East Hampshire Net Zero Evidence Base Study

Report for East Hampshire District Council

ED16378 | Issue Number 5 | Date 10/01/2023

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
01	06.06.22	HR, KS, MP, BS	HR, BS	HR	First draft (responses to Q1-Q5)
02	30.08.22	HR, KS, MP, BS	HR, BS	HR	Second draft (responses to Q1-Q6 & Q8)
03	18.11.22	HR, KS, MP, BS	HR, JH, OL	HR	Third draft (responses to Q1-Q8)
04	09.01.23	HR, KS, MP, BS	HR, JH, OL	GH	Final draft
05	10.01.23	HR, KS, MP, BS	HR, JH, OL	GH	Minor amendments

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1 Introduction

East Hampshire District Council (EHDC) declared a Climate Emergency in July 2019. Recognising that the Local Plan provides an opportunity to influence future greenhouse gas (GHG) emissions in the District, the Council has identified the following priorities in relation to the planning system:[1]

- "Minimise the climate impact of new development through our Local Plan policies and development management decisions
- "Ensure new builds are meeting or exceeding their planning permission conditions and obligations
- "Reinforce and implement plans and strategies which support low-carbon transport alternatives, including the Local Cycling and Walking Infrastructure Plan"

In line with those priorities, the Council has commissioned Ricardo to provide a sound evidence base that will:

- Define what is meant by net zero in the context of the Local Plan;
- Specify the standards that developments in East Hampshire can and should meet in order to be considered compliant; and
- Assess how the choice of spatial strategy may impact future GHG emissions in East Hampshire.

This information will help to ensure that the Local Plan and spatial strategy together make a positive contribution to the wider net zero agenda as far as is reasonably practicable.

[1] EHDC, *'Climate and Environment Strategy 2020-25'* (2020). Available at: https://www.easthants.gov.uk/climate-and-environment/climate-and-environment-strategy-2020-25

2 Background and context

This section of the report describes the relevant national and local policies, strategies and regulations which influence local planning and development decisions in relation to climate and net zero planning.

2.1 National policy context

2.1.1 UK climate change commitments and legislation

There is clear evidence for the need to respond to the threat of climate change, as laid out in the latest Intergovernmental Panel on Climate Change (IPCC) reports.[2] Over the past ten years, global GHG emissions were at their highest levels in human history, and without immediate and deep emissions reductions across sectors, we will be unable to avoid dangerous impacts of climate change. Local governments can reduce their contribution to climate change by reducing emissions through mitigation measures, as well as preparing their area for any likely or unavoidable impacts through adaptation measures.

In 2016, the UK became a signatory to the **Paris Agreement**, thus joining an international effort to keep global temperature rise 'well below' 2°C above pre-industrial levels, while aiming for temperature rise of no more than 1.5°C.

> *'Our recommended pathway requires a 78% reduction in UK territorial emissions between 1990 and 2035.'*
>
> *– CCC, 2020*

The UK **Climate Change Act**, first adopted in 2008 and amended in 2019, aligns with this international commitment by setting a legally binding target for the UK to achieve a 100% reduction in net emissions by no later than 2050. Under the Climate Change Act, the Government is also required to set interim 5-year carbon budgets, which specify the volume of GHGs that can be emitted in a given period. The **6th Carbon Budget**, which will run from 2033-2037, was announced by the Climate Change Committee (CCC) in late 2020 and enshrined in law in 2021.[3] Although such carbon budgets are legally binding, the UK is currently not on track to meet the latest reduction budget of 78% below 1990 levels by 2035. The **UK Net Zero Strategy** (2021), which sets out 'policies and proposals for decarbonising all sectors of the UK economy', is expected to go some way towards addressing this gap (for more information, see Appendix A.2.1).

Although there are legal requirements to reduce GHG emissions across the whole economy, and the CCC publishes illustrative pathways for doing so, there are no prescriptive targets for individual sectors. This means that the key *quantitative* targets for energy use and emissions in buildings are those set out in the UK Building Regulations and local planning policies.

In practice, this means that new buildings are most impacted by energy and CO_2 performance regulations, but the wider impacts of development – and the impacts of the existing building stock – are not subject to specific, quantitative GHG reduction targets.

