to the LPA to determine. However, taking payment later than commencement of works can mean a high degree of uncertainty as to when funding will be received and is unlikely to enable carbon savings from the offset fund to be delivered before the development is occupied, creating a delay in offsetting a development's carbon impact. LPAs should also note the time limits that apply to discharging Section 106 agreements and ensure funds are collected and spent in this time period."

One potential pitfall is that carbon offset payments received via S106 agreements have sometimes had to be returned after not being spent in the allotted timescale. National Planning Practice Guidance notes that:

> "[S106] agreements should normally include clauses stating when and how the funds will be used by and allow for their return, after an agreed period of time, where they are not."

This can be avoided. London's 2019 annual survey of the use of offset funds notes that in that financial year, "No LPAs reported returning offset payments to developers" and also that "The GLA would not expect offset payments to be returned in any instance and expects LPAs to be collecting offset payments for all applicable developments and identifying suitable projects for spending funds."

The Centre for Sustainable Energy notes that developers can ask for a refund of carbon offset payments that are unspent within 5 years. To avoid this, it recommends setting up:

> "defined structures and processes to stimulate new markets and opportunities for carbon saving measures … [Creating] an open application process to stimulate and attract carbon

saving projects from council departments, the market and community that would be unviable without subsidy, for example community energy projects or insulation schemes. Applications should be proportionate to the scale of the funding provided, the emissions to be saved and the risk profile of projects."

"Programmes of standardised measures, low unit cost, low risk and lower variability of carbon savings (such as the many domestic insulation programmes, run by council housing departments) should be required to apply to the fund just once as a whole programme, with detailed implementation targets, specifications, predicted carbon savings and reporting processes and timetables. Once approved, it should be as simple as possible for residents, communities or businesses to access funding through these programmes."

The 2018 London mayoral guidance encourages LPAs to pool Section 106 carbon offset payments rather than committing to spend them on specific projects. When the guidance was written, local planning authorities were only permitted to pool up to five S106 payments towards the same project, but this restriction was removed in 2019 and this can now be pooled with CIL payments too. Councils using either CIL or S106 must publish an infrastructure funding statement annually. When setting the carbon price, the LPA should factor in a cost to administer the fund and set up a pipeline of projects to be funded.

Precedent: Milton Keynes

A 2016 review of offsetting practices noted that both Ashford and Milton Keynes originally established their local carbon price in 2008 using an estimate of typical costs of making carbon savings elsewhere in their respective districts. This was set at £200/tonne in 2008, plus inflation.

The MK Adopted Local Plan 2019 Policy SC1 retains this requirement: Offsets must be paid for carbon emissions that remain subsequent to complying with the first two requirements for a 19% reduction in Part L 2013 carbon emissions, plus a further 20% emissions reduction through renewable energy.

Milton Keynes adopted Sustainable Construction SPD 2021 notes that Policy SC1 does not require offsetting of *unregulated* emissions. This is notable because the draft version of that SPD (2020) had sought offsets for both both regulated emissions (calculated by SAP in homes or SBEM in non-domestic buildings) and unregulated emissions (calculated by BREDEM for homes; in nondomestic buildings this can be calculated using CIBSE Guide F, CIBSE TM54, or metered evidence from previous work). This requirement appears to have been removed after one public consultee pointed out that the SPD could not require this because the plan policy SC1 itself did not specify that it included unregulated energy.

This SPD confirms that the price remains at £200/tonne plus 'indexation fluctuations' which will be decided at the time of calculation. The developer must only offset 1 year of emissions, but the SPD notes that they may apply an annual multiplier in future iterations of the local plan.

Precedent: New London Plan 2021

Policy SI2 allows offset payments to partially meet the net zero carbon requirement. It applies to:

- Major development only
- Any regulated residual emissions over a period of 30 years, after enough upgrades have been designed-in to result in at least a 35% on-site reduction in the regulated emissions (using SAP/SBEM calculation).

There is no London-wide requirement to offset unregulated emissions, but major developments must still "calculate and minimise" these.

At least one London Borough (Islington) does additionally require an offset for unregulated emissions (as of a 2016 NEF review of practices across London).

The same NEF review found that most London local planning authorities (LPAs) require that the carbon is calculated at the time of the planning application. However, several of these LPAs then update the calculation later:

- Recalculation at detailed design stage or discharge of planning conditions (Croydon, Hackney, Islington, Hillingdon, Kingston)
- Recalculation at 'as built' stage, on completion (Brent, Enfield, City).

The London Plan Policy SI2 requires that each borough must maintain its own fund to hold and use these offset payments. This must be

- Ring-fenced for carbon reducing actions, and
- Its activities monitored and reported on annually.

Mayoral guidance (2018) expects the local carbon offset price per tonne to be based on:

  - either a nationally recognised carbon pricing mechanism (starting at £60/tonne as the nationally recognised non-traded price, although the Plan 2021 raises this to £95/tonne),
  - or the cost of offsetting carbon emissions across the local planning authority area.

Precedent: Islington Local Plan Core Strategy 2011

Policy CS10: "All major development should achieve an on-site reduction in total (regulated and unregulated) CO_2 emissions of at least 40% in comparison with … Building Regulations 2006" and the rest offset via a contribution at £920/tonne for one year's emissions, or a flat fee for minor developments.

Neither the policy nor SPD say how unregulated emissions should be calculated, nor do they differentiate between regulated and unregulated emissions for offsetting. This implies that unregulated emissions are included in the offsetting.

Energy offsetting

Due to the rising number of local authorities setting standards based on the approach set out in the previous section (with fixed energy targets and 100% renewable supply), energy offsetting is becoming more prominent. In this context, it is preferred over *carbon* offsetting because the cost of offsetting is based directly on residual kWh (£/kWh), instead of tCO_2 (£/tCO_2). Carbon intensity factors of the grid or other energy sources are not required for calculations when energy is offset (instead of a carbon offset), which leads to a more direct reflection of exactly what is being offset. Carbon factors for offsetting are often quickly outdated, and are somewhat crude in their estimation since they are annually averaged and do not reflect seasonal grid intensity variations. Planning decisions on carbon offsetting could also face a stumbling block around uncertainty about what the grid carbon factor will be by the time the development is completed; energy offsetting avoids this problem.

Energy offsetting simplifies the process for project selection due to the absence of carbon factors, since it becomes easier to assess how many kWh a new rooftop solar PV installation will produce, for example. This better ensures that the residual kWh that were not mitigated on-site can be directly measured and mitigated off-site through a funded project through an energy offset fund.

With *carbon* offset funds, several types of project including energy efficiency, retrofitting, and renewable energy could be appropriate for the delivery of those offsets, because the residual amount of CO_2 is not directly assigned to a particular measure. In some cases even tree planting is proposed despite uncertainty about its longevity, or transport measures despite uncertainty that this will deliver the required CO_2 savings in reality. This uncertainty can result in political disagreement about how to spend the fund on competing priorities, and administrative complexity in assembling a portfolio of projects, thus the required amount of carbon mitigation may not be swiftly (if at all) achieved.

When *energy* needs to be offset, it is usually due to a technical inability to deliver the required on-site renewable energy generation. This makes it a simple decision to spend the fund on off-site solar PV installations, preferably on existing buildings, which should aim to at least generate the residual on-site kWh. Through this simplified system, energy offsetting can become a reliable mechanism to ensure that any residual on-site renewable energy generation is wholly mitigated elsewhere.

It should however be explicitly noted that offsetting in this context, as well as a carbon offset context, should strictly be a last resort only acceptable in exceptional circumstances. The risk of offsetting is that it may increase the burden on existing countywide decarbonisation plans and use up low hanging fruit resources. Additionality must therefore be the primary consideration of both offset approaches to ensure that the offset funding delivers something that would not have otherwise been created.

To best guarantee offset mechanism effectiveness, a locally-specific net zero offset price should ideally be set, which should be based on the cost of existing delivered renewable energy schemes of varying size. Subsequently, an appropriate price should be set to sufficiently deliver the residual kWh not mitigated on-site. In recent precedents, prices to achieve this have been set at 9-12p/kWh.

Assuming the current electricity emissions factor in SAP10.2 (136 gCO_2/kWh), an estimated net zero local offset price - £652/tCO_2 for Bath & North East Somerset Council – can be close to double the price of the 2023 BEIS Green Book valuation of £378/tCO_2. This represents the importance of a correctly set price, which otherwise risks insufficient funds to deliver the residual on-site energy elsewhere.

A recent study by the Centre for Sustainable Energy (CSE) for West of England (WoE) authorities determined the cost of energy offsetting based on 131 domestic rooftop PV installations that were delivered through the Local Authority Delivery Scheme (LADS), which was managed by Bristol City Council's energy service. The installation costs of solar PV projects through the LADS scheme well represents the costs of energy offset fund projects that are likely to occur in the WoE in the future, particularly due to the average installation capacity of 3.37kWp. The subsequent median installation cost under the LADS scheme was £2,180/kWp, in contrast to the BEIS installed cost statistics for 4-10kWp solar PV installations (2020-2021) value of £1,586/kWp. This again reiterates the importance of establishing a *locally-specific* offset price as nationally-averaged costs can produce a price 25% lower than the local cost, as demonstrated above. Using the £2180/kWp median installation cost value, an offset price (including 15% administration costs for the fund) of 9p/kWh was estimated by CSE, which can be considered a local net zero energy offset price for the West of England authorities.

Precedent: Cornwall Climate Emergency DPD (2023)

Policy SEC1 (Part 2b) "*allows offsetting where it is not feasible to meet all the renewable energy requirements for new-build residential and there is no connection to a low carbon district energy network*".

Cornwall will run a pilot offsetting spending scheme, which will install solar PV on existing Cornwall Council housing.

A study by the South West Net Zero Hub set the cost for energy offsetting, which is set at **10p/kWh** to reflect overall costs to deliver residual on-site renewable energy generation elsewhere. Over the assumed 30-year lifetime, the price accounts for:

- Administrative costs
- Annual maintenance
- Solar PV panel degradation
- Inverter replacement for a typical 3kW solar PV array for each home

Precedent: Bath & North East Somerset Council Local Plan Partial Update (2023)

Policy SCR6 provides a last-resort option for major development in exceptional circumstances.

The funds will be spent on solar PV installations on existing social housing and low-income households, which will be delivered in partnership with a community energy group and local housing provider.

A *study* by the South West Net Zero Hub established an initial local net zero cost for energy offsetting, set at £652/tCO_2 (converted from kWh). B&NES however selected the 2023 BEIS Green Book value of **£373/tCO_2**. 10% administrative costs are then added onto the final calculation for the lifetime financial contribution.

The lower yet nationally-recognised valuation was primarily selected due to time constraints with the Examination in Public, which did not allow the production of an in-depth study to establish a more robust local net zero offset price (an initial study only assessed one solar PV installation so was not deemed a robust basis for a price).

Emerging precedent: Bristol City Council Draft Local Plan (2022)

Bristol City Council have proposed two offsetting schemes in their Draft Local Plan: operational energy offsetting and embodied carbon offsetting. The latter is described in a following section, whilst operational energy offsetting is discussed here.

Policy NZC2 takes a different approach to energy offsetting to the two adopted precedents set out above. Instead of offsetting a shortfall to on-site renewable energy generation to meeting a net zero energy balance, it is residual kWh to energy use intensity that is to be offset as a last resort.

The offset cost is set at **9p/kWh** that is required over the typically assumed 30-year building lifetime. This is stated to be equivalent to providing additional renewable energy generation elsewhere in the city and is therefore a locally-specific net zero offset price. Cornwall (above) set a similar cost of 10p/kWh, which is the same as the estimated price for West of England authorities by the Centre for Sustainable Energy.

Energy performance gap

The energy performance gap is the difference between the predictions for a designed building's energy use, and the amount of energy it actually uses in operation. This is due to three factors:

1. Poor methods used to predict the energy use of a building (including poor calculations, incorrect assumptions, and exclusion of 'unregulated' energy loads)
2. Errors in construction which lead to worse airtightness or thermal envelope
3. Errors in system operation, and user behaviour different to assumptions (for example, turning up space heating while opening windows to dry laundry, not using heat system as intended, spending more time in the building than anticipated, or bright lighting left on overnight).

Unfortunately, the calculation methods used in Building Regulations Part L (SAP and SBEM) are very poor predictors[ii] of the actual energy use of a building. SAP and SBEM are compliance tools[iii], not really tools to predict energy and carbon performance (even though they purport to be). This is not only due to out-of-date carbon factors used for different energy sources, but the entire methodology.

For this reason, recalculating SAP on completion[9] will not prove that the building *performs* to the same metrics as in the SAP output (kWh/m^2 and CO_2/m^2), only that it is *built* as designed in terms of installed specification of insulation, heating system and renewable energy generation. The nation-wide lack of post-occupation energy monitoring means that both developers and planning/building control enforcers are often unaware of the scale of difference between SAP outputs and actual performance.

Point (2) above relates to how imperfections in the construction process can lead to worse energy performance than predicted. For example, a building may leak a lot of heat if insulation is incorrectly installed, or if a hatch to a cold loft is put in the wrong place and then moved, leaving holes in the air tightness membrane. Lower-spec products or poor substitutions may be made in the building –for cost-cutting reasons, supply difficulties, or simply because the right person was not on site at the time[iii].

Methods to address the performance gap

There are energy modelling methods that give much more accurate predictions than SAP/SBEM, such as the Passivhaus Planning Package (PHPP) and the CIBSE TM54 method. However, it is not entirely clear whether local planning authorities are legally empowered to require conformance with standards set using these alternative calculation methods because of definitions in the powers granted by Planning & Energy Act 2008 (discussed). The Local Plan may be able to require *reporting* of predicted energy use using these methods (subject to viability linked to the cost of the modelling), but it is uncertain whether the plan could require the building to *achieve* a certain metric using them (although please note the new precedents from Bath/North-East Somerset, Cornwall and Central Lincolnshire have all successfully required this, sometimes through supplementary guidance). Of the two, TM54 is likely to be more clearly supported by the 2008 Act as it uses building regulations Part L as a starting point[iv] and is now recognised in Part L 2021 for non-residential as a valid method to fulfil the new requirement for accurate energy forecasting).

There are also several quality assurance processes that can be applied during construction to avoid the unnecessary errors that can cause the building to perform worse than expected. Examples include:

- BEPIT (Building Energy Performance Improvement Toolkit) – a set of checks during construction that identify and remedy defects in the construction at every stage up to completion
- Passivhaus process – in addition to using accurate energy modelling, a Passivhaus project undergoes a series of stages during design and construction which improve the build quality
- NEF/GHA Assured Performance Process™ – this maps to the five stages of the RIBA Plan of Work (inception to verification) and involves expert impartial review by accredited assessor.
- Soft Landings – recommended by the UKGBC (as above) but discounted by some local planning authorities as an acceptable 'quality assurance' method (see precedent of Milton Keynes).

There may be other suitable quality assurance processes. These **must** be based on quality of energy performance, not just generic building quality. RCC would need to decide whether these are acceptable based on their individual merits and evidence that they are effective (verified by track record of previous projects' post-completion testing or post-occupation energy monitoring).

The Local Plan could require the use of these processes, subject to viability (again relating to the cost of appointing qualified professionals to undertake these processes). Proposals could submit:

- Energy modelling: evidence to be submitted in energy statement with planning application, and recalculation of this if any relevant details are changed at reserved matters / amendments.
- Quality assured construction: evidence to be submitted along with other documentation to gain sign-off on completion from building control and discharge of planning conditions.
- UKGBC Policy Playbook recommends "a recognised performance gap / assured performance tool will be used to minimise the potential performance gap between design aspiration and the completed development. The effectiveness of measures will be reviewed and ratified as part of the post-completion discharge of conditions".
- Evidence requirements in the case of no 'quality assured construction' scheme relating to energy use: set a standalone requirement to carry out air tightness tests whilst the air barrier is still accessible as a construction requirement, if the full use of specific third-party quality assurance schemes would make necessary development unviable.

Verifying energy performance post-completion

Post Completion certificates can be issued once Planning Conditions are discharged. Local Authorities can condition to ensure that buildings are performing as anticipated; however, this would require engagement with the main contractor outside of their practical completion contract. Precedents have sought this through an Area Action Plan and site-specific allocations.

There is debate about whether it is reasonable to hold developers accountable for carbon impacts of unregulated energy use, which would be untested by Part L SAP and largely out of their influence in terms of unconfirmed occupant fit-out, operational hours, occupancy, and other third-party factors.

[9] As-built SAP calculations have been used by several local authorities to determine the final amount of offset payments the developer must provide, but it does not verify performance or change the energy performance gap. Relying only on SAP will always mean the developer offsets far less carbon than the building will actually emit – although it does simplify the offset decision-making and data gathering process.

These uncertainties are larger in non-residential buildings, where there is a wider range of variation in how the buildings are used compared to residential building use patterns which tend to be more homogenous and predictable. However, even for non-residential, reasonable assumptions can be made about many of these uncertain factors, in order for the developer to include the appropriate amount of renewable energy in the design, even if the metered data in any post-occupation monitoring turns out to vary from the design-stage assumptions.

The following pre-completion testing requirements would help in the assurance of as-built performance against the design standard. Outline costs[10] are provided:

- Air tightness testing ~£1000 per property
- Thermographic testing[11] ~£400 per property
- U Value testing ~£400 for a dwelling (3 weeks per property)[12]
- Post-occupancy evaluation testing: ~£5000[13]. (if applied to scalable developments >c.50 dwellings, the economy of scale would reduce the cost burden through sample testing only).

[10] Communities and Local Government (2008), Performance Testing of Buildings BD 2535
[11] Thermographic surveys can only be completed during the heating season. Where building completion occurs outside that season, the applicant could commit test at the earliest opportunity and perform remedial measures where needed. Homeowners must be fully informed.
[12] Accredited construction details are to be checked through thermographic testing performed according to BS EN 13187: 1999 Thermal performance of buildings. Qualitative detection of thermal irregularities in building envelopes. Infrared method. Identified locations with deviations from expected performance are further investigated through a borescope survey and remedial works performed if practical.
[13] https://www.pollardthomasedwards.co.uk/download/PTEpost-occupancy_evaluation2015_LR.pdf

Precedent: Milton Keynes Local Plan 2019

Policy SC1 includes that:

- K. 5 All proposals of 11+ dwellings or non-residential space over 1,000m^2 must
    - "implement a recognised quality regime, which assures that 'as built' performance (energy use, carbon emissions, indoor air quality, and overheating) matches the calculated design performance", and
    - "Put in place a recognised monitoring regime to allow the assessment of energy use, indoor air quality, and overheating risk for 10% of the proposed dwellings for the first five years of their occupancy, and ensure that the information recovered is provided to the applicable occupiers and the planning authority..
- The Sustainable Construction SPD explains that a 'recognised quality regime' must include
    - (1) modelling of different scenarios at design stage and issuing performance targets such as kgCO2e/year or energy use (which must use expected usage profiles rather than standard ones, and should ideally include Dynamic Simulation Modelling using the National Calculation Methodology [SAP or SBEM] as a baseline),
    - (2) processes and plans in place to ensure everyone in construction and dwelling management knows how to avoid common reasons for the performance gap,
    - (3) suitable fabric testing and iterative feedback mechanisms,
    - (4) demonstrating that the 'as built' targets set are achieved, and
    - (5) third-party verification that the quality regime has been carried out.
- The SPD also asserts that the quality regime must ensure the post-occupancy data will be available by implementing a suitable metering and monitoring strategy that can deliver performance data to compare with the designed performance targets.
- The SPD also notes that two suitable regimes are the Quality Assurance sections of Home Quality Mark ONE, and BSRIA Soft Landings Framework.
- The above specified requirement for the 'quality regime' means that the developer must also test the 'as-built' performance and submit data to the council. A report is then submitted to both occupiers and to Milton Keynes Council, which states the performance gap metric and identifies any reasons for deviation from predicted energy usage, carbon emissions, indoor air quality and overheating performance, as well as specific actions that have or will be taken to reduce the gap.

Precedent: Greater London Energy Monitoring Guidance (2020)

The 'Be Seen' energy monitoring guidance (April 2020) requests that[lv]:

"Analysis guided by CIBSE TM54, which recommends using a tailored Part L model for the estimates of regulated and unregulated loads, should be undertaken and its findings should be reported in the 'be seen' reporting webform. A TM54 analysis gives more accurate predictions of a building's energy use. This approach also aligns with the reporting requirements under the GLA's Whole Life-Cycle Carbon (WLC) Assessment Guidance. The CIBSE TM54 findings should therefore also be used to represent the regulated and unregulated energy requirements for non-residential uses of Module B (operational energy use) of BS EN 15978."

Precedent: B&NES and Cornwall (2023)

Supplementary guidance from Cornwall Council, and the Sustainable Construction Checklist SPD from B&NES respectively set out compliance and reporting frameworks for the councils' recently adopted net zero homes policies.

Both documents recognise the inaccuracy of SAP to accurately assess building energy performance, particularly with policies that assess energy use intensity and space heating demand. To resolve issues with SAP and subsequently minimise a performance gap, the councils take the same approach, which provides two options to developers for new build residential applications:

- **Passive House Planning Package** (PHPP) – suitable for all residential development
- **SAP + Energy Summary Tool** – suitable for minor residential development

PHPP is the preferred option for any size of development, but it is a requirement for major residential development.

The option for SAP to be used alongside the Energy Summary Tool is offered as a benefit to developers, so that the use of familiar Part L software can continue for minor residential development. The use of the Energy Summary Tool ensures that final outputs from SAP for energy use intensity and space heating demand reflect genuine in practice performance.

It is important to note that these requirements, which have the intention to reduce the performance gap, were not tested thoroughly at Examination.

Emerging Precedent: Solihull Draft Local Plan 2021

Policy P9 requires that all major developments must “implement a recognised quality regime that ensures the 'as built' performance (energy use, carbon emissions, indoor air quality, and overheating risk) matches the calculated design performance of dwellings as specified above [a 30% reduction on Part L 2013 commencing from now, and net zero carbon for all new development commencing from April 2025]”

Emerging Precedent: Merton New Local Plan (draft 2021)

Merton is currently awaiting a response from the Inspector following the submission of additional requested information and documents post-examination. Its proposed draft with main modifications after inspector’s first comments[lvi] Policy CC2.3 includes a range of space heat and energy use intensity targets whose compliance must be demonstrated using calculations with (CIBSE) TM54, (PHPP) methodology or equivalent.

The supporting text explains that these calculation methodologies help to reduce the performance gap because they generate much more accurate predictions of energy use, compared to the SAP methodology used to fulfil Building Regulations Part L.

Existing buildings

There is less clear direction in legislation, and fewer precedents available, to demonstrate the acceptability of seeking energy and carbon improvements in existing buildings compared to new ones.

The variety of types, ages, uses and conditions of existing buildings make it impractical to devise universal requirements for their energy and carbon performance that could be reasonably sought through local plan policies. It is difficult or impossible to retrofit them to the same energy performance standard as new builds can achieve, and the workforce has a shortage of skills to do this effectively.

The decarbonisation of existing buildings is actually a more important challenge compared to new buildings, simply due to scale. The Committee on Climate Change has shown[lvii] (and Government has recognised[lviii]) that in order for the UK to meet its legally binding carbon reduction goals, it is vital that the existing building stock must be decarbonised via three main courses of action:

- Upgrades to building fabric and other energy efficiency measures
- Switching from gas or oil boilers to low carbon heating (largely heat pumps; some heat networks; and a small role for hydrogen in some areas in the future)
- Decarbonisation of the electricity grid via increases in wind and solar electricity generation to allow phase-out of fossil fuelled power stations.

The rollout of insulation and low carbon heating to existing buildings ('energy retrofit') have been far slower than predicted and needed[lix]. Heat pump rollout in particularly must be vastly accelerated[lx]. Both of these can be costly and take many years to recoup the investment through energy bill savings. Perhaps just as importantly, these works are often extremely disruptive to occupants and can risk long-term serious damage[lxi,lxii] to the building if incorrectly specified and installed, especially older buildings. Nevertheless both are vital for net zero carbon and will deliver economic and wellbeing-related benefits in the long term if implemented correctly.

Take-up of solar panels to existing homes dropped steeply[lxiii] since the closure of the Feed-In Tariff scheme in 2019, as new installations no longer generate income from energy sent to the grid. Solar PV installations are however now back on the rise due to householders becoming increasingly concerned about the cost-of-living and energy crises.

Local plans also have only a very limited influence on the carbon and energy performance of existing buildings, as they can only seek changes to buildings where the building owner is seeking to require a change to the building that requires planning permission.

However: The planning system can (correctly or incorrectly) be perceived by building owners as yet another obstacle to retrofitting, on top of the cost, disruption, and risk of building damage. Owners may (wrongly) assume that certain changes need permission, or that permission is likely to be refused Building owners' willing action and investment is essential to the net zero carbon transition, and therefore it is vital that the planning system becomes a facilitator and not an obstacle to this.

The National Planning Policy Framework confirms that (paragraph 152): "The planning system should support the transition to a low carbon future … [by] encourag[ing] the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure". It also confirms that (paragraph 158) when determining applications for renewable and low carbon development, the local planning authority should not require the applicant to demonstrate the overall need for renewable energy, and should approve the application if its impacts are acceptable or can be made so. This supports a permissive approach towards proposals for the addition of carbon-saving and renewable energy measures to existing buildings.

The role of local plan policy in reducing existing buildings' carbon therefore has two main strands:

1. Removing the actual or perceived planning barriers to energy retrofit changes to buildings.
2. Allocating sites suitable for renewable energy generation and distribution in order to decarbonise the energy that existing buildings use.

Point 1 (a permissive, supportive approach) could be pursued through the following tools:

- A local plan policy that explicitly welcomes energy efficiency and carbon improvements to existing buildings with significant weight attached to those benefits, and signposts the reader to further guidance about how to make such changes acceptable in heritage-sensitive settings
- Supplementary planning guidance that clearly explains the range of retrofit measures that can be effective in improving energy performance of existing buildings, which kinds of changes are acceptable in different settings, how to make acceptable changes in heritage settings (referencing available expert guidance[lxiv]), and advising which changes simply do not need permission in most settings
- A Local Development Order giving blanket permission to specific changes in geographic locations that are not considered heritage-sensitive – such as certain acceptable types of upgraded windows, doors, external insulation, or heat pumps visible from the street.

One further option is to seek 'consequential improvements' when changes are being made to a building that require planning permission. This could expand on Building Regulations requirements for the same. We have identified one precedent for this. However, discussions with energy officers at that local authority reveal that this has not proven very effective because very few relevant proposals pass over their desk, and the improvements can only be applied to the part of the building that is undergoing works, not the whole building – which renders many retrofit measures ineffective.

Point 2 (proactive promotion of renewable energy generation and low-carbon energy distribution) could be pursued through the following tools:

- Spatial strategy (allocating or identifying suitable locations for such renewable energy features and potential low carbon heat network locations, in consultation with citizens, local business, conservation bodies and the electrical grid District Network Operator) – this can help to de-risk the prospect for potential investors, site owners and developers of renewable energy
- Infrastructure Delivery Plan – ensuring the electrical grid District Network Operator is ready to make the capacity upgrades necessary to serve a growing proportion of all-electric, gas-free, solar-exporting buildings, electric vehicles, and suitably located large-scale renewable energy
- A Local Development Order that gives blanket permission to add solar panels to buildings in locations not considered heritage-sensitive, expansion of strategic low carbon heat networks.

Precedent for actively welcoming energy improvements to existing buildings: Milton Keynes Local Plan (adopted 2019)[lxv]

Policy SC1 (Sustainable Construction) includes that:

> "Proposals which would result in considerable improvements to the energy efficiency, carbon emissions and/or general suitability, condition and longevity of existing buildings will be supported, with significant weight attributed to those benefits."

Supporting text notes that:

- "existing domestic buildings contribute 28% of the Borough's carbon dioxide emissions (1.5 tonnes of CO_2 per capita in 2014). Along with other non-domestic buildings, retrofitting the existing building stock in the Borough presents a significant opportunity to help meet the strategic carbon dioxide reduction target of 57 per cent by 2030".

- Policy SC1 recognises the benefits that retrofitting buildings can bring [such as fit-for-purpose housing as well as carbon reductions], giving significant weight to them … in order to help achieve Strategic Objectives 11 [delivery of housing that meets needs] and 13 [mitigation of climate change]. The Council will encourage retrofit improvements to existing buildings in the Borough, on an individual and area-wide basis. Where appropriate the Council may employ Local Development Orders to support area-wide schemes".

Precedent using a Listed Building Consent Order to enable easier solar PV installation in listed buildings: Kensington and Chelsea (2022)

The Royal Borough of Kensington & Chelsea is the first council in the UK to issue a Listed Building Consent Order, which gives consent for solar PV on the majority of Grade II and Grade II* listed buildings without a requirement for listed building consent.

Certain conditions must be demonstrated on:

- Positioning
- Materials
- Fixings
- Protecting the appearance of fabric of the listed building

Providing the conditions are demonstrated, a far simpler application compared to a usual listed building consent application is required. This makes solar PV installations a more attractive and less time intensive prospect for householders in Kensington and Chelsea.

Precedents (various): using Local Development Orders to expand renewable and low carbon energy systems and promote energy retrofit

Swindon Borough Council has used LDOs to promote the growth of renewable energy generation and use, both on specific sites and in borough-wide terms. Examples include:

- A borough-wide LDO for non-domestic air source heat pumps and district heating
- Hydrogen and electric vehicle charging stations (specific sites) –
- Identifying specific sites for solar photovoltaic arrays including solar farms. The LDO on solar farms has been particularly successful, by de-risking the process. It was created by issuing a 'call for sites' and then assessing these sites against various criteria.

Across several London Boroughs, an LDO was created to make it easier to deliver heating and cooling networks. By removing the need to make a separate application for each new network section, this makes the network more flexible for new connections and reduces the costs of expansion. It also creates a common standard for new heat networks.

Milton Keynes local plan 2019 indicates a willingness to use LDOs to encourage wide scale energy retrofit.

Embodied carbon

Embodied carbon means the carbon that was emitted in the production and transport of building materials, and their assembly on site. It can also include the emissions associated with maintaining and eventually disposing of a building too. If the latter are included, this is termed 'whole-life embodied carbon'.

These emissions rise largely from fossil fuel energy use to extract and process raw materials such as minerals and metals, then transport them. There can also be emissions from chemical processes to produce building elements (such the carbon dioxide that is cooked-off minerals to make cement) or from the breakdown of the material at the end of its lifespan.

Embodied carbon makes up a very large share of the total carbon emissions caused by the creation and use of a building across a typical 'design lifetime' of a building, usually 60 years (see UKGBC pie charts diagram previously referenced). Many commonly used building materials like ordinary cement, steel, aluminium and zinc have inherently high embodied carbon because of how they are produced. Vice versa, plant-based materials like timber can have less than zero embodied carbon because the tree absorbed carbon dioxide from the atmosphere and this is locked up in the material for as long as it is in use.

Unlike operational energy and carbon, there is currently no mechanism to address embodied carbon in national building regulations or other national legislation for planning and building. Still, embodied carbon is relevant for the net zero goals of the UK and Rutland because some of materials or products will have been produced here, and all will have been transported within the country or district, and energy will be used during construction.

In the absence of a national regulatory approach to address embodied carbon and without a specific local planning power granted to address it, some local plans have nevertheless taken steps to ensure embodied carbon is not entirely neglected.

Precedent plans have taken one or both of the following approaches:

- Requirement to assess the building's embodied carbon, reported within the planning application
- Requirement to provide narrative about what steps are being taken to minimise embodied carbon, such as reusing existing buildings, use of lower-carbon materials, or efficient design to reduce material use.

Our review has not identified any adopted plan precedents that require a development to achieve a specific numeric target for embodied carbon, whether a limit or a % improvement on a baseline. This may be because of a lack of explicitly granted powers, and the 2015 Written Ministerial Statement that directed local plans not to set 'additional technical standards' relating to the sustainability of housing. It may also simply be because this is an emerging area where local planners do not yet feel confident to set these requirements, robustly justify them at inspection, or interpret whether developers have sufficiently demonstrated their compliance.

There is an industry standard method to calculate a building's embodied carbon: the RICS Whole Life Carbon Assessment for the Built Environment[lxvi], which builds on the relevant British/European Standard (BS EN 15978). This RICS method splits the building's whole-life embodied carbon into a series of 'modules':

- Modules A1 – A5: 'Cradle to completion stage' (from raw material extraction through to completion of the building)
- Modules B1 – B5: The 'use stage' of the building (such as maintenance, repair, replacement and refurbishment)
- Modules C1-C4: 'End of life stage' (deconstruction, demolition, transport, waste processing, and final disposal).

It is important to note that the RICS / EN15978 approach assumes that any carbon that was sequestered by trees and stored in timber is released during the C1-C4 modules. In reality this may be avoided if the timber is eventually reused. This means that a whole-life carbon assessment may not recognise the full benefit offered by timber buildings, which is that the timber would lock up carbon for most of this century. This is a critical period[lxvii] in which we are at risk of reaching tipping points for feedback loops of runaway climate change – such thawing permafrost releasing huge amounts of methane, or large areas of rainforest dying back. It matters not only *how much* carbon is emitted, but *when*.

Therefore it makes sense to set targets that exclude modules C1-C4, to give timber buildings the 'credit' for the carbon they will lock up for many decades. B1 – B5 also include many assumptions about uncertain future actions, therefore may need to be omitted from any planning targets due to a lack of robust justification.

Using the RICS 'modules', other building industry specialist bodies have created benchmarks and 'good practice' targets expressed in kilogrammes of embodied carbon per square metre of floor area:

RIBA Climate Challenge embodied carbon targets[lxviii]: Includes all RICS modules **A1-C4**.			
	Business as usual	2025	2030
Homes	1200 $kgCO_2e/m^2$	<800 $kgCO_2e/m^2$	<625 $kgCO_2e/m^2$
Offices	1400 $kgCO_2e/m^2$	<970 $kgCO_2e/m^2$	<750 $kgCO_2e/m^2$
Schools	1000 $kgCO_2e/m^2$	<675 $kgCO_2e/m^2$	<540 $kgCO_2e/m^2$

LETI Embodied Carbon Primer targets[lxix]: RICS modules **A1-A5 only**.			
	Business as usual	2020	2030
Homes	800 kgCO2e/m^2	500$kgCO_2e/m^2$, (400 including sequestration)	300$kgCO_2e/m^2$ (200 including sequestration)
Office or school	1000 $kgCO_2e/m^2$	600$kgCO_2e/m^2$ (500 including sequestration)	350$kgCO_2e/m^2$ (250 including sequestration).

Bath & North East Somerset Council (see precedent below) has adopted an embodied carbon policy that requires a target to be met, yet this does not go as far as the LETI standards. However, it forms a highly important precedent that it is possible to justify such a target.

LETI/RIBA levels of target could still inform supplementary planning guidance, to educate developers and allow planning officers a point of comparison to assess the relative merits of schemes' embodied carbon reports submitted by developers.

If a local plan were to seek to require any of the LETI or RIBA embodied carbon targets, there would be challenges from the development sector consultees and potentially also the inspector. One likely objection is the argument that such a requirement may inhibit the delivery of housing targets.

For the best chance of successful adoption, it would be useful to assemble evidence that:

- The target is feasible with existing materials & techniques (the RIBA 2025 and LETI 2020 targets should both meet this criterion)
- The target is achievable in the kind of development that can be expected in RCC's local plan period (e.g. housing type; housing size; other building typologies)
- There is the capability in the design and construction industry to conduct the embodied carbon assessments (e.g. as development in London already reports embodied carbon to the GLA)
- The selected target would not have an unacceptable impact on costs, considering:
    - Cost of design
    - Cost of alternative materials / construction methods
    - Cost of the embodied carbon assessment.

The LETI and RIBA baselines are derived from a range of existing project data. Their future targets may also be based on case studies that would justify the planning policy, especially on technical feasibility.