2.1.2 Building Regulations

Part L of the UK Building Regulations is the key statutory guidance document on the conservation of fuel and power in new and existing buildings.[4] All new buildings, and those undergoing major

[2] Available at: https://www.ipcc.ch/

[3] CCC, *'The Sixth Carbon Budget: The UK's path to net zero'* (2020). Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

[4] HM Government, *'Approved Document L: Conservation of fuel and power'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057372/ADL1.pdf

refurbishment works or extensions, are required to demonstrate compliance with Part L, which sets requirements for:

- Energy efficiency of the building fabric
- Primary energy use
- CO_2 emissions arising from regulated energy uses

Standards for energy performance in Part L have become progressively more stringent over time, with uplifts in 2006, 2010, 2013 and new requirements that came into force in June 2022. The Government has also announced its intention that a Future Homes Standard (FHS) for domestic buildings and Future Buildings Standard (FBS) for non-domestic buildings will be implemented from 2025 onwards. The expectation is that these will result in c. 75-80% lower regulated CO_2 emissions compared with Part L 2013, and in all likelihood require the use of heat pumps instead of gas boilers. However, the details and technical standards have not yet been set, and the timing is not guaranteed. The Government has said that it intends to start a full technical consultation on the FHS and FBS in 2023.

'Homes built under the Future Homes Standard will be 'zero carbon ready', which means that […] no further retrofit work for energy efficiency will be necessary to enable them to become zero-carbon homes as the electricity grid continues to decarbonise.'

– MHCLG, 2021

It is also important to note that many sources of energy use or emissions associated with buildings fall outside the remit of Building Regulations; these are known as 'unregulated' emissions in contrast to the 'regulated' emissions that are covered by the standards. Therefore, although the Government has said that new buildings from 2025 onwards will be 'net zero ready', it is likely that this will only apply to regulated emissions. This is discussed in more detail in Section 3.2.

In addition to having to meet Building Regulations, all buildings that are constructed, sold or rented are required to have an **Energy Performance Certificate (EPC)**, which provides a standardised means of indicating the energy efficiency and fuel costs associated with the property. EPCs form the basis for the **Minimum Energy Efficiency Standard (MEES)** introduced as part of the Energy Efficiency (Private Rented Property) Regulations 2015. MEES requires private rented properties to achieve a minimum EPC rating. The intention is that the minimum rating will be increased over time, prompting landlords to improve the standards of their properties. This is a key measure to ensure that as many buildings as possible achieve a 'C' rating or better by 2035. Local authorities have the power to issue fines for non-compliance, but there is evidence that enforcement rates are very low[5] and the Government is seeking to increase support in this area.[6]

2.1.3 Planning system

Section 19 of the **Planning and Compulsory Purchase Act 2004** places a legal duty on local planning authorities (LPAs) to ensure that development plans 'include policies designed to secure that the development and use of land in the LPA's area contribute to the mitigation of, and adaptation to, climate change.'[7]

The **Planning and Energy Act 2008** enables local authorities to impose 'reasonable requirements' for:

[5] Madeleine Cuff writing for i news, *'Little punishment for landlords flouting energy efficiency rules designed to protect renters'* (2020). Available at: https://inews.co.uk/news/environment/little-punishment-landlords-flouting-energy-efficiency-rules-527015

[6] HM Government, *'Heat and Buildings Strategy'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1044598/6.7408_BEIS_Clean_Heat_Heat__Buildings_Strategy_Stage_2_v5_WEB.pdf

[7] Planning and Compulsory Purchase Act 2004. Available at: https://www.legislation.gov.uk/ukpga/2004/5/contents

a) a proportion of energy used in development of their area to be energy from renewable sources in the locality of the development;

b) a proportion of energy used in development in their area to be low carbon energy from sources in the locality of the development;

c) development in their area to comply with energy efficiency standards that exceed the energy requirements of building regulations.[8]

The **National Planning Policy Framework (NPPF)**, most recently updated in 2021, provides a national framework for local authorities to support the preparation of planning policies and planning decisions.[9] It explains that the planning system should 'shape places that contribute to radical reductions in greenhouse gas emissions.' It goes on to say that plans should consider suitable areas for renewable and low-carbon energy sources, and that new development should be planned in such a way that GHG emissions are reduced. Paragraph 153 of the NPPF requires that development 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 (see above).

In regard to new building standards, the 2021 NPPF also states that, 'Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.' As shown in the timeline below, this is part of a series of announcements that have resulted in significant uncertainty as to whether local authorities are allowed to set higher standards for energy performance, particularly for homes.[11] (The **National Planning Practice Guidance (NPPG)** on climate change, issued in 2018, states that there are no restrictions on energy performance standards for non-housing developments.[12])

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[8] Planning and Energy Act 2008. Available at: https://www.legislation.gov.uk/ukpga/2008/21/pdfs/ukpga_20080021_en.pdf

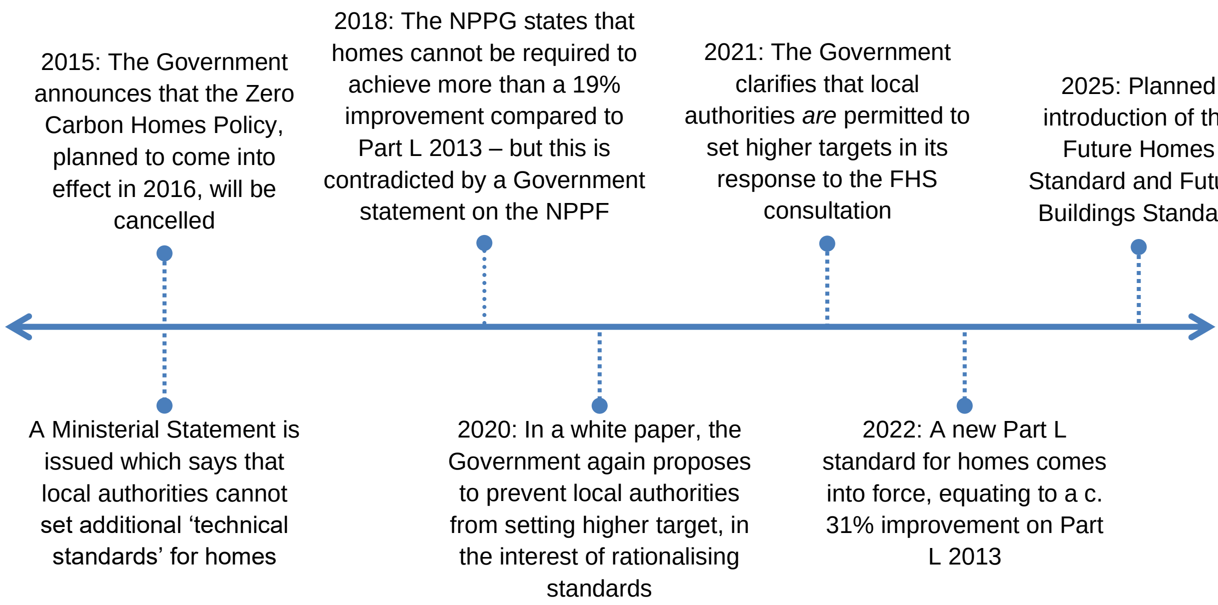
[9] Ministry of Housing, Communities & Local Government, *'National Planning Policy Framework'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

[11] References:

- HM Government, *'Briefing Paper No. 6678: Zero Carbon Homes Policy'* (2016). Available at: https://researchbriefings.files.parliament.uk/documents/SN06678/SN06678.pdf
- Ministry of Housing, Communities & Local Government (MHCLG), *'Planning Update March 2015'* (2015). Available at: https://www.gov.uk/government/speeches/planning-update-march-2015
- MHCLG, *'Government response to the draft revised NPPF consultation'* (2018). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728498/180724_NPPF_Gov_response.pdf
- MHCLG, *'Planning White Paper'* (2020). Available at: https://www.gov.uk/government/consultations/planning-for-the-future
- MHCLG, *'The Future Homes Standard: Summary of responses received and Government response'* (2021): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

[12] MHCLG, *'National Planning Practice Guidance on climate change'* (2018). Available at: https://www.gov.uk/guidance/climate-change#what-are-governments-national-standards-for-a-buildings-sustainability-and-for-zero-carbon-buildings

Timeline of announcements on new building standards



So, despite the emphasis on sustainable development within the NPPF, and the obligation for Local Authorities to contribute to legally binding GHG reductions, to date the level of emissions reduction that can be demanded or achieved via the local planning process has been limited. There have been some legal challenges on this issue (see Appendix A.1) but it is not yet clear which duties take precedence. In its response to the Future Homes Standard, the Government acknowledged the need to clarify the role of LPAs in setting energy efficiency requirements beyond the minimum standards of the Building Regulations, stating that, *'To provide some certainty in the immediate term, we will not amend the Planning and Energy Act 2008, which means that local authorities **will** retain powers to set local energy efficiency standards for new homes'* [emphasis added]. Reforms to the planning system could clarify matters, but there is no information on whether the proposals of the Levelling Up and Regeneration Bill, such as the establishment of nationwide development management policies, would ultimately include climate change within their scope. An NPPF prospectus setting out intended changes to national planning policy is also planned for publication in 2022, which could include new provisions on tackling climate change[13].