RICS may be able to provide estimates of the typical cost of embodied carbon assessments and the number of professionals who are able to conduct such assessments.

We also note that further evidence is continually emerging on this topic, which could help the planning justification for such targets. For example, in early 2022, the UK Green Building Council[lxx] found that a real-world large low rise residential development in south-west Cambridgeshire achieved a 20% reduction in embodied carbon reduction at masterplan level compared to a typical baseline, with only a negligible impact on capital costs (0.6%). This was achieved through simple changes such as reducing the area of asphalt in favour of low-carbon permeable paving, and using swales to reduce the need for other drainage infrastructure.

However, all of these evidence topics may be seen as more robust if they can be made directly relevant to RCC or similar areas.

Relevant data could begin to be assembled by the local authority if it firstly adopts a local plan requirement for major developers to simply *report* on their embodied carbon using the RICS methodology, and ideally also any costs associated with steps taken to reduce embodied carbon as a percentage of overall costs. From these, local benchmarks for 'business as usual' and 'best practice' could be derived for inclusion in a subsequent local plan policy or supplementary planning document.

Precedent: New London Plan 2021

Policy SI 2 includes that:

F. Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Emerging precedent: Salt Cross Area Action Plan

Policy 2 states that proposals should "demonstrate attempts to reduce embodied carbon to meet the following KPI: < 500 kg CO2/m2 Upfront embodied carbon emissions (Building Life Cycle Stages A1-A5)". A report containing these calculations should be submitted with the application.

The Inspectors requested, in the Main Modifications (26th May 2022), the removal of "references to absolute requirements and KPIs that must be met and instead to reframe as standards for consideration as part of an energy statement". This was confirmed in Inspectors' full report in March 2023. The wording for embodied carbon in Policy 2 was however not as strong as set out in the Bristol Draft Plan or B&NES Local Plan Partial Update, so it is not clear whether or not the embodied carbon KPI would have been a strict, mandatory requirement.

Emerging precedent: Bristol Draft Local Plan Review 2022

Policy NZC3 of this draft plan requires that new development will be expected to achieve the following targets as a minimum:

- Residential (4 storeys or fewer) - <625 $kgCO_2e/m^2$
- Residential (5 storeys or greater) - <800 $kgCO_2e/m^2$
- Major non-residential schemes - <970 $kgCO_2e/m^2$

The requirements are based on the RIBA Climate Change targets for 2025 Homes, 2030 Homes and 2025 Offices.

Any shortfall against the embodied carbon targets will be offset at a cost of £373/tCO_2 – the BEIS Green Book 2023 value. Embodied carbon offsetting and target setting at this level has yet to be tested at Examination. Additionally, the £373 price is based on operational emissions and has not been calculated based on embodied carbon, which could be seen as a flaw in the approach.

Precedent: Bath & North East Somerset Council Local Plan Partial Update (2023)

Policy SCR8 of requires that large scale development (>50 dwellings or >5000m^2 of commercial floor space) achieves an embodied carbon target of 900 $kgCO_2/m^2$ for RIBA modules A1 – A5 (upfront embodied carbon). The target only includes the following building elements:

- *Substructure*
- *Superstructure*
- *Finishes*

The policy requirement was selected because it is predicted to be cost neutral, as set out in the evidence study produced by WSP.

There is no last resort option to offset any shortfall of embodied carbon emissions to the required target.

Emerging and more innovative recent precedents

The previous section explored the existing adopted precedents and recognised their successes or limitations in terms of effectiveness in delivering carbon savings in line with the Climate Change Act. It also included some emerging precedents that take a similar approach.

There are also very newly adopted local plans and emerging local plans (including DPDs and Area Action Plans) that are aiming to remedy more of those limitations in innovative and pioneering ways. The following sections are based around the key topics of innovation in these emerging plans.

Please note: some of the emerging plans are receiving different reactions from the inspectors during examination, despite having very similar policies and rationales.

This may be due to differences between the assigned inspectors in terms of opinion, legal interpretation of powers, or depth of expertise in the topic of climate and carbon.

It may also be because of differences in the clarity of the explanation of need and justification given in the evidence bases (or the robustness of local applicability of those evidence bases). Where available, we will note those differences here.

Setting absolute targets for energy use intensity, space heat demand and renewable energy generation, and use of accurate calculation methodologies to fulfil these

Emerging Precedent: Merton New Local Plan (draft 2022)

In April 2023, the inspectors expressed concerns in the Post-Hearings Letter[lxxi] around the viability of policies set out below, particularly for smaller development, that may negatively impact delivery. Further main modifications have been requested for the inspectors to find climate change policies 'justified' – these have not yet been released.

The currently proposed draft with main modifications after the inspectors' first comments[lxxii,lxxiii] sets Policy CC2.3, which includes the following maximum **Energy Use Intensity** targets from Jan 2025 – this is likely to change now following the Post-Hearings Letter:

- Residential and multi-residential – 35 kWh/m²/year
- Offices, retail, GP surgery, hotels and higher education – 55 kWh/m²/yr
- Schools – 65 kWh/m²/yr
- Leisure – 100 kWh/m²/yr
- Light industrial uses – 110 kWh/m²/yr

Supporting text paragraph 2.3.18 explains that major developments should calculate these with (CIBSE) TM54, (PHPP) methodology or equivalent. Minor residential schemes are permitted to instead calculate these with Part L SAP. 5-year post occupancy monitoring is also required for major development.

The targets match those developed by the London Energy Transformation Initiative to be consistent with achieving national net-zero carbon targets (paragraph 2.3.21) and proven feasible by energy modelling for another emerging local plan. In contrast, paragraph 2.1.14 notes that typical current Part L EUI is 140/kWh/m²/yr.

The policy also includes the following **space heat demand** targets, with SAP:

Development type	Until 31/12/2022	01/01/2023 – 31/12/2024	From 01/01/2025
Block of flats & mid-terrace house	<43 kWh/m²/year	39 kWh/m²/year	15 kWh/m²/year
Semi-detached, end-terrace & detached house	52 kWh/m²/year	46 kWh/m²/year	20 kWh/m²/year
Non-residential (target flexible)	-	-	15 kWh/m²/year

Supporting text paragraphs 2.3.9 – 2.3.13 explain that the gradual uplift allows time for developers to adapt, and that the 2022-24 targets reflect the Zero Carbon Hub 'interim fabric energy efficiency standard' and 'full fabric energy efficiency standard' which have been demonstrated to be feasible, viable, and achieved in several schemes in Merton.

In Policy CC2.4, proposals must use low carbon heat. Proposals must demonstrate "how the proposal has made the best potential use of roof space" to maximise renewable energy generation, which should meet "100% of energy demand … where possible".

Emerging precedent: Winchester Draft Local Plan (2022)

This proposed submission underwent Regulation 19 consultation in March-May 2022[lxxiv].

Proposed Policy CN3 (Energy efficiency standards to reduce carbon emissions) requires that all residential development must demonstrate the following:

- **No on-site fossil fuels** for space heating, hot water or cooking.
- Space heating demand of **15 kWh/m²/year.**
- Energy consumption (EUI) of the building(s) to less than **35 kWh/m²/year.**
- **Passive House Planning Package or CIBSE TM54** to be used for predicted energy modelling.
- On-site renewable energy generation to provide 100% of the energy consumption required by residential buildings.

It appears in the Draft Plan that there is no option to offset shortfalls to the renewable energy generation and/or EUI target. No other authority has proposed the EUI approach without a last resort option to offset, although most evidence studies prove that the absolute energy requirements are technically feasible for the majority of housing typologies and therefore offsetting may not be required.

High-rise flat block is the primary typology that may struggle to meet on-site renewable energy requirements since there is limited roof space relative to the internal floor area. Given the housing mix in Winchester is unlikely to include this typology, this could explain why offsetting is not currently included in the Plan – this could be an approach RCC also explore for the same reasons.

Emerging precedent: Greater Cambridge Local Plan (First Proposals 2021[lxxv])

Policy CC/NZ *will require and guide net zero carbon new builds.* This will include:

- Space heat demand of 15-20 kWh/m²/year in all new developments
- No new developments to be connected to the gas grid; all heating low-carbon
- Total energy use intensity targets to be achieved as follows:
  - Dwellings including multi-residential: 35 kWh/m²/year
  - Office, retail, higher education, hotel, GP surgery: 55 kWh/m²/year
  - School: 65 kWh/m²/year
  - Leisure: 100 kWh/m²/year
  - Light industrial: 110 kWh/m²/year
- Proposals should generate at least the same amount of renewable energy (preferably on-plot) as they demand over the course of a year [including] all energy use (regulated and unregulated), calculated using a methodology proven to accurately predict a building's actual energy performance.

The need and deliverability of this policy is evidenced by a suite of net zero carbon evidence reports including:

- Local area carbon reduction targets that would represent a fair local contribution to the national net zero carbon transition and Paris Agreement
- Expert analysis by the Committee on Climate Change and various building industry experts about what must happen in the buildings sector to deliver the national net zero goal and interim carbon budgets – including proposed targets for heat demand, total energy use, and on-site renewable energy generation – and explaining how/why this is not delivered by building regulations (current or incoming)
- Technical feasibility studies which modelled whether it was possible to reach the proposed zero carbon energy balance in the typical types of development expected to come forward in the plan period (based on applying a range of energy improvement measures to real recent development proposals that received permission) – this showed that the targets were feasible
- Cost modelling to show the cost uplifts to meet the modelled energy improvement measures, as above, for inclusion in the viability assessment.

The supporting text notes that the alternative – having no policy and relying instead on incoming uplifts to building regulations – would fail to fulfil the plan's statutory duty to help fulfil the Climate Change Act and would fail to play Greater Cambridge's role in helping the UK fulfil its commitment to the Paris Agreement to limit climate change to 1.5C or 2C.

The plan is still in its relatively early stages as of May 2022. It completed its First Proposals/Preferred Options consultation in December 2021, from which issues are being explored. A draft of the local plan itself is expected be released in 2023.

Emerging precedent: Leeds City Council Draft Local Plan (2023)[lxxvi]

Policy EN1 Part B *requires new development to be operationally net zero.*

All development must demonstrate a space heating demand of 15 kWh/m²/year.

Energy use intensity required targets vary significantly between typologies, as set out below:

- All residential development – 35 kWh/m²/year
- Offices, retail, GP surgery, hotels and university facilities – 55 kWh/m²/year
- Schools – 65 kWh/m²/year
- Leisure – 100 kWh/m²/year
- Light industrial uses – 110 kWh/m²/year
- Research facility – 150 kWh/m²/year

On-site renewable energy generation is to deliver an annual net zero carbon balance (including regulated and unregulated emissions).

Additional secondary requirements:

- Calculations must be carried out using an approved building modelling software such as IES-VE, SBEM and PHPP.
- Gas boilers and direct electric resistive heating will not be supported.
- Expected official UK government electricity grid carbon intensity values to be used instead of static SAP10.2 factors.
- Offsetting at a cost of £248/tCO_2 – rising to £280 by 2030 to reflect further predicted grid intensity reductions.

Policy EN1 Part B goes further than similar recently adopted policies, since it prescribes EUI targets for non-residential typologies alongside residential. The policy is also explicitly refers to the use of gas boilers, whereas other policies rely on the energy targets themselves to rule out gas boilers and direct electric heating.

Emerging precedent: Bristol City Council Draft Local Plan (2022)[lxxvii]

Policy NZC2 requires new development to be operationally net zero based on absolute energy limits.

All development will be expected to:

- Achieve a maximum 15 kWh/m²/year space heating demand
- Achieve a maximum 35 kWh/m²/year energy use intensity – new homes and other forms of accommodation to achieve
- Comply with operational energy/carbon requirements of BREEAM 'Excellent' – major non-residential
- Provide on-site renewable electricity generation with an output equivalent to at least the annual energy consumption of the development
- Development should provide onsite renewable energy of 105 kWh/m²fp/year

In the case of Policy NZC2, offsetting is a last resort option for energy use intensity instead of on-site renewable energy generation – price set at £90/MWh or 9p/kWh. See *previous section* for further information.

The key policy element here that is unique to similar emerging precedents is the expectation of a certain amount of renewable energy based on the footprint of the building. Best practice for this metric is currently 120 kWh/m²fp/year. Setting a target for this ensures that it is easy for planning officers to assess whether a development has truly maximised all available roof space. In most cases, if on-site roof top solar PV generation is predicted to be lower than the target set out, it can be assumed that all opportunities for generation have not been maximised from the earliest stage of the scheme.

More effective offsetting schemes for new development that cannot feasibly achieve net zero carbon status on-site

As previously outlined, existing carbon offset mechanisms in local plans are affected by the following problems:

1. Using Part L SAP to calculate the amount of carbon to be offset – this fails to account for unregulated energy and is affected by the performance gap (i.e. SAP is highly inaccurate in predicting actual energy and carbon performance) and the carbon factors used in SAP are generally several years out of date with the rapidly decarbonising electricity grid

2. Failing to account for the decarbonisation in the electricity grid over the period for which carbon is expected to be offset – thereby unfairly penalising electricity use compared to gas use

3. Risk of spending offset funds on measures that may not deliver measurable, permanent carbon savings that are additional to what would have happened in the absence of the fund – or not spending them at all due to a lack of projects

4. Risk of the amount paid for offsets not being sufficient to enact projects that will save the same amount of carbon that is emitted

5. Risk of the offset fund becoming a 'leak' whereby the new buildings sector becomes able to shirk its achievable responsibility to achieve carbon emissions, and pass on this responsibility to other sectors (such as land use or existing buildings) when in fact all sectors need to rapidly reach net zero carbon if the UK is to hit its legislated carbon goals – meaning we need absolute carbon cuts, not just displacement of emissions between sectors.

There are various emerging precedent plans that are attempting to remedy the potential pitfalls of carbon offsetting mechanisms for new development in their area.

Please also see subsequent section on how costs of offsetting could be calculated for inclusion in a viability assessment, using a method that accounts for on-site savings and the decarbonisation of the electricity grid over the lifespan of the development.

Regarding point 5 on offsets as 'leakage': This point largely is a caveat that funds to offset carbon from new buildings should ideally be used to deliver renewable energy, and not to deliver land-based carbon sequestration such as afforestation. This is because Committee on Climate Change and Tyndall Centre analysis (referenced previously in this document) show that the UK's carbon budgets mean that the land use/agriculture sector needs all its carbon sequestration capacity for its own purpose. That sector is already expected to be unable to reach net zero carbon in 2050, which will have to be balanced by even greater afforestation, large reductions in beef and dairy and fertiliser, or future unproven innovations in farming techniques. The same is true for the aviation sector. Meanwhile the UK has a relatively limited amount of land that can be converted to forest or other carbon-sequestering land (given the competing land uses such as food production, renewable energy generation, and built uses). The argument is therefore that any carbon savings achieved by expansion of green infrastructure should be used to balance out the emissions of sectors that actually cannot feasibly reach net zero carbon, not those of sectors that can technically achieve this.

The existing buildings sector, like the new buildings, is one of the sectors considered relatively feasible to decarbonise and should therefore do this under its own steam. If new buildings 'offset' their emissions by taking credit for insulation or heating systems to be added existing buildings, the existing buildings cannot reciprocate. The offset emissions are not really 'gone', they just appear in a different building's account. Either way, renewables must be added to the energy system to address the emissions of both buildings at source – so it makes sense for any 'offset' scheme to simply deliver those renewables directly.

One counter-argument to this is that an offset scheme could route cash to the purpose of existing building retrofit actions that are vital for the net zero carbon future but currently lack financial mechanism to deliver them, such as heat pumps or insulation in hard-to-insulate properties. In contrast, the necessary expansion in the UK's renewable energy generation may simply come about through market forces. That is, the energy sector has cash to invest, proven technologies and relative certainty of profits from their investment, in contrast to building occupants who often do not have the cash, the certainty about retrofit technologies/measures, or the certainty of returns on investment (given the removal of the feed-in tariff system and various high-profile horror stories about incorrectly installed insulation and heat pumps) and also are discouraged by the potential disruption or even damage to their home.

We therefore note several emerging precedents that have expressed an intention to deliver offsetting schemes that only fund renewable energy or existing building retrofit. See also previous section on confirmed precedents of offset schemes that follow similar approaches.

Emerging precedent: Warwick Emerging Net Zero Carbon Development Plan Document[lxxviii]

At the time of writing, this emerging precedent recently underwent Examination in Public with a timeline for adoption in mid/late 2023.

It requires developments (of 1 or more dwellings and/or 1000m2 non-residential space) to achieve reductions in energy use and carbon in line with the Future Homes Standard 2025, calculated using SAP/SBEM, followed by offsetting.

This is supported by an evidence base which draws on the national Future Homes Standard documentation and the evidence bases of other plans:

- Feasibility - using technical building modelling by other local plans' evidence bases, and the national Future Homes Standard Consultation
- Cost evidence for the capital cost uplift associated with delivering the fabric and low carbon heat of the Future Homes Standard – drawing on the FHS Impact Assessment by national government, and cost modelling from other local plans' evidence bases (specifically Cornwall).

Policy NZC2(C) (Offsetting) requires that where a development cannot demonstrate that it is net zero carbon, it must offset any residual emissions by a Section 106 contribution. This can be a cash contribution to the council's offsetting fund, or a verified local off-site offsetting scheme.

> "The amount of carbon to be offset will be calculated according to the SAP or SBEM carbon emissions submitted in the energy statement … multiplied to reflect emissions over a period of 30 years from completion. Where "zero-carbon ready" technology is proposed, associated carbon emissions should be calculated in accordance with the stated national trajectory for carbon reduction of the energy source (i.e. annual Treasury Green Book BEIS projections of grid carbon intensity or future national equivalent)."

Supporting text notes that electric heating is a 'zero carbon ready' technology for which there is a national trajectory for the decarbonisation of that energy source. For other energy sources without such projections, emissions are steady for 30yrs.

> "The carbon offset price is the central figure from the nationally recognised non-traded valuation of carbon, updated annually as part of the Treasury Green Book data by BEIS." Supporting text notes that in 2021, this was £245/tonne.
>
> "Funds raised through this policy will be ringfenced and transparently administered by the Council to deliver a range of projects that achieve measurable carbon savings as locally as possible, at the same average cost per tonne. The fund's performance will be reported in the Authority Monitoring report on: amount of funds spent; types of projects funded; amount of CO_2 saved."