Nonetheless, and irrespective of uncertainties about future planning legislation and policy, there are examples of local authorities that have proposed even higher targets for reducing carbon emissions in recent years (for more information, see Section 3.3.3).

2.1.4 How can a local plan help achieve net zero?

Local Authorities are important players in the race to net zero. While council operations are usually only responsible for 2-5% of emissions, their influence can extend far beyond that, with the Climate Change Committee (CCC) estimating total influence over around 33% of emissions.[14] Other sources suggest

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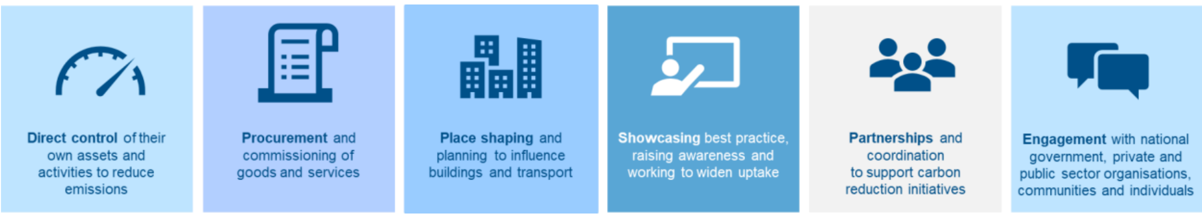
[13] Michael Gove, the Secretary of State for Levelling Up, Housing and Communities, announced in Parliament that *'the national planning policy framework that will be published in July will say significantly more about how we can drive improved environmental outcomes'*. For more information, see the Second Reading of the Levelling Up and Regeneration Bill (2022): https://hansard.parliament.uk/Commons/2022-06-13/debates/B7B5E134-FA02-47E3-BC76-7275A27797C4/HousingCommunitiesAndLocalGovernment

[14] CCC, *'Local Authorities and the Sixth Carbon Budget'* (2020). Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/Local-Authorities-and-the-Sixth-Carbon-Budget.pdf

that this figure could be even higher, for example with South Gloucestershire Council estimating influence over 40% of total emissions.[15]

The council's levers to influence emissions range from direct control (e.g., emissions from council operations), to place-shaping (e.g., spatial planning) to engagement and communication (e.g., raising awareness in the community), as shown in Figure 2-1.

Figure 2-1. Local Authorities' influence over GHG emissions (adapted from CCC)



In its remit as an LPA, the Council's key areas of influence are new buildings, spatial planning (particularly because this impacts the ways people travel and the mix of uses/facilities in a given area), and changes of land use. LPAs can also support decarbonisation of the wider UK energy system by supporting renewable energy developments and identifying land suitable for this purpose. To a lesser extent, there is an opportunity to influence emissions reductions in existing buildings via policies aimed at refurbishments, retrofits and extensions. In short, any activities that require planning permission present leverage points for the Council.[16]

2.2 Local policy context

2.2.1 Climate emergency declaration (July 2019)[17]

Around 300 local councils have declared a 'climate emergency' in the UK, setting out aims to reduce carbon emissions and work with the local community to reduce the impacts of climate change locally.[18] As part of this effort, in July 2019, East Hampshire District Council declared a climate emergency, with the aim to take action to make all Council Services carbon neutral as soon as reasonably practicable, and by 2050 at the latest (in line with national targets). The declaration includes the commitment to work with partners and communities, lobby the government, and expand infrastructure to make East Hampshire a carbon neutral district. The Council plans to change its delivery of services, but also recognises that it depends on the support of the community to make transformative changes.

2.2.2 Climate and Environment Strategy (2020-2025)[1]

The Climate and Environment Strategy 2020-2025 builds on the climate emergency declaration, presenting the Council's climate and environment objectives, actions, and approaches to support the change needed up to 2025. The strategy lays out how local communities and businesses will be supported and includes stakeholder engagement as part of the development process. The two key objectives for the strategy are:

1. to reduce carbon emissions to net zero by 2050; and
2. to protect and enhance the local natural environment.