Emerging precedent: Greater Cambridge Local Plan (First Proposals 2021[lxxix])

Policy CC/NZ aims to ensure new buildings achieve net zero carbon. This includes scope for offsetting, for those developments unable to meet the requirements on site.

*The proposed policy includes that "*Offsetting [is] to only be used in certain circumstances (e.g. insufficient roof space to generate renewable energy) – money would only be used to invest in additional renewable energy generation to ensure net zero carbon buildings are delivered. Where a proposal cannot meet the requirements in full, in addition to offsetting, the development must be futureproofed to enable future occupiers to easily retrofit or upgrade buildings and/or infrastructure in the future to enable achievement of net zero carbon development"

Emerging Precedent: Merton New Local Plan (draft 2022)

This plan is with the inspector over Summer 2022. Its proposed draft with main modifications after inspector's first comments[lxxx,lxxxi] Policy CC2 still includes the following, which begins similarly to existing precedents in London:

"All new build development resulting in the creation of 1 or more dwellings or 500sqm or more non-residential GIA:

e. To demonstrate compliance with the Mayor's net-zero carbon target ….
f. Where it is clearly demonstrated that the net-zero carbon target cannot be fully achieved on site … any carbon shortfall to be provided, either:
   i. through a cash in lieu contribution to Merton's carbon offset fund, or
   ii. off-site provided that an alternative proposal is identified, delivery is certain and subject to agreement with the council."

This emerging plan's innovation arises in the supporting text, which notes that:

> "2.2.15 … the London Plan carbon offset price (£95/t in the London Plan 2021) is too low to actually deliver equivalent carbon savings and therefore does not incentivise sufficient on-site savings. Indeed, the cost of installing additional PV … is currently at around £190/t … expected to increase to £325/t using the SAP 10.1 carbon factors [reflecting] decarbonisation of grid electricity. …
>
> 2.2.16 … It would cost a local authority at least £300/t to save carbon in a sustainable way, taking into account administration and management costs …
>
> 2.2.17 In order to incentivise developers to implement lower carbon strategies on site where possible, and to ensure that any remaining carbon shortfall can adequately be addressed off site, the carbon shortfall for the assumed life of a development (e.g. 30 years) will therefore be offset at a rate of £300/t as at 2021. The price for offsetting carbon is regularly reviewed; this will be monitored and, if necessary, updated."

Actively welcoming energy and carbon improvements to existing buildings

Emerging precedent: Wokingham Draft Local Plan Update 2020

Draft Climate Change Policy SS8 confirms the local plan will "support retrofitting existing buildings with measures to improve their energy efficiency and generate onsite renewable energy".

Supporting text notes that "Proposals to sensitively refurbish or retrospectively improve the performance to reduce their energy use and improve comfort will be supported. Interventions to upgrade historic buildings should be undertaken sensitively in recognition of their heritage value."

This is supported by policy DH7 (Energy) which includes that:

> "Development proposals which would result in considerable improvements to the energy efficiency, carbon emissions and/or general suitability, condition and longevity of existing buildings will be supported, with significant weight attributed to those benefits[*]. The sensitive retrofitting of energy efficiency measures and the appropriate use of micro-renewables in historic buildings, including listed buildings and buildings within conservation areas will be encouraged, providing the special characteristics of the heritage assets are protected."

*Please note: The first sentence of policy DH7 is identical to Milton Keynes adopted local plan 2019 Policy SC1 (point N), thus is supported by that precedent.

Precedent: Cornwall Climate Emergency Development Plan Document

This emerging plan has been through Regulation 19 consultation, underwent independent examination in Summer 2022[lxxxii], and was adopted in early 2023.

Policy SEC1 (Sustainable Energy and Construction) includes that:

> Significant weight will be given to the benefits of development resulting in considerable improvements to the energy efficiency and reduction in carbon emissions in existing buildings.
> Proposals that help to increase resilience to climate change and secure a sustainable future for historic buildings and other designated and non-designated heritage assets will be supported and encouraged where they:
> 1. conserve (and where appropriate enhance/better reveal) the design, character, appearance and historical significance of the building; or
> 2. facilitate their sensitive re-use where they have fallen into a state of disrepair or dereliction (subject to such a re-use being appropriate to the specific heritage asset).

Emerging precedent: Greater Cambridge Local Plan (First Proposals 2021[lxxxiii])

Policy GP/CC *is titled* 'Adapting heritage assets to climate change'.

The proposed policy direction includes

- "Require retrofit works to be carried out in accordance with the BSI PAS 2035 framework and Historic England guidance for energy improvements to heritage assets
- Require proposals to take a 'whole building' approach to undertaking works to heritage assets to enhance environmental performance"
- Support proposals which seek to undo the damage caused by previous inappropriate interventions (e.g. removal of cement render and replacement with breathable options).
- Give consideration to measures that will reduce carbon emissions and assist with adaptation to our changing climate (for example external shading or property level flood protection).
- The plan will also direct residents to further guidance on how to approach works to older homes."

The supporting text notes that need for this policy is evidenced by the local plan's Net Zero Carbon Study which showed that existing buildings cause one-third of the area's greenhouse gas emissions and therefore "we cannot meet our climate targets without reducing emissions and energy usage in all our homes", given that "the Committee on Climate Change have concluded that at least 90% of existing buildings in the UK should have energy efficient retrofits for the UK to meet its zero carbon targets".

The supporting text emphasises that this is particularly relevant because 20% of homes were built before 1919, and Listed Building Status applies to 1% of homes in Cambridge and 3% of homes in South Cambridgeshire. It also notes that such improvement to existing buildings reduces running costs and also increases the lifespan of the building.

It explains that "Policy is therefore needed to support owners of heritage assets to undertake sensitive works to address the performance of their buildings, in line with best practice guidance for heritage assets".

The plan is still in its relatively early stages as of Summer 2022. It completed its First Proposals/Preferred Options consultation in December 2021, and the first draft of the local plan itself is expected be released in Autumn 2022.

Beyond the building: Reducing carbon via the spatial strategy and standalone renewable energy

The local plan's spatial strategy is a vital tool for the minimising the carbon emissions caused by new growth, and potentially even making reductions on the county's existing annual carbon emissions.

Because this document was produced to support a local plan review at a stage where there was not much scope to influence the spatial strategy, we do not go into as much depth here as we have done for buildings. However, this is an incredibly important topic in terms of what planning can do to enable the transition to a net zero carbon future. Therefore for completeness we give an overview here.

The Planning Practice Guidance section on climate[lxxxiv] confirms that location of new development are appropriate carbon reduction measures in local planning, as is deployment of renewable energy: "The distribution … of new development and the potential for servicing sites through sustainable transport solutions, are particularly important considerations".

The key ways in which the spatial strategy can support the net zero carbon transition are:

1. Transport – shaping the spatial pattern of new growth to reduce the use of cars and increase the viability of public transport services
2. Renewable energy – proactively enabling development of generation, storage and distribution
3. Protecting green infrastructure that removes or stores carbon, such as forests, grassland, peatland, or other high-carbon soils
4. Density: this has a smaller impact than points 1 and 2, but higher-density developments generally have smaller sizes per unit, which means less floor space to heat and light. Higher density can also make settlements more walkable by reducing sprawl between destinations.

Allowing growth only where the transport carbon emissions can be minimised

Transport is now the UK's largest emitter of CO2 – representing 34% of total CO_2 emissions across the UK[14],[lxxxv] (compared to homes 26%, commercial/public buildings 8%, industry 15%, and land use 3%). In Rutland, transport is responsible for 14% of emissions. Moreover, transport carbon emissions have not been reducing much in the past decade before 2020 (unlike the homes and other buildings sectors which have benefitted from reductions in electricity grid carbon). This is because the small increases in vehicle efficiency (and electric vehicles) have been outweighed by an overall increase in miles driven. A switch to electric vehicles is underway but has been slow and it will be many years before EVs make up the majority of new vehicles, let alone the majority of vehicles on the road (as the ban on sales of new fossil fuelled cars and vans is not till 2035, and the last fossil fuelled cars can be expected to be still in use for at least 14 years[lxxxvi] after that).

There is therefore a strong climate justification to devise the spatial strategy to focus the bulk of development in locations where there is a realistic likelihood of low car use, in particular on public transport corridors and walkable urban locations, and to refrain from allocating any sites where driving will be the only realistic option. Walkable sites also enable more efficient land use due to reduced parking area, while growth in urban locations can share existing infrastructure and thus avoid embodied carbon associated with new infrastructure. Where other considerations constrain this approach (such as green belt designations preventing growth around well-served railway stations or bus routes) there may be grounds to review the relative merit of those designations compared to the climate imperative. This should not be done lightly and should be supported by analysis to explore the differences in carbon emissions that would result in growth in different locations.

Transport carbon emissions are largely determined by *where* the development takes place as opposed to what policies are imposed to regulate the quality of each development itself. Once the location is set, it is difficult or impossible for the developer or the local plan to effectively influence the transport habits of the occupants and their associated carbon emissions. Recognising this, emerging local plans are taking steps at a very early stage of plan development to ensure that transport carbon emissions are considered from the outset of spatial strategy design and not as an afterthought.

To avoid locking-in long-term avoidable carbon emissions that come with development in car-dependent locations, spatial strategies can be informed with evidence to show how much carbon could be saved by choosing to direct growth to locations that are inherently conducive to public transport and active travel. This gives a quantifiable value to the carbon savings, thus allowing them to be more fairly weighed alongside other considerations for growth sites such as ecology, landscape or impact on existing residents.

Emerging Precedent: Greater Cambridge Local Plan

In 2020-21, the emerging Greater Cambridge Local Plan was in the early stages of identifying the possible options for its spatial strategy. There were several broad spatial categories reflecting the potential areas where new growth could occur. There was also a range of housing growth numbers (low, medium, high).

Greater Cambridge Shared Planning service commissioned comparative modelling of the carbon emissions of buildings and transport in different types of location: urban, suburban, public transport corridors, new towns, villages.

This modelling used publicly available data on the local area's energy use and emissions of buildings and transport, combined with a locally-specific transport model. It also took into account the different locations' typical densities, home sizes and amount of new infrastructure that would be needed along with housing.

The potential sites being considered for growth were categorised into these different types of location. A range of options were tested, with homes spread in varying proportions across different types of location.

This revealed[lxxxvii] a very large difference in carbon emissions in the plan period depending on where homes were built. Importantly, it showed that the carbon emissions difference (between growth in the most versus least car-dependent locations) was just as large as the difference that would be made by applying zero-carbon buildings policies.

Village-led growth had far higher carbon emissions than any other option. Growth on public transport corridors was nearly as low-carbon as urban growth, and both were better than new settlements. Applying a range of carbon reduction policies (for buildings and transport) would halve the total emissions, except in villages because more of their carbon due to transport, which is influenced more by location than policy.

This informed the further refinement of the growth options. The modelling was repeated[lxxxviii] for the refined options. Both were taken into account in the sustainability appraisal[lxxxix]. As a result, the proposed preferred option is led mainly by growth on public transport corridors and urban areas, and does not include significant development in villages (only where they are well connected to existing transport and employment.)

[14] As percentage of UK emissions, before taking into account sequestration by forests and grassland.

Precedent: Central Lincolnshire Local Plan Review

Central Lincolnshire used the same approach as Greater Cambridge, with same consultant team conducting analysis[xc] to compare the carbon impacts of its various spatial growth options.

Here, the difference between locations was less pronounced. This was partly because the spatial options in Central Lincolnshire were less starkly 'urban' or 'rural' but more blended, and partly because the Lincolnshire growth locations did not include areas with such an unusually high level of cycling and low car use as urban Cambridge has.

Actively allocating sites for growth of renewable energy generation and distribution

Development of large-scale renewable energy can be controversial topic with communities, especially regarding wind turbines. However, Committee on Climate Chance carbon budgets and recommendations show that it is necessary for all local areas to accept a reasonable amount of new renewable generation in order to bring about the electricity grid decarbonisation that is essential for the entire country's legally binding transition to net zero carbon.

The shared challenge becomes even larger given that especially as we must not only switch existing electricity generation to zero-carbon sources, but also dramatically upscale electricity production and distribution to meet the rising electricity demand imposed by the equally necessary switch of heating and transport away from gas and oil and onto electrical power (the role of hydrogen is expected to be limited in geography, scale and application for the foreseeable future).

Energy distribution and storage infrastructure is a vital part of this renewable-heavy energy system, to match generation with demand (as renewable energy generation fluctuates with the wind or sun, and can be generated at a different time to when it is needed for use).

The Royal Town Planning Institute notes[xci,xcii] that planning for renewable energy (generation, storage and other smart energy infrastructure) is most likely to be successful when specific suitable sites are allocated in concert with communities, grid operator/district network operator, and other stakeholders with relevant concerns e.g. ecological and landscape conservation bodies. This RTPI document also highlights the potential usefulness of Local Development Orders to encourage the development of renewable generation, energy storage and expansion of renewable/low-carbon energy distribution infrastructure.

Perhaps the key success factor is to define reasonable requirements to mitigate the impacts and community acceptability, while not creating a planning environment that is so hostile as to entirely deter or block potential projects for renewable energy and energy storage. Community engagement is a key action to mitigate hostility towards local renewable energy projects. The Centre for Sustainable Energy has carried out Future Energy Landscape workshops and produced a guidance note on how others can replicate the approach. Workshops such as these assist communities to feel empowered in the decision-making process for potential site selection of renewable energy projects.

Recognising this challenge, several emerging local plans are attempting to make provision for such developments.

Emerging precedent: City of York Draft Local Plan (2018)

Policy CC1 of this emerging local plan confirms that:

> *"Renewable and Low Carbon Energy Generation and Storage: Proposals for renewable and low carbon energy storage developments will be supported and encouraged. Developments should be sited a suitable distance from major residential areas and have suitable fire suppression procedures".*

The policy also explains why storage is crucial, acknowledges that this is an emerging field and commits the council to work with experts to understand what the options are and develop an SPD which will include safety considerations.

This plan is still with the inspector *as of May 2022, but the CC1 policy stance already formed the basis of a 2019 planning approval for a 50MW battery storage development in greenbelt, due to its location (near a substation) and its contribution to sustainable development, innovation, and energy resilience.*

Emerging precedent: Greater Cambridge Local Plan (First Proposals 2021[xciii])

Policy CC/RE aims to bring forward standalone renewable energy development, in an acceptable way. *This will include:*

- A positive policy framework for development of renewable energy generation capacity, and associated infrastructure such as battery storage and grid capacity
- Identify broad areas of suitability for different types of renewable energy generation equipment, informed by Cambridgeshire Renewables Infrastructure Framework and a Landscape Sensitivity Assessment
- Indicate support for community-led projects
- Identify a set of criteria which will apply to all renewable energy projects with regards to their impact on amenity, landscape appearance, biodiversity, geodiversity, water, history/heritage, highway safety, aviation and telecoms
- Require special community engagement in the case of wind turbines
- Consideration of green belt impact and the potential for renewable energy development to be justified by 'very special circumstances'.

The need for this policy is evidenced by reference to national planning policy expectations that local plans should recognise the responsibility of all communities to contribute to energy generation from renewable sources, and a Net Zero Carbon study which had identified how much a 'fair share' of that contribution would be for the area. It is also noted that the alternative – having no policy to identify such areas – may not generate the renewable energy required for the net zero carbon transition.

The plan is still in its relatively early stages as of May 2022. It completed its First Proposals/Preferred Options consultation in December 2021, and the first draft of the local plan itself is expected be released in Autumn 2022.

Precedent: Cornwall Climate Emergency Development Plan Document

The Cornwall Climate Emergency DPD was adopted in February 2023.

Background text notes that Cornwall is already ahead of the national average in the percentage of its electricity that is derived from renewables, with potential for more. Also:

> "The Policy map identifies broad areas that may be suitable for wind energy. [This] does not mean that proposals will automatically be granted … They are essentially an 'area of search' within which the Council will consider whether turbines should be granted permission in line with local and national policy which sets out a series of technical tests (including distances from homes and heritage assets …) and demonstrate the acceptability of their visual impact. An interactive map … sets out constraints against which proposals will be considered".

Proposed Policy RE1 proceeds to affirm that proposals for renewable generation and distribution projects will be supported where they:

- Contribute to Cornwall's target of 100% renewable electricity supply by 2030,
- Balance the wider environmental benefits and not result in significant adverse impacts on the local environment that cannot be satisfactorily mitigated (in AONBs they must be small scale and only in exceptional circumstances),
- Allow for the continuation of some form of agricultural activity on the site
- Provide for 10% net biodiversity gain
- Provide for community benefit (including offering an option for communities to own at least 5% of the scheme if it is 5MW or more)
- Have appropriate plans in place for removal of the technology 'on cessation of generation' and restoration of site to original or acceptable alternative use.

Wind energy development proposals will be permitted where they:

- Are located in a 'broadly suitable area' identified on the Policies Map or are for the repowering of an existing wind turbine/farm
- Demonstrate that various impacts have been consulted on and mitigated (community, shadow, flicker, noise, air traffic, radar, overshadowing / overbearing effect on habitations, integrity of European Sites, foraging zones for waders in 3km buffer zone of specific coastal habitat areas).

Solar energy development proposals for building mounted installations will be supported and encouraged wherever possible. Standalone ground-mounted solar will be supported on previously developed land and away from 'best and most versatile' agricultural land 'unless exceptionally justified'.

Hydroelectricity energy development (including tidal) will be supported subject to acceptable impacts on the water regime and nature conservation.

There is a presumption in favour of grid energy storage development where it is collocated with renewables, alleviates grid constraints, or enables further renewables to be deployed.

Quantifying and protecting the carbon sequestration value of green landscapes

Green infrastructure for carbon sequestration is relevant in Rutland as an area with a particularly large proportion of green landscape. This green infrastructure has a small but significant effect on reducing the county's overall greenhouse gas account. National figures show[xciv] that in Rutland as of 2020, forest and grassland remove 6% of the carbon dioxide emissions that the county's other sectors cause. This is a proportionally larger achievement than the national picture, where the UK's forest and grassland recapture only 0.3% of the UK's overall annual CO_2 emissions.