[15] South Gloucestershire Council, *'Climate Emergency Strategy'* (n.d.). Available at: https://beta.southglos.gov.uk/static/2f6a99c0e8736dfa043ddfacdd8614aa/Climate-Emergency-Strategy.pdf

[16] Bioregional & Etude, *'Greater Cambridge Net Zero Carbon Evidence Base'* (2020). Available at: https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-08/NetZeroDefiningNetZero_GCLP_210831.pdf

[17] EHDC, *'Meeting Agenda for 18th July 2019'* (2019). Available at: https://easthants.moderngov.co.uk/documents/g2469/Public%20reports%20pack%2018th-Jul-2019%2018.30%20Council.pdf?T=10

[18] Local Government Association, *'Climate, environment and waste'* (n.d.). Available at: https://www.local.gov.uk/topics/climate-environment-and-waste#:~:text=Around%20300%20councils%20have%20declared,change%20on%20their%20local%20area.

More specific priorities include: reducing emissions from council buildings and vehicles to net zero by or before 2050; all new or review contracts and procurement to embrace net zero; promoting the climate crisis message to raise awareness and foster change; extend retrofitting of existing homes; supporting energy audits of occupied buildings; minimising climate impact of new development; encouraging the switch to electric vehicles (EVs). Priority B2 is particularly relevant to this study: the Council has set itself the target of minimising the climate impact of new development through its Local Plan policies and development management decisions.

2.2.3 Local Plan: Joint Core Strategy[20] and the emerging Local Plan

The Local Plan: Joint Core Strategy provides a policy framework for new development to deliver the vision that has been established alongside the Sustainable Community Strategy. The Joint Core Strategy (JCS) was adopted by EHDC on 8 May 2014 and by the South Downs National Park Authority (SDNP) on 26 June 2014. In the South Downs National Park, this Strategy has now been superseded by the South Downs Local Plan (see below), which was adopted on 2 July 2019. For the remainder of East Hampshire District, however, the Joint Core Strategy is still in effect.

The Local Plan has been under review since January 2018.[21] The Emerging Local Plan will only cover areas in East Hampshire outside of the SDNP. In line with the Climate and Environment Strategy, EHDC's ambition is that both the individual Local Plan policies, as well as the wider spatial strategy, will all contribute towards achieving radical reductions in GHG emissions from the District. The Council has already announced its intention *'that all new developments are energy efficient, zero-carbon homes that are clean and cost-effective'.* As part of the present study the Council is seeking to define precisely what net zero carbon development should mean for East Hampshire.

Other local policies and strategies that are relevant to climate change and sustainability include the Sustainable Community Strategy, Green Infrastructure Strategy, Local Cycling and Walking Infrastructure Strategy, Infrastructure Delivery Plan. Further details are provided in Appendix A.3.

2.3 Summary of key policy issues

EHDC is in a fairly unique position among UK Local Authorities, having already announced an intention for all new developments in the District to be "energy efficient, zero-carbon homes". This level of ambition exceeds the standards proposed as part of the interim Building Regulations Part L uplift for domestic buildings (a 31% improvement on Part L 2013) and the Future Homes Standard (expected to comprise a c. 75-80% improvement on Part L 2013).

Considering the EHDC's commitment in a wider context, the policy landscape is complex:

Under the Climate Change Act, the UK is legally obliged to reach net zero emissions by 2050. However, this legislation does not include sector-specific decarbonisation targets that prescribe a route towards decarbonising buildings.

Although interim changes to Part L of the Building Regulations will come into effect this year, the specific details and timing of future changes are uncertain. It is not yet clear how the Government intends new buildings to be fully net zero compatible.

The Government has proposed a range of potential reforms to the planning system that would standardise requirements, but also limit Local Authorities' ability to set higher targets for energy efficiency and GHG emissions.

[20] EHDC and SDNP, *'Local Plan: Joint Core Strategy'* (2014). Available at: https://www.easthants.gov.uk/adopted-local-plan

[21] For more information, refer to the EHDC website at: https://www.easthants.gov.uk/emerging-local-plan

There is a growing recognition that new developments result in a range of GHG emissions that are not currently considered within the Planning or Building Control process. Therefore, in the context of the UK's net zero target it is important to consider these wider impacts.