There is therefore a strong argument that the site allocations process should be designed to direct new growth away from woodland and grassland – unless a particular greenfield site would give greater carbon savings for other reasons, for example if the site is on a well-served public transport route that would dramatically reduce car use compared to delivering that new growth elsewhere.

Beyond trees and grass, soil can also be a huge store of carbon which can be emitted if the soil is drained or otherwise disturbed – for instance during groundworks or excavation. For example, natural wetland (especially peatland) is a rich store of carbon that has been sequestered over many years by plants growing there, and stored thanks to being submerged in water. If drained, peatlands start emitting large amounts of greenhouse gas.

Data on the distribution of high-carbon soils in the county might justify decisions not to allocate these sites, or development management policies to mitigate and compensate for losses of soil carbon. 'Heat maps' showing topsoil carbon intensity are available from the Centre for Ecology and Hydrology[xcv], although the data must be downloaded and used with GIS mapping software and is not available to view directly through online maps at the time of writing.

Emerging precedent: Greater Cambridge Local Plan (First Proposals 2021[xcvi])

Policy CC/CS *will:*

- "Support the creation of land and habitats that play a role as carbon sinks and protect existing carbon sinks from development in particular undisturbed or undrained peat"
- "Promote approaches that minimise soil disturbance, compaction and disposal during construction projects".

The details of how this policy will be structured are not yet available.

However, the First Proposals document explains that it is supported by (and will draw on) an evidence base including:

- Net Zero Carbon Study
- Green Infrastructure Opportunity Mapping Report – this took an 'ecosystem services' approach to identify existing and potential green infrastructure, of which one of the ecosystem services is carbon sequestration. This included approximate mapping of soil carbon and above-ground carbon in vegetation.
- Natural England (2021) report on Carbon Sequestration and Storage by Habitat (report NERR094).

It is noted that although many carbon-rich land areas will already be protected by nature conservation policies or designations, this is not true for all existing or potential carbon sinks. The policy is therefore needed because the Net Zero Carbon Study had shown that additional land-based carbon sequestration will still be necessary in the UK's net zero carbon future, even after all possible actions have been taken to reduce carbon emissions at source.

Emerging precedent: Central Lincolnshire Local Plan Review

This proposed plan underwent Regulation 19 consultation in Spring 2022[xcvii].

Aware of the region's widely distributed peatland as well as other green infrastructure, the Central Lincolnshire planning team commissioned specialists[xcviii] to map the area's peatland and estimate the potential amount of carbon that is stored, removed, or emitted *by those areas.*

It found that while the area of peatland is small, its degraded condition means that it has a meaningful impact on overall emissions (potentially amounting to more climate impact per year than the operational carbon emissions of all the proposed new housing for which the plan must make room). As a result, the emerging plan is proposing Policy S16[xcix] *[note: now Policy S17] which will* require assessment and mitigation or compensation of the carbon impacts of development on any carbon sinks including peat.

However, carbon sinks do not appear to have been a criterion in the sustainability appraisal for site allocations as only 2% of the land was identified peatland and thus not expected to be a common issue confronting many sites.

While not yet adopted and therefore not yet a full legal precedent, this approach could be relevant to other local plans with substantial amounts of high-carbon soils, woodland, grassland or other natural carbon sinks.

Proposed Policy S17 (carbon sinks) includes that:

> "Existing carbon sinks, such as peat soils, must be protected, and where opportunities exist they should be enhanced in order to continue to act as a carbon sink.
>
> Where development is proposed on land containing peat soils or other identified carbon sinks, including woodland, trees and scrub; open habitats and farmland; blanket bogs, raised bogs and fens; and rivers, lakes and wetland habitats*, the applicant must submit a proportionate evaluation of the impact of the proposal on either the peat soil's carbon content or any other form of identified carbon sink as relevant and in all cases an appropriate management plan must be submitted."

It also states that: "The demonstration of meaningful carbon sequestration through nature based solutions … will be a material consideration in the decision-making process. Material weight in favour of a proposal will be given where the net situation is demonstrated to be a significant gain in nature based carbon sequestration … Where a proposal will cause harm to an existing nature based carbon sequestration process, weight against such a proposal will be given … with the degree of weight dependent on the scale of net loss." The text refers the reader to the carbon soil mapping, and Natural England report NERR094 to assist in identifying the significance of carbon sinks.

Justifying the requirements: Necessity, feasibility and viability

Necessity and feasibility

The **necessity** for net zero carbon policies is clearly demonstrated by the previous sections' exploration of the scale and urgency of the climate crisis, the changes necessary to deliver the UK's legislated Net Zero Carbon 2050 goal and legislated carbon budgets (Climate Change Act), the absence of suitably ambitious national regulation or other incentives to deliver those changes, and the Local Plan's legal duty to proactively pursue carbon reductions (Planning & Compulsory Purchase Act) in line with the Climate Change Act 2008 (National Planning Policy Framework).

The Royal Town Planning Institute[c] points out that "Where local plan policy which complies with the duty [to mitigate climate change] is challenged by objectors or a planning inspector on the grounds, for example, of viability, they must make clear how the plan would comply with the duty if the policy were to be removed". This is because that duty stems from the Planning and Compulsory Purchase Act and Climate Change Act (supported by powers in the Energy and Planning Act). Formal legislation holds more weight than other government guidance that might seek to limit local plans' requirements.

The **feasibility** of identified measures is demonstrable through the fact that all measures have been previously delivered by the building design and construction industry in the UK before today (low heat demand via effective insulation and airtightness; accurate energy modelling; heat pumps or other low carbon heat; well-oriented solar panels; Section 106 offset payments; embodied carbon assessment).

Feasibility is further evidenced by supporting documents of several emerging plans that have similar performance requirements. The evidence bases for emerging local plans in Greater Cambridge[ci], Central Lincolnshire[cii] and Cornwall[ciii] all have studies showing that the requirements can be fulfilled in typical new buildings types in these areas. In these cases, it was shown how recent local new builds could have complied with the policy without changing the form or orientation of the building – only needing to add reasonably improved fabric, a heat pump, and solar panels that fit within the roof area.

The only potential policy components whose feasibility might be difficult to prove are the enhanced energy reporting and embodied carbon reporting. These skills are present and growing in the sector, but may not be mainstream outside of London projects and so there might be a bottleneck of skilled professionals available to conduct these. The impact of this bottleneck depends on the rate and scale of development that comes forward (in any local plan areas making a competing demand for these skills, as these services can be performed remotely). If development takes the form of fewer but larger applications consisting of broadly similar house types, these can be assessed efficiently via representative sampling. The skills bottleneck may be more impactful if housing comes forward via smaller and more varied applications that each need a separate assessment.

It should be noted that these specialist skills will be a far smaller factor in housing delivery compared to the overarching construction labour shortage[civ] which constrains the whole sector today. As national housing targets are thought to already be too large for the workforce to deliver[cv], energy/ carbon modelling should not be assumed the deciding factor in the feasibility of delivering housing.

The policy requirements would stimulate the industry to expand its capacity to fulfil them (noted in the FHS Consultation Response, paragraph 2.40, 2.60, 2.61, 2.62). In the absence of data to show whether there is or is not enough capacity in the industry to deliver these reports, a cautious approach could be to require the enhanced energy & carbon modelling only in major developments. If this choice is made, a required minimum specification could be devised for minor and householder proposals that would be likely (if not guaranteed) to deliver the required targets.

Viability of required improvements to the building

The cost of measures to comply with increased building energy performance standards should be considered within a whole-plan viability assessment. Despite a range of aforementioned precedent plans that include carbon reduction requirements, there is not a consistent approach to transparently assessing the cost of policy compliance. Their viability studies have variously applied cost uplifts of:

- £5/m² for 'BCIS Energy + Carbon' although it is not explained how this reflects the policy requirements, and somehow reaching £25,000/dwelling for fully zero carbon homes.
- £15,000 per dwelling for a bundle of sustainability measures including carbon and renewable energy– without clarifying the breakdown, or how this cost of policy compliance was identified.
- 1% uplift to overall costs to allow for professional fees, and BCIS cost data reflecting the construction cost of the Code for Sustainable Homes Level 4.

These precedents were successfully adopted and so their viability assessments must have been deemed sound by the Planning Inspectorate for the purpose of those plans' policies.

Nevertheless it will be more robust to use more transparently evidenced cost uplift data, directly linked to policy requirements, if Rutland chooses to put forward policies that push the boundaries of precedents.

To support viability assessment of requirements for energy efficiency and renewable energy, there is a variety of credible costs data available. Two key sources are identified:

- National Government Future Homes Standard Consultation Impact Assessment[cvi]
- Other local plan evidence bases for similar requirements (as cited under 'feasibility'.)

The following table compares estimated cost uplifts in a three-bedroom semi-detached home for various steps that an effective net zero carbon buildings policy might require (compared to a building regulations Part L compliant baseline), based on the national and local government cost sources.

It is important to note that the above documents look at cost uplifts compared to a 'business as usual' baseline of a building that complies with Part L 2013. By the time the updated Local Plan is adopted, the new Part L uplift (2021/22) will be in force, which raises the 'business as usual' baseline energy performance and thus the cost difference for 'net zero carbon' will be smaller. The strongest justification would be to commission a similar study of up-to-date cost uplifts specific to Rutland for a range of building typologies expected to come forward during the local plan period. These cost uplifts could be locally-specific, more reflective of the current market, and could be compared to the baseline cost of complying with the new Part L 2021/22 rather than the 2013 Part L.

We note that a November 2021 viability study[cvii] for an emerging Cornwall DPD found that most of the cost uplifts to meet the DPD's true net zero carbon policy, compared to building regulations Part L 2013, would already be incurred in order to meet Part L 2021 even in the absence of the policy. It also found that the steep rise in house prices from 2019-2021 meant that viability improved in several of the locations and development types despite an increase in build costs too.

Cost uplifts in comparison to basic compliance with Building Regulations Part L 2013

(Note: Uplifts are not the entire component cost, but the *difference* compared to the component that would be used for basic compliance with Part L 2013).

Policy requirement	FHS Impact Assessment 2019	Currie & Brown 2021 for Cornwall DPD Evidence Base
Future Homes Fabric	+£2160 (£2560 minus £400 for waste-water heat recovery)	+£1977
Heat pump system (to reach Future Homes carbon emission rate that is 75% lower than Part L 2013, or 35kWh/m²/year EUI)	Not specified as an individual element	+£1562
Solar PV to meet remaining regulated energy use (*Not part of FHS requirements – but shown here to illustrate approximate cost to go from FHS to net zero regulated operational carbon).	+£2700 to +£3100 (Derived from £1,100 fixed cost + £800 per kWp; estimating that the regulated energy demands of a home with FHS fabric and heat pump could be covered by a ~2 – 2.5kWp system.)	+£1328 to meet regulated energy use of 20kWh/m²/year (Derived from cost of solar panels to meet total energy use in home with efficient fabric and heat pump, minus the share of unregulated energy, rounded up to 6 whole panels.)

The viability study[cviii] for the Bath & North East Somerset Local Plan Partial Update used a different uplift methodology to Cornwall, instead testing three different % uplift scenarios. 3% was the expected uplift scenario for the net zero new build policies, yet 5% and 6% scenarios were also tested to reflect potential market fluctuations after the assessment had been carried out. At the higher uplift scenarios, the policies remained largely viable, excluding high-rise flats in rural areas, which we are highly unlikely to see. The additional headroom gained through testing more expensive uplift scenarios, which remain viable, ensures a stronger defence against developer objections to policies on viability grounds.

Further cost evidence bases for energy target-led planning requirements were developed for Greater Cambridge and Central Lincolnshire (through a similar approach to that of Cornwall), the latter of which is in the public realm as the Central Lincolnshire policy has now been examined and adopted.

Finally, there is some evidence[cix] showing that homes with better energy and carbon performance may command higher sale prices thus aiding viability, but these effects were regionally specific at the time. This effect may be magnified by the current and ongoing energy cost crisis. It may further increase if the government follows through on its proposals to financially incentivise improved building carbon performance through the mortgage lending system, as suggested in its recent Net Zero Strategy[cx] and Heat and Buildings Strategy[cxi].

Viability of offsetting any remaining carbon emissions

The cost of offsetting can be reasonably estimated, using publicly available data on new homes' carbon emissions in combination with an assumption about what the local plan policy will required in terms of on-site reductions.

It is up to the local authority to decide on the cost per tonne of carbon, and the period of time for which the emissions must be offset. Most precedent local plan policies on offsetting require a period of 30 years' worth of emissions to be offset. They usually also that the annual emissions do not change over that time, and nor does the price per tonne of carbon. Their total offset cost would be as follows:

(Annual carbon emissions) x (£cost per tonne) x (**30 years**) = £total offset payment.

We can estimate the likely amount of *regulated* carbon emissions that new homes in Rutland are likely to have, using publicly available data of recently completed new homes in the area. The live public record of new dwelling energy performance certificates[cxii] includes data on average annual regulated CO_2 emissions per dwelling, as calculated by Part L SAP. This can be filtered by local authority area and date. An average of all new build homes in the last two years gives a reliable typical new build performance under 'business as usual' in Rutland (that is, in the absence of a local plan policy that requires a specific degree of on-site carbon reductions, under the then-current Building Regulations Part L 2013). In Rutland as of May 2023, this average is 1.99 tonnes.

Next, this average figure must be **reduced to reflect any proposed policy requirements for on-site improvements to regulated carbon.** For example, a 75% improvement if the policy will bring forward the Future Homes Standard (as the new builds completed up to today are likely to have been planned and consented under the Part L 2013 building regulations, and the Future Homes Standard is expected to represent a ~75% reduction in regulated carbon compared to the Part L 2013). Therefore:

(Annual 1.99 tonnes – 75% = 0.50 tonnes) x **30 years** = 15.00 tonnes of carbon to offset.

Next the cost per tonne of carbon must be decided. The precedent local plans have sometimes used a local study to understand the cost to achieve carbon removals or reductions, but most use a £60-90/tonne figure that reflected a previous year's nationally recognised central value per tonne of non-traded carbon. This approach was adopted by London when the London Plan first began to require carbon offsetting, but the London guideline price has not been regularly updated to reflect the subsequent increases to the nationally recognised value of carbon. That nationally recognised central value is now[cxiii] £252/tonne as of 2023, and rises by 2% year-on-year to reach £378/tonne in 2050 – the 'high' scenario in 2023 sets a price of £373/tonne. Rutland could therefore use the current value for the whole local plan period as follows:

(15.00 tonnes emitted within the 30-year period) x £252 = £3,768 total offset payment.

Alternatively, Rutland could apply an increase to reflect that the financial value of the home's carbon emissions will go up over time to reflect the changing nationally recognised value:

(0.50 tonnes x 2023 value) + (0.50 tonnes x 2024 value) + (0.50 tonnes x 2025 value) … etc **for all years over a 30-year period**. The resulting total is £4,728.

However, if we are going to apply future years' monetary values for carbon, it seems reasonable to also recognise that the carbon emissions will also change in future years due to changes in grid electricity generation, as more renewables come online and gas is phased-out. Publicly available data for on future years' electricity grid carbon is found in the same data set as the national carbon values. *Assuming the home is gas-free and all-electric*, we can apply the future grid carbon reduction percentages to the home's total regulated carbon. This would work out as follows:

(0.50 tonnes x 2023 value) + (0.52 tonnes x 2024 value) + (0.45 tonnes x 2025 value) … etc **for all years over a 30-year period**. The resulting total is £1,024.

If the home has gas or other forms of energy supply other than electricity, the calculation must *not* apply the future electricity grid decarbonisation to the home's whole carbon figure.

This final total of £1,024 is suitable for viability testing alongside the cost of making any required on-site carbon reductions, if Rutland's policy only covers regulated carbon and seeks an on-site improvement equivalent to the Future Homes Standard.

If the policy also requires *unregulated* carbon emissions to be offset, this must be added to the annual *regulated* carbon amount before multiplying by the years, grid carbon reductions, and carbon value.

An estimation of the typical amount of *unregulated* carbon may need analysis by an energy specialist using BREDEM calculations, or PHPP / CIBSE TM54 calculations if the policy approach chooses to require those as the method for compliance with policy requirements for total energy/carbon.

Alternatively, it may be possible to make a broad-brush assumption about the ratio of unregulated to regulated carbon based on existing industry studies. For example, using figures from the UKGBC Net Zero Carbon Buildings Framework Definition[cxiv] which includes case studies which break down buildings' whole-life carbon emissions (regulated, unregulated, and embodied). In the residential example given, the home's *regulated* carbon contributed 24% of its whole life carbon while its unregulated carbon contributed 7%. This would indicate that unregulated energy adds ~30% on top of the regulated figure in homes. This would make the following differences to typical offset costs in Rutland:

- An additional +£1045 bringing the total per home to £1909, if we assume that the policy does not require an on-site reduction in carbon from unregulated energy use.
- An additional +£259 bringing the total per home to £1124, if we assume that the policy requires an on-site 75% reduction in carbon from unregulated energy use (matching the reduction in carbon from regulated energy use).

Commented [AM11]: UPDATE FOR RUTLAND

Finally: If the policy firstly seeks net zero carbon buildings through entirely on-site measures, then there would be no further offset costs. The viability study must not add the cost of offsetting on top of the cost of already achieving a net zero carbon home with on-site measures, as this would result in double-counting of costs. In reality, many homes would most likely use a combination of on-site measures and offsetting.

Carbon reductions as an issue of design quality

There is evidence that the new National Planning Policy Framework is leading the Planning Inspectorate to place a greater focus on design quality. A recent analysis[cxv] of appeals since July 2021 found that inspectors are no longer dismissing poor design as a reason for refusal simply because of a shortfall in housing land supply, and that the likelihood is very low of the developer being awarded costs if their application is refused on design grounds.

The relevant parts of the NPPF state that:

- "Development that is not well designed should be refused, especially where it fails to reflect local design policies … [and] Significant weight should be given to … outstanding or innovative designs which promote high levels of sustainability". (Paragraph 134)
- "Local planning authorities should seek to ensure that the quality of approved development is not materially diminished between permission and completion". (Paragraph 135)

This is likely to be most relevant to the setting of bold local plan policies on the topic of embodied carbon and the use of specific processes to reduce the energy performance gap. This is because:

- Embodied carbon is related to design quality through durability, heritage. biophilia[15] and generally 'innovative design which promote[s] high levels of sustainability'.
- Energy performance gap remediation processes are created solely for the purpose to 'ensure that the quality … is not materially diminished between permission and completion'.

[15] 'Biophilia' refers to humans' innate attraction to the living natural world, and wellbeing benefits experienced via exposure to it. Renewable materials like timber can support this and also reduce embodied carbon, reflected in today's growing focus on biophilic design in architecture.

Position Statement

The following section proposes a position statement that sets out net zero carbon for the local plan, based on the preceding literature review.

1. A Net Zero-Carbon Rutland is one that:

    - Contributes no more GHG emissions in scopes 1 and 2 (including all 7 gases named in the Kyoto Protocol) on an annual basis than are removed from the atmosphere by the area's carbon sinks:
        - Including all energy and refrigerant use by buildings and transport,
        - Including peatlands' and wetlands' emissions and removals (if present) along with other land use,
        - Including all sectors and emissions sources except aviation and shipping
        - Without relying on offset schemes delivered outside the UK, and minimising the use of UK carbon offset credits too.

    - Stays within CO_2 emissions budgets for energy use (including transport) that are consistent with a 1.5˚C climate change pathway to 2100 (as calculated by the Tyndall Centre to be a proportional contribution by Rutland as part of a globally fair contribution by the UK to the Paris Agreement)

    - Keeps track of its scope 3 emissions (aviation, shipping and embodied carbon of goods, especially building materials), and takes steps to reduce these through resource efficiency, land use, and exerting influence over its supply chain, and finds effective means for the appropriate offsetting of the remainder within the UK.

2. A local plan consistent with a Net Zero-Carbon Rutland is one that:

    - Allocates development sites, densities and mix of uses so as to minimise the potential carbon emissions for built environment and transport:
        - In terms of modal shift to active travel and public transport
        - In terms of availability of grid infrastructure to support both electrification of vehicles and the necessary renewable energy generation on buildings linked to the grid
        - Using a cautious estimation of the rate of shift towards electric vehicles
        - Avoiding the expansion of existing airports (if present) or the development of new ones

    - Requires the maximum feasible reduction (typically 100%) in scopes 1 and 2 of energy use and carbon emissions from any new development's operation
        - Including both regulated and unregulated energy at the development
        - Calculated using a proven methodology to reliably predict the building's energy use and minimise the energy performance gap
        - To be achieved on site using an energy hierarchy considering passive design, fabric efficiency and zero-carbon heating and disallowing fossil fuel energy use
        - Adopting space heating and energy use intensity targets from relevant green building frameworks that are aligned with science-based carbon targets
        - Taking into account exchanges of energy over the course of a year (with exports of zero-carbon energy counting as negative emissions)
        - With the energy strategy for major developments to include monitoring of energy and carbon emissions for the first 5 years to help create benchmarks

    - Requires new developments to install the sufficient on-site renewable energy generation to match total energy use (in order to meet the aforementioned 100% carbon reduction), and should also:
        - Adopt a guideline metric of renewable energy capacity per square metre of building footprint (to acknowledge that the key factor is roof space for solar panels),
        - Expect that plots below a certain height should be able to become net exporters of zero-carbon energy across the course of a year

    - Requires developer contributions to offset the development's any residual on site renewable energy generation that does not match total energy use, only as a last resort and in exceptional circumstances where this is shown to be unavoidable, and define the 'allowable solutions' for offsetting to include the following:
        - Direct local action funded through setting a price as £/tCO_2 or p/kWh to be charged to the developer, that reflects the actual cost of emissions reduction in Rutland
        - Prepare structured schemes to deliver these offsets within Rutland in a measurable and time-bound way (for example, to retrofit existing buildings with insulation or zero carbon heating, to invest in renewable energy in the local area, or to transition existing heat networks to zero-carbon sources)

    - Requires developments over a certain size or value to calculate and limit their embodied carbon emissions up to the stage of building completion (RICS methodology stages A1 to A5) and specify steps taken to reduce this through resource efficiency, construction practices and materials selection, making this a material issue in planning

- Align embodied carbon limits with industry recognised benchmarks such as set by LETI and RIBA

- Is supported by an infrastructure development plan that explicitly prioritises carbon-reducing infrastructure – and avoids spending on infrastructure that would be likely to lead to increased emissions (such as highways upgrades other than bus routes, cycle routes, and features that support zero-emissions vehicles only)

- Explicitly encourages and supports renewal and refurbishment proposals that include significant retrofit and improvements to existing building stock, both through policy wording and other planning mechanisms available, such as Local Development Orders

- Identifies and allocates sufficient and suitable space for large scale generation, storage and transmission of renewable energy to support the transition of all buildings and vehicles away from fossil fuels, again identifying suitable sites and using permissive tools, such as Local Development Orders

- Identifies and protects sites in the combined authority area that are or could feasibly become carbon sinks (i.e. peatlands and areas suitable for biodiverse native afforestation), and supports the restoration of these, ideally of sufficient size to offset the remainder of unavoidable emissions from sectors that cannot reach zero emissions by 2050.

3. A Net Zero-Carbon Development in Rutland:

- Contributes net zero GHG emissions in operation in scopes 1 and 2 for all its energy use, consuming only renewable energy from on-site generation OR importing no more grid energy than the amount of renewable energy the home is able to export to the grid over the course of the year. To do this, the home would:
  - Achieve targets for space heating demand and Energy Use Intensity (including unregulated), either from the local plan or industry frameworks if better (e.g. RIBA Climate Challenge, LETI Net Zero Operational Carbon and Passivhaus Plus or Premium)
  - Follow an energy hierarchy process in the design that considers orientation, form, fabric renewable heat supply and renewable energy generation
  - Be assessed using a proven methodology that accurately forecasts and minimises actual total energy use of the building (e.g. PHPP), including the performance gap
  - Be monitored for 5 years from first occupation for major developments (with a method built into the energy strategy)
  - Design towards a minimum kWh of renewable generation on site per square metre of building footprint
  - Where there is insufficient on-site renewable energy generation to match the total energy use of the development, offset any residual kWh over the building's lifetime (assumed to be 30 years) through a direct financial contribution determined by a locally-specific set price that covers the cost of achieving the same energy generation within Rutland
    - This offset payment should go into a structured fund held by the Council to be spent on local schemes with direct and measurable carbon reductions that would otherwise not occur (i.e.. additionality), or invested directly in additional off-site renewable generation (ideally on the roofs of other new builds that have excess space, so as to save land elsewhere and decarbonise the new build growth as a whole).

- Calculates and complies with a limit set for the embodied carbon from construction (major developments only, stages from production through to completion – A1 – A5)

- Does not hinder the site's ability to be an existing carbon sink, or feasibly be converted to a significant carbon sink, if the site is identified to have good potential for this function

- Is sited and equipped to support a pathway towards zero-emissions transport: active travel, public transport or electric vehicles (in that order of preference).

Appendices: additional guidance and advice

Best practice frameworks for achieving net zero development

This section focuses only on achieving net zero ***operational*** *carbon and does not consider net zero* ***embodied*** *carbon because the planning system is currently not well-equipped to support net zero embodied carbon policy.*

As net zero carbon development becomes a priority for local authorities and an increasing number of developers, net zero carbon frameworks can provide stability and consistency as to how this is achieved.

The Low (formerly 'London') Energy Transformative Initiative (LETI) is the leading industry body, and has consistently produced open-source information and frameworks since 2017. The LETI Net Zero 1-pager is a concise summary of how to both *define* and *achieve* net zero operational carbon in new buildings. LETI's definition equates to 'net zero operational energy', so that no 'carbon offsetting' is needed. LETI's Climate Emergency Design Guide sets out in more detail how net zero operational energy can be achieved and is aligned with the net zero framework. For specific questions on how to achieve net zero development, LETI produced a series of 'Net Zero FAQs' in partnership with the Chartered Institution of Building Services Engineers.

There is widespread agreement across the industry that the LETI net zero framework set out in the 1-pager is currently considered best-practice. The key operational elements of the framework, which deliver key interventions needed in new buildings for the UK's science-based carbon pathway, are:

- **Low energy use**: 35 kWh/m²/yr (residential); 65 kWh/m²/yr (schools); 55 kWh/m²/yr (offices)
- **Low space heating demand**: 15 kWh/m²/yr (all building types)
- **Maximise on-site renewable energy**
- **Measurement and verification**: post-occupancy monitoring for first 5 years
- **No fossil fuels for heating and hot water**
- **Reduce construction impacts**
- **Incorporate energy demand response and storage measures**

As set out in the precedents in the previous sections, local authorities are beginning to adopt new-build policies that are aligned with the LETI net zero development framework, most notably Central Lincolnshire. Local planning policy is fast catching up with the pace of action needed in new development's performance in the climate transition. However, requirements for post-occupancy monitoring and incorporating energy demand response and storage measures remain difficulties.

The policy recommendations in Task D of this evidence base are likely to follow the LETI net zero operational framework and aim to integrate the more challenging measures of the LETI framework.

In 2019, the UK Green Building Council (UKGBC) set out their net zero framework, Net Zero Carbon Buildings: A Framework Definition, which distinguishes five key elements to achieving operationally net zero development:

1. **Establish net zero carbon scope**
2. **Reduce construction impacts**
3. **Reduce operational energy use**
4. **Increase renewable energy supply**
5. **Offset any remaining carbon**

The UKGBC framework recommends the same energy based approach as LETI, with a kWh/m²/yr metric, yet did not set specific targets for energy use or space heating demand. Recognising that the document was becoming outdated, the UKGBC's Clarifications document now recommends that energy use targets should be aligned to the LETI guidance previously set out; targets from the Carbon Risk Real Estate Monitor and Royal Institute of British Architects (RIBA) are also recommended.

Also important to note is that a wider group of industry bodies is now in the process of developing a 'UK Net Zero Carbon Buildings Standard' bringing together the LETI, UKGBC, RIBA, CIBSE and other experts' work. Its exact content is not yet available, its stated intention is that – like LETI – it will reflect what is necessary in new buildings as part of the UK's science-based carbon pathway.

Achieving a net zero carbon development is highly important, yet achieving holistic sustainability also requires other considerations. We would note the **One Planet Living** framework, which aims to ensure that a place enables a good quality of life within the resource limits of our single planet (including the planet's limited ability to absorb our carbon emissions). The framework comprises of ten elements, which together address all aspects of social, environmental and economic sustainability:

In the context of this evidence base, developers and local authorities are the primary groups that One Planet Living applies to, although anyone can use the framework. 'Zero carbon energy' is an essential element of the framework, but One Planet Living uniquely puts people first. Additionally, the aforementioned LETI framework could be used within One Planet Living to specifically achieve the 'zero carbon energy' element, since One Planet Living does not specify targets on energy use.

Potential implications of future changes to national policy

At present, there are no fully confirmed changes to national policy that will impact net zero carbon development. However, a number of policy changes may occur in the coming years that could either positively or negatively impact the ability for local plans to deliver net zero carbon development:

- Building Regulations

  During the plan period, Building Regulations will be updated for 2025 with the Future Homes Standard (FHS) and Future Buildings Standard (FBS). Proposed standards in the 2019 FHS consultation, which deliver 75 – 80% reduction to *regulated only* CO_2 emissions over current building regulations, are not highly ambitious or aligned with science-based targets required for a net zero UK by 2050. Additionally, this 'regulated carbon reduction' is currently calculated using the existing Building Regulations methodologies for energy and carbon (SAP in homes; SBEM in non-residential), which as previously noted are highly inaccurate as they underestimate the building's actual energy and carbon. Further changes to the scope and specification to the FHS and FBS will be made, which could move standards closer to true net zero, which would include unregulated emissions reductions.

  The introduction of the FHS could undermine local planning policy, or be accompanied by planning system changes that remove local authority powers to set specific energy standards. However, as per the Government's 2021 FHS consultation response, local authorities at present will retain the power to set local energy efficiency standards that exceed Building Regulations.

- National Planning Policy Framework

  Significant indicative changes to the National Planning Policy Framework have been proposed and could be enacted prior to the inception of the Rutland's local plan period, as explained in detail in a previous section. Related to the NPPF changes is the Levelling Up and Regeneration Bill, which was consulted from December 2022 – March 2023. The Bill floats the introduction of 'National Development Management policies', the content of which has not yet been indicated. It is possible these National DM policies could include new requirements around carbon assessments, which could alter the power of local authorities to set their own carbon-related policies. Yet there is no immediate indication that this is the case.

  The Bill has also included proposals to adjust local planning authorities' powers to require developer contributions (Section 106 and CIL), which could alter the ability to collect carbon offset funding from new development (an approach used by various precedents previously noted). The recent indication is that the use of Section 106 may be 'scaled back' and limited to specific uses, rather than scrapped. Carbon offsets may well be a uses that remains permitted.

- Electrification of transport and decarbonisation of heat

  The key future change to national policy to enable electrification of transport is the ban on new diesel and petrol cars, which would be implemented from 2030, whilst hybrid car sales will continue until 2035. Already this has been somewhat supported by a change to Building Regulations as of 2021 via the new Part S which requires a certain ratio of electric charging provision in development that provides parking. However, in some cases this may not go far enough (especially in non-residential development and development where on-street parking is proposed). The local plan will therefore need to support this transition through transport policies on electric vehicle charging infrastructure, through allocating areas (or ratios to parking, including on-street parking and non-residential) to install fast or rapid charging points that will enable greater uptake of electric vehicles. It is however important to consider active travel and public transport simultaneously, and not encourage parking provision in dense urban areas where walking, cycling or public transport is suitable. This is primarily because the charging of electric vehicle will still result in carbon emissions until the grid has fully decarbonised, which is not expected to be until 2035. Additionally, the production and maintenance of individual private vehicles – and the infrastructure for them – involves far more embodied carbon emissions than that for walking and cycling.

The FHS is the primary national legislation relating to local plans that will drive heat decarbonisation (as it proposes to set the limit for regulated carbon emissions to a level that reflects a home with a heat pump, thus being difficult to achieve in a gas-fired or direct-electrically heated home).

However, the FHS does not explicitly address or active encourage district heating network development, which will also be key towards the decarbonisation of heat.

Identifying suitable locations for district heating is therefore an important task that the local plan can work towards, so that networks can be integrated into both existing and new developments. Linked to this is supporting renewable energy infrastructure to clean supply heat pump district heating networks and individual electric heating systems.

Policy relating to climate change adaptation

Whilst ensuring new development is built a net zero standard to address climate change mitigation, it is of increasing importance to ensure development is resilient to current and future climatic risks. Many of these risks are to an extent already 'baked in' to our future, due to the carbon that has already been emitted to date, and the length of time in which the world's atmospheric CO_2 concentration continues rising until humanity as a whole manages cut its emissions to a net-zero level. Such risks include overheating, biodiversity loss and increased variability and extremity of precipitation.

Local risk and vulnerability assessments should be carried out to identify specific risks to the area and where they are likely to be most intense, using climate projections in combination with knowledge about the area's characteristics (such as built-up areas and potentially flood-affected areas). Collecting this local data and information is necessary to provide the required justification to adopt local plan policies that address identified risks and anticipated impacts.

Climate projection data should be incorporated into the standard set of background evidence base pieces for the local plan and for development applications. For example, flood risk assessments should be combined with future climate projection data (such as UKCP18[cxvi]) to determine the most at-risk locations vulnerable to intensifying flooding in the future. Any county-wide water cycle studies and Infrastructure Delivery Plans should also take into account future projected changes to rainfall, in order to understand how drought might affect the county; for example in some local plan areas the predicted availability of water has even placed limitations on how much growth the local plan can reasonably make provision for[cxvii].

Policy and site allocations can therefore best ensure that new development is not located in the highest-risk areas, and/or ensure that the development is best prepared and resilient to such risks. This could include specifying that new development must be at a certain elevation and use waterproof sealants and materials to minimise flooding impacts on-site.

Overheating risk also becomes a greater concern as buildings (necessarily) become more energy efficient and thermally insulated. Overheating risk can decrease comfort or even safety of residents. Integrating overheating assessment requirements into policy alongside operational energy/carbon requirements works towards a well-rounded policy approach, that can address mitigation and adaptation holistically.

Building Regulations Part O offers either a simplified method or a dynamic modelling method to assess overheating, but the more effective 'dynamic method' is not necessarily required although it provides more detailed information on specific risks and their locations within a building. Alternatively, CIBSE TM52 and TM59 overheating risk assessment methodologies provide a robust approach for accurately assessing and mitigating such risks, which could be implemented as policy alongside operational energy/carbon measures. Requiring that new development appropriately integrates the cooling hierarchy into design decision-making also best ensures that overheating risks are considered throughout the entire decision process, allowing for more effective measures to be selected.

Although a 2021 Written Ministerial Statement claims that now Building Regulations Part O (Overheating) has been introduced "there will be no need for policies in development plans to duplicate this", we note that Part O does not make mandatory the more effective full dynamic overheating modelling approach exemplified by CIBSE TM52 and TM59 as above. Therefore if introducing a policy on this topic, it may be helpful to justify this by producing evidence that Part O would not guarantee sufficient overheating risk mitigation in the specific local context with local climate projections.

Overheating and operational energy/carbon should be treated together, for example to ensure that the development does not increase overheating risk by excessively pursuing solar gain to reduce heating demand, and that the design does not require energy use for active cooling now or in future climate conditions. Therefore it is important that passive cooling measures are prioritised and active cooling measures are only used as a last resort because their use will increase energy consumption and subsequent associated carbon emissions. Design elements such as building form, orientation, shading and passive ventilation should be decided at the earliest possible stage to ensure passive measures are maximised and overheating is sufficiently addressed.