3 Defining net zero development

3.1 General principle

Q1: What does 'net zero carbon' mean for new development in East Hampshire and how could and should it be measured?

In simple terms, 'net zero' refers to a situation where the amount of carbon that is emitted to the atmosphere is balanced out by an equivalent amount of carbon being saved, or removed from the atmosphere, elsewhere.[22] However, this simple definition belies the fact that 'net zero' (sometimes used interchangeably with the term 'carbon neutrality') has different meanings depending on the context. In particular, definitions vary with regards to:

- Whether the term only relates to carbon dioxide (CO_2) or includes other GHGs such as methane, nitrous oxide, and fluorinated gases (f-gases)
- Whether the target only includes direct emissions resulting from the operation of a scheme, or includes indirect emissions from the broader supply chain (e.g., material extraction, manufacturing, transportation, construction, decommissioning/disposal, etc.)
- What types of carbon savings or carbon removals are acceptable for offsetting emissions. Different organisations/authorities in the past have proposed a range of projects, such as tree planting, renewable energy or energy efficiency initiatives in other locations, or future use of carbon removal technologies (which are not yet commercialised).

In the context of the UK built environment, net zero targets most commonly relate to regulated operational CO_2 emissions occurring due to energy uses located within the redline boundary of a development site. However, as illustrated in the diagram below, this is a narrow definition that excludes many significant sources of GHG emissions related to development.

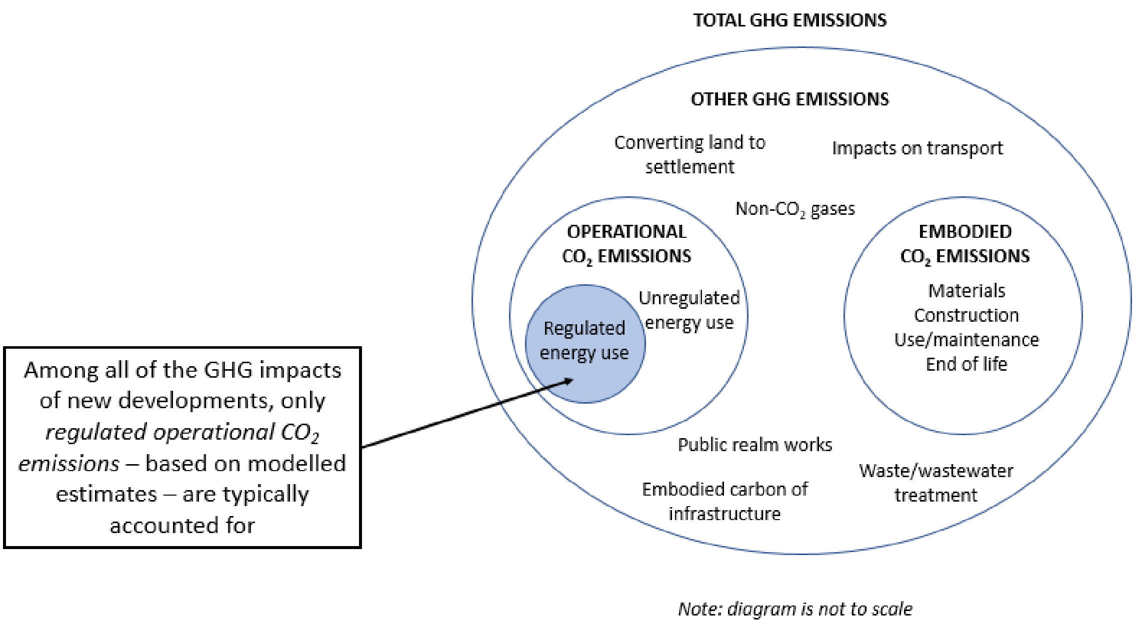


Figure 3-1. Sources of GHG emissions associated with new developments.

[22] BEIS, *'Energy White Paper: Powering our Net Zero Future'* (2020), p.153. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

The remainder of this section will:

- Explore these sources of emissions in more detail, explaining what causes them, the rationale for including them in a definition of net zero, and the practical considerations associated with doing so;
- Summarise government and industry definitions of net zero carbon and related concepts; and
- Provide examples of other definitions and the scope of targets included in other UK planning policies.

Taken together, this will form the basis for deciding which sources of emissions should be included in EHDC's definition of 'net zero carbon development'.