Green and blue infrastructure measures are highly effective at mitigating risks from both overheating and flooding, which can be included as design requirements for local plan development. For example, green roofs are able to reduce the surface temperature of a building yet also collect rainwater and reduce runoff onto impermeable surfaces that could worsen flood risks. Similarly, Sustainable Drainage Systems often include measures that overlap with green infrastructure, such as swales and rain gardens, meaning that policy should seek to simultaneously address multiple risks.

Water availability and drought-resilience are another climate adaptation topic that policy could respond to. Given the projections for hotter, drier summers (likely 20-30% drier in the 2060s than the 1990s) there will be a need to minimise the amount of additional water demand placed on the limited water supplies by new development. Water efficiency measures such as the 'optional limit' of 110 litres/person/day should be incorporated into policy as a minimum. Industry frameworks such as the RIBA Climate Challenge have also devised some suggested targets that are more ambitious, differentiated by different use classes including residential, schools and offices. Additionally, the BREEAM environmental certification framework offers several credits specifically for water use reduction in non-residential developments; policy could require a development to achieve all or some of these credits (for example, one precedent, Cambridge Local Plan, requires non-residential development to achieve a full five credits in the BREEAM topic 'Wat 01' which relates to percentage of water use reduction against a typical baseline for the building type/use).

A further way in which adaptation to reduced future water availability could be built into policy is by requiring developments to demonstrate how they are designing their green space/landscape to be drought resilient and require minimal watering, for example through including systems to reuse greywater in irrigation, or through selection of a drought-resistant planting palette. This would of course be most relevant to developments with large amounts of public or shared green space.

Infrastructure requirements

As the grid decarbonises through a greater share of renewables in the mix of electricity generation, infrastructure upgrades will be required since the capacity of the electricity grid will need to be larger than it currently is. As the UK transitions away from fossil fuel transport and gas heating to electric vehicles and heating, electricity demand will significantly increase – however, this is not the only reason why the net zero carbon transition requires grid capacity upgrades. The other reason is to account for the varying levels of electricity generation due to weather variations, such as a prolonged period with or without solar PV or wind energy generation. The UK electricity grid infrastructure is not yet prepared for this anticipated increase in capacity or flexibility to respond to fluctuations in generation. This inhibits growth towards a net zero Rutland and UK.

Upgrades to the capacity of power sub-stations are already becoming problematic to achieve due to a lack of investment and is subsequently limiting some areas in the UK to no new connections until the mid-2030s. This is a clear barrier to achieving net zero at both a local and national level, which could resultantly limit the electrification of heat and transport. This could also present obstacles to a net zero carbon new development policy that relies on the development's ability to export zero-carbon power to the grid in order to balance out the amount of grid electricity it has to use at times when the development's own onsite renewables are not able to match its energy use. If (as in some UK locations is already the case) the grid operator refuses to take any energy exports from the new development, the development's only route to net zero carbon would then be through expensive energy storage on-site (to store any excess) or pay towards off-site offsetting.

The local plan must therefore provide the best available framework to enable these infrastructure upgrades and move towards a decentralised local energy network that is increasingly self-sufficient and resilient to future challenges.

Increasing the amount of energy storage is essential to create a resilient energy system suitable for our net zero carbon future, to account for periods for renewable energy generation is low. At a local level, this is likely to primarily consist of battery storage, which can respond rapidly to increased energy demand or generation. Ensuring the energy system is able to rapidly respond to increases in electricity demand and generation is the key to a future resilient system. The local plan can also work towards encouraging or requiring new development to integrate storage systems alongside renewable energy generation to create a decentralised system that stores electricity on-site.

As previously noted, Local Development Orders can provide a useful tool to bring forward infrastructure for renewable energy storage and distribution.

An innovative approach would be to provide a policy framework that supports smart local grids for new larger development that has peak-demand-response capabilities built in that can operate throughout the site. Supporting a policy approach in this way moves towards truly decentralised energy networks that increase resilience to external grid factors. For example, in a new net zero development that has sufficient on-site renewable energy generation to match total energy consumption over the course of a year, a house with residents working from home during the day will demand more energy at this time than another house where the residents are not occupying the property at the same time. If the occupied house is not producing enough on-site energy from a rooftop solar PV installation to consume 100% renewable energy, it would be able to take any residual generation from the unoccupied house during that time through a purchase agreement throughout the site – this can be replicated amongst all houses on-site to create a development-wide energy network. Additionally, if a minimal amount of energy is generated from on-site solar PV on one day, if a storage system is in place on-site, the occupied houses will have access to renewable energy generated during preceding days.

The scale of intervention required to achieve net zero carbon at a local scale is difficult to predict without specific modelling for the area. However, the local plan can ensure that interventions for new development halt any new emissions from new development (i.e. require that all residential and non-residential buildings can generate sufficient renewable energy on-site to match the total energy that is consumed). It is inevitable that grid infrastructure upgrades and a large increase in localised energy storage is necessary to achieve a resilient net zero local system. The most important thing the local plan can focus on to reach a net zero future is provide the policy framework to easily enable growth of EV charging infrastructure, net zero new builds, energy storage and distribution, alongside creating smooth planning processes for retrofitting and renewable energy proposals.

Framework for monitoring net zero carbon development implementation

The adoption of net zero carbon planning policy for new development is clearly a positive step to a more sustainable Rutland. However, the adoption of such policies is only meaningful if they are complied with in practice, most notably that buildings are built to standards required by policy.

Three key topics could be monitored to assess the effectiveness of the policy:

- Proportion of applications that comply with the policy fully at the design stage, with all required information submitted and all policy targets hit
- Completion of buildings to the same standard and quality as designed (possibly through discharge of conditions)
- Actual performance of the buildings when occupied, through monitoring.

The first bullet point – application compliance with the policy – could be monitored through a validation checklist that could be compiled into data that could feed into the local authority's existing Annual Monitoring Report (this could also track related points such as amount of developer carbon offset funding raised or spent). This helps gauge whether the policy is effective in communicating expectations to developers and effecting change in the industry.

The second bullet point – regarding verification of build quality – addresses the 'energy performance gap'. The performance gap (as previously noted) is a widespread and common issue for new build development in the UK. Without monitoring of the construction and completion quality, it is likely that the development will not operate in practice to the exact energy targets that were stated in the design to meet the policy. There would be cost uplifts during the construction process to conduct the required checks and compile verification data. This may be too much of a burden for smaller schemes, but these checks should be a more viable option for larger scale development.

Several quality verification processes are available, often termed 'assured performance processes'. Some of these are for construction and completion only, while others continue through to post-occupation monitoring also. These schemes run throughout the construction phase to ensure that construction is delivered as intended in the design, raising the likelihood that the building will perform at or close to the designed energy performance. Specific staff on-site look over construction techniques required to achieve the designed performance best ensures that human error is minimised when building to a high standard. In some cases, actions are required to ensure correct commissioning and calibration of energy-using systems, and/or a smooth handover to the user.

Assured performance processes could be required by the policy, or conditions could be applied that the developer must submit evidence of having undergone such a process and submit as-built construction quality data that is produced via that process. A few schemes that might fulfil this function include:

- Building Energy Performance Improvement Toolkit (BEPIT) (includes a series of design and construction process improvements and quality checks to ensure build quality is sufficient to meet designed energy performance, but does not cover post-occupancy monitoring)
- Passivhaus Building Certification (includes design reviews and post-construction quality checks, but does not cover post-occupancy monitoring)
- National Energy Foundation/Good Homes Alliance Assured Performance Process (covers all stages from design, construction, post-completion testing and post-occupancy evaluation).

The third bullet point regards in-use energy performance monitoring data. It is difficult to hold developers to account and penalise them if actual energy consumption exceeds intended levels, as a large part of the energy usage (specifically the *unregulated* energy consumption) is controlled by occupant behaviour. Monitoring is still however essential to gain an understanding of a policy's impact in practice. Without data gathering of in-operation building energy performance, it will remain unclear what the overall impact of the policy has been, and what measures are effective at reducing the energy performance gap between design-stage performance predictions and as-built performance.

Such monitoring could therefore be required through policy. The indicators should align to what is required by the associated policy and could be set as a condition as post-occupancy monitoring.

One potential policy mechanism could be a requirement for development to achieve certain credits that relate to post-occupancy energy monitoring within certification systems such as BREEAM and Home Quality Mark. The relevant credits include BREEAM 'Ene 02' and HQM criteria 4 – 6.

The policy could require that the monitoring must meet a certain standard. BS40101: Building Performance Evaluation is the first British Standard that provides guidance on 'what, why, when, how and who' in relation to evaluating the performance of buildings on various different parameters, including energy and carbon among other metrics. It can be used at any stage of a building's operational life, and can be used to determine a retrofit strategy as well as for general monitoring.

Whilst it may be difficult to implement assured performances process schemes and full monitoring within new build development policies, upskilling internal Development Management (DM) colleagues and setting specific conditions on building performance throughout construction phases will reduce the risk and magnitude of energy performance gap. Training sessions for DM officers on technical processes involved with net zero carbon development, such as modelling techniques and typical performance values of building elements, can strengthen internal capabilities to assess and scrutinise applications that may have submitted overly-optimistic building performance values for the sake of policy compliance. Setting building performance conditions during construction will also open up opportunities to correct any potential energy performance risks before completion. For example, a condition might require an air tightness test to be carried out on a building from each typology on-site whilst the air barrier remains accessible. This would inform DM officers whether the building is likely to comply with a space heating demand target requirement.

To assess policy implementation at a wider scale, annual indicators to demonstrate that the local plan is driving clear progress on emissions reductions could include:

- MW capacity of solar PV installed on buildings – planning portal or MCS data
- MW capacity of solar PV installed as standalone scheme (above 1MW) – BEIS REPD data
- MW capacity of wind turbine installed as standalone scheme (above 1MW) – BEIS REPD data
- MW capacity of battery storage installed – BEIS REPD data
- Annual CO_2 emissions of new build development
- Number of heat pumps installed – planning portal or MCS data
- Number of insulation retrofitting measures installed – planning portal
- Number of listed buildings retrofitted – planning portal
- Number of EV charging points installed
- % of Rutland residents who use active travel for commuting

References and Endnotes

[i] AECOM & Zero Carbon Hub (2012), *Fabric energy efficiency for Part L 2013*. https://www.zerocarbonhub.org/sites/default/files/resources/reports/Fabric_Standards_for_2013-Worked_Examples_and_Fabric_Specification.pdf
[ii] HM Government Ministry of Housing, Communities & Local Government (2021), *National Planning Policy Framework*. See page 65 for NPPF definition of climate change mitigation. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf
[iii] Intergovernmental Panel on Climate Change (2022), *IPCC Sixth Assessment Report: Mitigation of Climate Change*. Chapter 1: Introduction and framing – FAQ 1.11, What is climate change mitigation? https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FAQ_Chapter_01.pdf
[iv] World Wildlife Fund, *What's the difference between climate change mitigation and adaptation?* https://www.worldwildlife.org/stories/what-s-the-difference-between-climate-change-mitigation-and-adaptation
[v] Committee on Climate Change (2022), *Current programmes will not deliver net zero.* https://www.theccc.org.uk/2022/06/29/current-programmes-will-not-deliver-net-zero/
[vi] ClientEarth (2022), *Historic High Court ruling finds UK government's climate strategy 'unlawful'*. https://www.clientearth.org/latest/press-office/press/historic-high-court-ruling-finds-uk-government-s-climate-strategy-unlawful/
[vii] Town & Country Planning Act 1990, Part III: Control over development – other controls over development. https://www.legislation.gov.uk/ukpga/1990/8/section/106
[viii] Town & Country Planning Act 1990, Part III: Control over development; Section 61: Local development orders. https://www.legislation.gov.uk/ukpga/1990/8/part/III/crossheading/local-development-orders
[ix] Intergovernmental Panel on Climate Change (2018), *Special Report: Global Warming of 1.5C*. https://www.ipcc.ch/sr15/
[x] Intergovernmental Panel on Climate Change (2022) *IPCC Sixth Assessment Report: Summary for Policymakers – Headline statements*. https://www.ipcc.ch/report/ar6/wg3/resources/spm-headline-statements/ . See paragraph C.1: "Without a strengthening of policies beyond those that are implemented by the end of 2020, GHG emissions are projected to rise beyond 2025, leading to a median global warming of 3.2 [2.2 to 3.5] °C by 2100".
[xi] Committee on Climate Change (2020), *The Sixth Carbon Budget: The UK's path to Net Zero*. https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf
[xii] Committee on Climate Change (2019), *UK Housing: Fit for the future?* https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/
[xiii] See table 3.2.c in the Committee on Climate Change Sixth Carbon Budget (2020) referenced previously.
[xiv] AECOM & Zero Carbon Hub (2012), *Fabric energy efficiency for Part L 2013*. https://www.zerocarbonhub.org/sites/default/files/resources/reports/Fabric_Standards_for_2013-Worked_Examples_and_Fabric_Specification.pdf. Please note this AECOM document considers two potential TFEE levels that were being considered in 2012 for inclusion in the 2013 building regulations. Government later confirmed that the 'interim TFEE' option was the one adopted in Part L 2013.
[xv] Committee on Climate Change (2021), *2021 Progress Report to Parliament: Joint recommendations*. https://www.theccc.org.uk/publication/2021-progress-report-to-parliament/
[xvi] Committee on Climate Change (2022), *News: Current programmes will not deliver Net Zero (29 June 2022)*. https://www.theccc.org.uk/2022/06/29/current-programmes-will-not-deliver-net-zero/
[xvii] Etude on behalf of Cornwall Council (2021), *Cornwall Council Climate Emergency DPD: Technical Evidence Base for Policy SEC1 – New Housing Technical Appendices*. https://www.cornwall.gov.uk/media/dxchs1xq/eb042-1-20200359-climate-emergency-dpd-residential-energy-technical-evidence-base-appendices-rev-g.pdf
[xviii] Intergovernmental Panel on Climate Change (2018), *Special Report on 1.5C: Summary for Policymakers – Headline Statements*. This includes a note that to keep global temperature rise below 1.5C and thus avoid catastrophic climate change, global emissions would need to be cut by approximately 45% between 2010 and 2030, and reach net zero around 2050. As a richer and more developed nation, the UK should – per its commitment to the Paris Agreement – attempt to achieve faster and deeper carbon cuts. https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Headline-statements.pdf
[xix] Committee on Climate Change (2021), *Independent Assessment of UK Climate Risk*. https://www.theccc.org.uk/publication/independent-assessment-of-uk-climate-risk/
[xx] Committee on Climate Change (2021), *2021 Progress Report to Parliament: Progress in adapting to climate change*. https://www.theccc.org.uk/wp-content/uploads/2021/06/Progress-in-adapting-to-climate-change-2021-Report-to-Parliament.pdf
[xxi] HM Government Department for Environment, Food & Rural Affairs (2022), *UK Climate Change Risk Assessment 2022*. https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2022
[xxii] WWF (2017), *Water for Wildlife: Tackling drought and unsustainable abstraction*. https://www.wwf.org.uk/sites/default/files/2017-06/Water%20For%20Wildlife_Abstraction%20Report_June%202017.pdf
[xxiii] HM Government Ministry of Housing, Communities & Local Government (2021), *National Planning Policy Framework*. See page 65 for NPPF definition of climate change mitigation. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf
[xxiv] Intergovernmental Panel on Climate Change (2022), *IPCC Sixth Assessment Report: Mitigation of Climate Change*. Chapter 1: Introduction and framing – FAQ 1.11, What is climate change mitigation? https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FAQ_Chapter_01.pdf
[xxv] World Wildlife Fund, *What's the difference between climate change mitigation and adaptation?* https://www.worldwildlife.org/stories/what-s-the-difference-between-climate-change-mitigation-and-adaptation
[xxvi] HM Government Ministry of Housing, Communities & Local Government (2021), *National Planning Policy Framework*. https://www.gov.uk/government/publications/national-planning-policy-framework--2
[xxvii] HM Government Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2019), *Planning Practice Guidance – Climate Change*. https://www.gov.uk/guidance/climate-change
[xxviii] HM Government Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2019), *Planning Practice Guidance – Renewable and low carbon energy*. https://www.gov.uk/guidance/renewable-and-low-carbon-energy
[xxix] HM Government. Department for Business, Energy, Innovation & Skills (2021). *Consents and planning applications for national energy infrastructure projects* https://www.gov.uk/guidance/consents-and-planning-applications-for-national-energy-infrastructure-projects
[xxx] HM Government (2020), *Explanatory memorandum to the Infrastructure Planning (Electricity Storage Facilities) Order 2020. 2020 no. 1218*. https://www.legislation.gov.uk/uksi/2020/1218/pdfs/uksiem_20201218_en.pdf
[xxxi] BEIS 2005 to 2020 UK local and regional greenhouse gas emissions (2022). https://www.gov.uk/government/statistics/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics-2005-to-2020
[xxxii] Town & Country Planning Act 1990, Part III: Control over development – other controls over development. https://www.legislation.gov.uk/ukpga/1990/8/section/106
[xxxiii] Town & Country Planning Act 1990, Part III: Control over development; Section 61: Local development orders. https://www.legislation.gov.uk/ukpga/1990/8/part/III/crossheading/local-development-orders
[xxxiv] Infrastructure Act 2015. https://www.legislation.gov.uk/ukpga/2015/7/part/5/crossheading/offsite-carbon-abatement-measures/enacted
[xxxv] HM Government Ministry of Housing, Communities & Local Government (2021), *National Planning Policy Framework*. https://www.gov.uk/government/publications/national-planning-policy-framework--2

[xxxvi] HM Government Department for Levelling Up, Housing and Communities (2022), *Levelling up and regeneration bill: Reforms to national planning policy.* Please note: This was a consultation on updates to the NPPF, not the Levelling Up Bill itself. https://www.gov.uk/government/consultations/levelling-up-and-regeneration-bill-reforms-to-national-planning-policy

[xxxvii] National Grid (no date), *Energy Explained: Onshore Wind.* https://www.nationalgrid.com/stories/energy-explained/onshore-vs-offshore-wind-energy#:~:text=It's%20one%20of%20the%20least,can%20help%20lower%20electricity%20bills.

[xxxviii] HM Government Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2019), *Planning Practice Guidance – Climate Change.* https://www.gov.uk/guidance/climate-change

[xxxix] Royal Town Planning Institute and Town & Country Planning Association (2021), *The Climate Crisis A Guide for Local Authorities on Planning for Climate Change.* Third edition. https://www.rtpi.org.uk/media/9379/tcpa-rtpi-climate-guide_oct-2021_final.pdf

[xl] HM Government Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2019), *Planning Practice Guidance – Planning Obligations.* https://www.gov.uk/guidance/planning-obligations

[xli] Local Government Association Planning Advisory Service (no date). *Levelling-up and Regeneration Bill: Delivering Infrastructure.* https://www.local.gov.uk/pas/our-work/levelling-and-regeneration-bill#:~:text=The%20Levelling%20Up%20and%20Regeneration,a%20charge%20on%20development%20for

[xlii] Levelling Up, Housing and Communities Committee (2022), Letter to Secretary of State for DHLUC, 24th August 2022. https://committees.parliament.uk/publications/28460/documents/171233/default/

[xliii] Greater London Authority (2017), *London Plan 2016.* See paragraph 5.19. https://www.london.gov.uk/sites/default/files/the_london_plan_2016_jan_2017_fix.pdf

[xliv] UKGBC (2021), *The New Homes Policy Playbook – version 2.1.* https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2021/01/05144257/New-Homes-Policy-Playbook-January-2021.pdf

[xlv] Greater London Authority (2020), Energy Assessment Guidance: Greater London Authority guidance on preparing energy assessments as part of planning applications (April 2020). DRAFT. https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_april_2020.pdf

[xlvi] HM Government. Department for Business, Energy, Innovation & Skills (2021). *Consents and planning applications for national energy infrastructure projects* https://www.gov.uk/guidance/consents-and-planning-applications-for-national-energy-infrastructure-projects

[xlvii] HM Government (2020), *Explanatory memorandum to the Infrastructure Planning (Electricity Storage Facilities) Order 2020. 2020 no. 1218.* https://www.legislation.gov.uk/uksi/2020/1218/pdfs/uksiem_20201218_en.pdf

[xlviii] Royal Town Planning Institute (2018), *Renewable Energy: Planning's role in delivering renewable energy in the new low carbon economy.* https://www.rtpi.org.uk/media/1834/renewableenergypracticeadvice2018.pdf

[xlix] Royal Town Planning Institute (2019), *Planning for a Smart Energy Future.* https://www.rtpi.org.uk/research/2019/july/planning-for-smart-energy/

[l] National Energy Foundation (2016), *Review of Carbon Offsetting Approaches in London. A NEF research report commissioned by the GLA.* https://www.london.gov.uk/sites/default/files/gla_cof_approaches_study_final_report_july_2016.pdf

[li] Etude, CIBSE, Levitt Bernstein, Elementa, WSP, Clarion Housing Group & UCL (2021), *Making SAP and RdSAP 11 Fit for Net Zero: 15-minute summary.* https://www.etude.co.uk/wp-content/uploads/2021/06/Making-SAP-and-RdSAP-11-fit-for-Net-Zero-Summary.pdf

[lii] Chartered Institute of Building Services Engineers (2012), Carbon Bites: The Performance Gap. https://www.cibse.org/getmedia/55cf31bd-d9eb-4ffa-b2e2-e567327ee45f/cb11.pdf.aspx

[liii] Elrond Burrell (2015), *Passivhaus in Plain English & More: Mind the Building Performance Gap.* https://elrondburrell.com/blog/performance-gap/

[liv] Greater London Authority (2021), *London Plan Guidance Documents: 'Be seen' energy monitoring guidance.* *https://www.london.gov.uk/sites/default/files/be_seen_energy_monitoring_london_plan_guidance_2021.pdf*

[lv] Greater London Authority (2021), *London Plan Guidance Documents: 'Be seen' energy monitoring guidance.* *https://www.london.gov.uk/sites/default/files/be_seen_energy_monitoring_london_plan_guidance_2021.pdf*

[lvi] London Borough of Merton (2022) *LBM02 – Response to the Inspectors second preliminary matters* – Appendix 2. https://www.merton.gov.uk/system/files/LBM02%20response%20to%20inspectors%20second%20preliminary%20letter%2028%20March%202022.pdf

[lvii] Committee on Climate Change (2020), *The Sixth Carbon Budget: Buildings.* https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Buildings.pdf

[lviii] HM Government Department for Business, Energy and Industrial Strategy (2021), *Heat and Buildings Strategy.* https://www.gov.uk/government/publications/heat-and-buildings-strategy

[lix] Committee on Climate Change (2021), *2021 Progress Report to Parliament: Progress in reducing emissions.* https://www.theccc.org.uk/wp-content/uploads/2021/06/Progress-in-reducing-emissions-2021-Report-to-Parliament.pdf

[lx] Element Energy on behalf of Committee on Climate Change (2021), *Development of trajectories for residential heat decarbonisation to inform the Sixth Carbon Budget.* https://www.theccc.org.uk/wp-content/uploads/2020/12/Full-Report-Development-of-trajectories-for-residential-heat-decarbonisation-to-inform-the-Sixth-Carbon-Budget-Element-Energy.pdf

[lxi] BRE (2016), *Solid wall heat losses and the potential for energy saving.* Appendix A: Summary of major 29 unintended consequence categories.

[lxii] BRE & Constructing Excellence in Wales (2017), *Post Installation Performance of Cavity Wall & External Wall Insulation.* http://www.cewales.org.uk/files/3014/7671/0110/Post_Installation_Performance_of_Cavity_Wall__External_Wall_Insulation.pdf

[lxiii] Solar Power Portal (2019), *Residential solar installs slide in first post-FiT figures.* https://www.solarpowerportal.co.uk/news/residential_solar_installs_slide_in_first_post_fit_figures

[lxiv] Historic England (2017), *Energy Efficiency and Historic Buildings: Application of the Building Regulations to Historic and Traditionally Constructed Buildings.* https://historicengland.org.uk/images-books/publications/energy-efficiency-historic-buildings-ptl/heag014-energy-efficiency-partll/

[lxv] See page 220, point 17.16: https://www.milton-keynes.gov.uk/planning-and-building/plan-mk

[lxvi] Royal Institution of Chartered Surveyors (2017), *Whole Life Carbon Assessment for the Built Environment.* https://www.rics.org/uk/upholding-professional-standards/sector-standards/building-surveying/whole-life-carbon-assessment-for-the-built-environment/

[lxvii] Intergovernmental Panel on Climate Change (2018), *Special Report: Global Warming of 1.5C.* Chapter 3: "Impacts of 1.5ºC global warming on natural and human systems". https://www.ipcc.ch/sr15/chapter/chapter-3/

[lxviii] Royal Institute of British Architects (2021), *RIBA 2030 Climate Challenge: Version 2.* https://www.architecture.com/about/policy/climate-action/2030-climate-challenge

[lxix] London Energy Transformation Initiative (2020), *LETI Embodied Carbon Primer: Supplementary guidance to the Climate Emergency Design Guide.* https://www.leti.london/ecp

[lxx] UK Green Building Council (2022), *Building the Case for Net Zero: A case study for low-rise residential developments.* https://www.ukgbc.org/ukgbc-work/building-the-case-for-net-zero-low-rise-developments/ and see also press release summary: https://www.ukgbc.org/news/masterplan-report/

[lxxi] The Planning Inspectorate (2023). *Examination of the Merton Local Plan: Post-Hearings Letter.* https://www.merton.gov.uk/system/files/INSP22%20-%20Post%20Hearings%20Letter.pdf

[lxxii] London Borough of Merton (2022) *LBM02 – Response to the Inspectors second preliminary matters* – Appendix 2. https://www.merton.gov.uk/system/files/LBM02%20response%20to%20inspectors%20second%20preliminary%20letter%2028%20March%202022.pdf
[lxxiii] London Borough of Merton (2022) *LBM05 - Merton's Local Plan incorporating proposed modifications dated 20 May 2022.* https://www.merton.gov.uk/system/files/LBM05%20Merton%27s%20Local%20Plan%20incorporating%20Main%20Modifications%20dated%2020th%20May%202022.pdf
[lxxiv] Central Lincolnshire Authorities (2022), *Local Plan Review.* https://www.n-kesteven.gov.uk/central-lincolnshire/local-plan-review/
[lxxv] Greater Cambridge Shared Planning Service (2021), *Greater Cambridge Local Plan First Proposals.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-10/First%20Proposals%20-%20FINAL%20FURTHER%20REVISED%2028.10.21-red.pdf
[lxxvi] Leeds City Council Draft Local Plan – Proposed new and amended policies (2022). https://www.leeds.gov.uk/planning/planning-policy/local-plan-update/proposed-policy
[lxxvii] Bristol Local Plan Review – Policies and Development Allocations (2022). https://www.bristol.gov.uk/files/documents/5446-bristol-local-plan-review-nov-22-further-consultation/file
[lxxviii] Warwick District Council (2022), *Draft Net Zero Carbon DPD – Regulation 19 – April 2022.* https://www.warwickdc.gov.uk/info/20799/development_plan_documents/1713/net_zero_carbon_development_plan_document
[lxxix] Greater Cambridge Shared Planning Service (2021), *Greater Cambridge Local Plan First Proposals.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-10/First%20Proposals%20-%20FINAL%20FURTHER%20REVISED%2028.10.21-red.pdf
[lxxx] London Borough of Merton (2022) *LBM02 – Response to the Inspectors second preliminary matters* – Appendix 2. https://www.merton.gov.uk/system/files/LBM02%20response%20to%20inspectors%20second%20preliminary%20letter%2028%20March%202022.pdf
[lxxxi] London Borough of Merton (2022) *LBM05 - Merton's Local Plan incorporating proposed modifications dated 20 May 2022.* https://www.merton.gov.uk/system/files/LBM05%20Merton%27s%20Local%20Plan%20incorporating%20Main%20Modifications%20dated%2020th%20May%202022.pdf
[lxxxii] Cornwall Council (2021), *Climate Emergency Development Plan Document (DPD).* https://www.cornwall.gov.uk/planning-and-building-control/planning-policy/adopted-plans/climate-emergency-development-plan-document
[lxxxiii] Greater Cambridge Shared Planning Service (2021), *Greater Cambridge Local Plan First Proposals.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-10/First%20Proposals%20-%20FINAL%20FURTHER%20REVISED%2028.10.21-red.pdf
[lxxxiv] HM Government Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2019), *Planning Practice Guidance – Climate Change.* https://www.gov.uk/guidance/climate-change
[lxxxv] HM Government Department for Business, Energy and Industrial Strategy (2021), *UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019: 2005 to 2019 UK local and regional CO2 emissions - data tables (excel).* https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019
[lxxxvi] Society of Motor Manufacturers and Traders (2021), *Average vehicle age.* https://www.smmt.co.uk/industry-topics/sustainability/average-vehicle-age/
[lxxxvii] Bioregional and Mode on behalf of Greater Cambridge Shared Planning Service (2020), *Greater Cambridge Local Plan - Strategic spatial options appraisal: implications for carbon emissions.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-08/gclp-strategic-spatial-options-assessment-implications-for-carbon-emissions-nov2020.pdf
[lxxxviii] Bioregional and Mode on behalf of Greater Cambridge Shared Planning Service (2021), *Greater Cambridge Local Plan Strategic Spatial Options Assessment: Carbon Emissions Supplement.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-09/STRATE~2.PDF
[lxxxix] LUC on behalf of Greater Cambridge Shared Planning Service (2021), *Greater Cambridge Local Plan First Proposals: Sustainability Appraisal.* https://democracy.cambridge.gov.uk/documents/s56602/App.%20B2%20-%20Greater%20Cambridge%20Local%20Plan%20SA.pdf
[xc] Bioregional, Mode & Etude on behalf of Central Lincolnshire Authorities (2021), *Central Lincolnshire Local Plan: Climate Change Evidence Base. Task B: Carbon Emissions from Spatial Growth Options.* https://www.n-kesteven.gov.uk/_resources/assets/attachment/full/0/121823.pdf
[xci] Royal Town Planning Institute (2018), *Renewable Energy: Planning's role in delivering renewable energy in the new low carbon economy.* https://www.rtpi.org.uk/research/2018/june/renewable-energy/
[xcii] Royal Town Planning Institute (2019), *Planning for a Smart Energy Future.* https://www.rtpi.org.uk/research/2019/july/planning-for-smart-energy/
[xciii] Greater Cambridge Shared Planning Service (2021), *Greater Cambridge Local Plan First Proposals.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-10/First%20Proposals%20-%20FINAL%20FURTHER%20REVISED%2028.10.21-red.pdf
[xciv] BEIS 2005 to 2020 UK local and regional greenhouse gas emissions (2022). https://www.gov.uk/government/statistics/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics-2005-to-2020
[xcv] Centre for Ecology & Hydrology / Henrys, P.A.; Keith, A.M.; Robinson, D.A.; Emmett, B.A. (2012). Model estimates of topsoil carbon [Countryside Survey]. NERC Environmental Information Data Centre. http://doi.org/10.5285/9e4451f8-23d3-40dc-9302-73e30ad3dd76 or see also https://eip.ceh.ac.uk/naturalengland-ncmaps/reportsData
[xcvi] Greater Cambridge Shared Planning Service (2021), *Greater Cambridge Local Plan First Proposals.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-10/First%20Proposals%20-%20FINAL%20FURTHER%20REVISED%2028.10.21-red.pdf
[xcvii] Central Lincolnshire Authorities (2022), *Local Plan Review.* https://www.n-kesteven.gov.uk/central-lincolnshire/local-plan-review/
[xcviii] RSK and Bioregional (2021), *Central Lincolnshire Local Plan Climate Change Evidence Base: Task L – Peat soil mapping.* https://www.n-kesteven.gov.uk/_resources/assets/attachment/full/0/121834.pdf
[xcix] Central Lincolnshire authorities (2021), *Central Lincolnshire Policy S16 Carbon Sinks Evidence Report.* https://www.n-kesteven.gov.uk/_resources/assets/attachment/full/0/122484.pdf
[c] RTPI & TCPA (2018), *Rising to the Climate Crisis: A Guide for Local Authorities on Planning for Climate Change.* https://www.rtpi.org.uk/media/3568/rising-to-the-climate-crisis-1.pdf
[ci] Etude, Bioregional and Currie & Brown on behalf of Greater Cambridge Shared Planning Authority (2021), *Greater Cambridge Local Plan Net Zero Carbon Evidence Base: Task D – Technical feasibility.* https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-08/NetZeroTechnicalFeasibility_GCLP_210831.pdf
[cii] Etude, Bioregional and Currie & Brown (2021), Central Lincolnshire Local Plan Climate Change Evidence Base: Task G – Feasibility assessment. Reference CLC006 in evidence library, climate change section. https://www.n-kesteven.gov.uk/central-lincolnshire/local-plan-review/
[ciii] Etude and Currie & Brown on behalf of Cornwall Council (2021), *Cornwall Council Climate Emergency DPD: Energy review and modelling.* www.swenergyhub.org.uk/wp-content/uploads/2021/04/20200359-Climate-Emergency-DPD-Energy-review-and-modelling-Rev-H.pdf
[civ] Financial Times (2021), *Construction stalls as UK shortage of workers bites.* https://www.ft.com/content/e37e2944-da21-4a2c-af16-9b5c0b70d4eb
[cv] CHAS (2020/21), *Tackling the skills shortage in construction.* https://www.chas.co.uk/blog/tackling-construction-skills-shortage/

[cvi] HM Government Ministry of Housing, Communities & Local Government (2019), *The Future Homes Standard: 2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings: Impact Assessment*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/836925/REQUEST.pdf
[cvii] Three Dragons on behalf of Cornwall Council (2021), *Climate Emergency Development Plan Viability Assessment Update: November 2021.* https://www.cornwall.gov.uk/media/vtigrrk3/sd06-ce-dpd-viability-report-nov-2021.pdf
[cviii] Bath & North East Somerset Local Plan Partial Update Viability Study. *August 2021.* https://beta.bathnes.gov.uk/sites/default/files/2021-08/B%26NES LPPU Viability Study.pdf
[cix] HM Government Department of Energy and Climate Change (2013), *An investigation into the effect of EPC ratings on house prices.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/207196/20130613_-_Hedonic_Pricing_study_-_DECC_template__2_.pdf
[cx] HM Government Department for Business, Energy and Industrial Strategy (2021), *Net Zero Strategy: Build Back Greener.* https://www.gov.uk/government/publications/net-zero-strategy
[cxi] HM Government Department for Business, Energy and Industrial Strategy (2021), *Heat and buildings strategy*. https://www.gov.uk/government/publications/heat-and-buildings-strategy
[cxii] Ministry of Housing, Communities and Local Government. *Live tables on Energy Performance Certificates of Buildings.* Updated quarterly. See table NB7. https://www.gov.uk/government/statistical-data-sets/live-tables-on-energy-performance-of-buildings-certificates#epcs-for-all-new-domestic-properties-including-new-build-dwellings-conversions-and-change-of-use
[cxiii] HM Government Department for Business, Energy and Industrial Strategy, *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal.* Updated annually; last update April 2023. https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[cxiv] UK Green Building Council (2019), *Net Zero Carbon Buildings: A Framework definition.* See page 19 for pie charts showing percentages of regulated, unregulated and embodied carbon across a building's lifetime. https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition/
[cxv] Place Alliance (2022), *Appealing Design: The evidence of planning appeals and the need to reject poor and mediocre housing design.* http://placealliance.org.uk/wp-content/uploads/2022/03/Place-Alliance-Appealing-Design_2022-Final.pdf
[cxvi] Met Office (2018), *UK Climate Projections.* https://www.metoffice.gov.uk/research/approach/collaboration/ukcp ; see also *UKCP18 User Interface* https://ukclimateprojections-ui.metoffice.gov.uk/ui/home
[cxvii] Cambridge City Council (2022), *News: Emerging Local Plan and concerns about water.* https://www.cambridge.gov.uk/news/2022/07/20/emerging-local-plan-and-concerns-about-water