3.2 Sources of GHG emissions

3.2.1 Operational CO_2 emissions

Operational emissions from buildings include those associated with energy use within the building during its operational lifespan. These emissions are commonly referred to as being either 'regulated' or 'unregulated', referring to whether they fall under the remit of Building Regulations. Definitions from the Building Research Establishment (BRE) are provided below:

- **Regulated** (operational) energy use: *'Regulated energy is building energy consumption resulting from the specification of controlled, fixed building services and fittings, including space heating and cooling, hot water, ventilation, fans, pumps and lighting. Such energy uses are inherent in the design of a building.'*
- **Unregulated** (operational) energy use: *'Energy consumption resulting from a system or process that is not 'controlled', i.e. energy consumption from systems in the building on which the Building Regulations do not impose a requirement.'* Examples include IT equipment, electrical appliances, cooking appliances, etc.

In very simple terms, regulated emissions are usually associated with systems that are in place when the occupant moves in, and unregulated emissions are usually associated with things that occupants plug in afterwards.

Regulated operational emissions

Regulated emissions are typically estimated at the design stage using approved modelling software. Once the building is complete, the model is updated (if necessary) to reflect any changes in the construction or product specification, and results are used as proof of compliance with Part L of the Building Regulations.

Local Authorities have the ability to influence regulated emissions by stipulating minimum performance requirements, either as part of a planning policy or condition. They are also responsible for enforcement via Building Control.

However, this process has some drawbacks. In particular: because compliance is based on modelled estimates of energy performance, rather than metered data, there is often a significant 'performance gap' between the predicted and actual emissions from a building. Some of this is linked to issues such as materials not being installed correctly or quality control problems onsite. It is also due to the fact that unregulated energy uses are not adequately reflected in the modelling methodology.

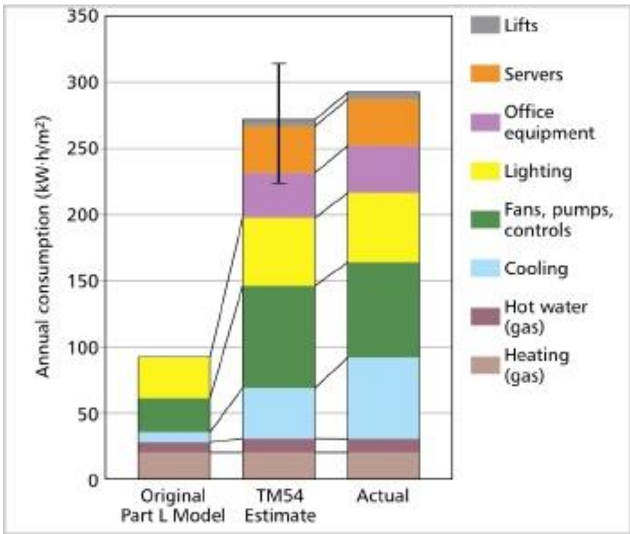


Figure 3-2. Difference between Part L compliance model and actual fuel consumption in a case study (non-domestic) building. Source: CIBSE TM54

Unregulated operational emissions

Although unregulated emissions are important from an environmental standpoint – in some cases accounting for 50% of a building's operational energy use – for a variety of reasons they are more challenging to address. Some of the key issues are set out below, although note that this is not an exhaustive list.

First, there is no standard (national) calculation methodology for estimating unregulated emissions at design stage.[23] Second, due to the nature of unregulated energy use and emissions, they are generally outside of the designer's or developer's control, and it is arguable whether they should be held to account for the activities of the occupants. Third, in order to ensure that operational emissions are in line with any estimates submitted at planning stage, it would be necessary to measure the actual energy use once the development is occupied. Building occupants would therefore need to agree to some form of data collection and EHDC would need to decide how to process that data, which raises a variety of legal and practical issues. Finally, there are potential viability implications due to the need for additional assessments, design changes and mitigation measures.

3.2.2 Non-operational CO_2 emissions

Non-operational emissions comprise of the 'embodied' emissions that have already occurred by the time a building is completed, and other emissions associated with subsequent stages of the building's lifecycle such as maintenance, repair, retrofitting, demolition and disposal. As shown below, collectively these account for a very significant proportion of whole life-cycle (WLC) emissions from buildings.

[23] Although there is no national standard at present, there are several options:

- Domestic buildings: The Standard Assessment Procedure (SAP) calculation methodology provides an estimate of energy use and emissions associated with cooking and appliances, although this is based on standard assumptions not specific to the scheme in question. The Passivhaus Planning Package (PHPP) modelling software provides a more detailed estimate of unregulated energy use and allows the user to consider more efficient appliances, but the disadvantage is that many of these will not be specified at design stage. Alternatively, if there is metered energy data available for comparable buildings (e.g. built to the same specification by the same developer or occupied by the same tenants), this could be used as a proxy in some instances.
- Non-domestic buildings: As a very rough estimate, outputs for equipment loads can be taken from the Part L models, although again this is based on standard assumptions. CIBSE TM54 provides a more detailed means of estimating operational emissions for non-domestic buildings.

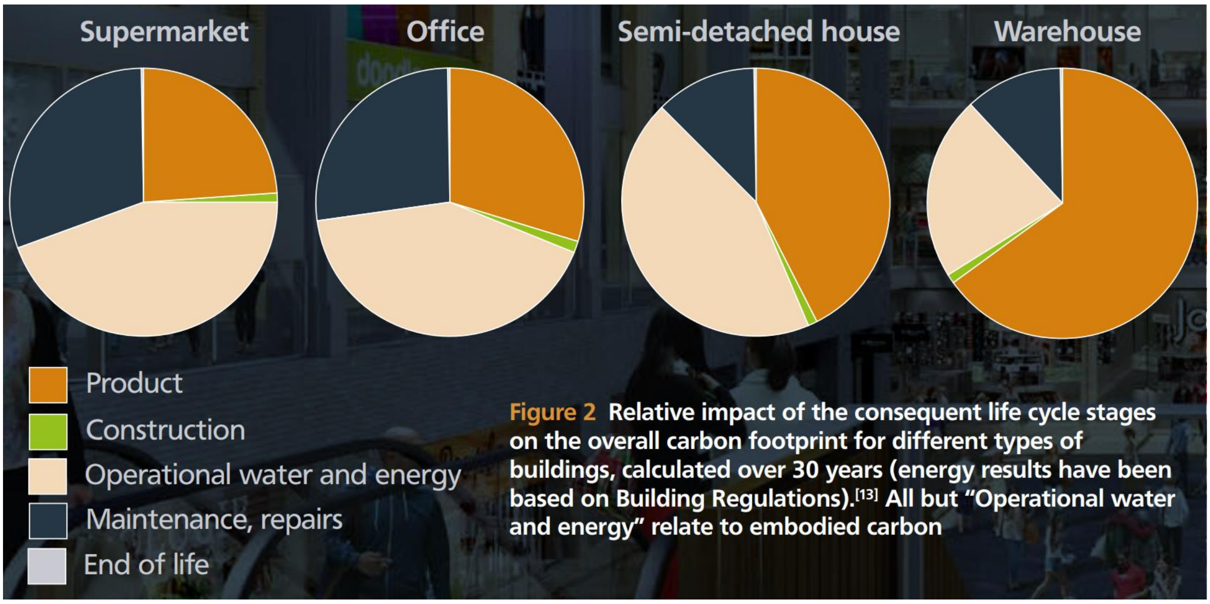


Figure 3-3. Proportion of emissions from different life cycle stages and different building types. Source: UKGBC, Embodied Carbon: Developing a Client Brief (2017)

These emissions are increasingly recognised as being important in decarbonising the building sector efforts, but they are not yet covered by Building Regulations. The WLC approach is still evolving; RICS only issued guidance on the topic for the first time in 2017. There are currently no industry standard benchmarks, so detailed calculations are required to get a reliable estimate of WLC emissions. These calculations add to development costs and are not routinely carried out.

An important point to note is that, although operational emissions from energy use can be net zero if all energy demands are met with 100% renewable energy, in order for embodied CO_2 emissions to be net zero, the entire supply chain for all construction materials and processes would have to be fully decarbonised. In practice, therefore, achieving net zero carbon for embodied or WLC emissions is impossible to achieve onsite. It would need to rely on some form of carbon offsetting or carbon removal technologies.

3.2.3 Other sources of emissions

In addition to the operational and WLC CO_2 emissions from the buildings themselves, there are a variety of other emissions associated with the construction and operation of new developments. Although these show up in the UK or District-wide GHG emissions inventory, they are not generally considered when predicting the future emissions from a specific new development. Examples include:

- Non-CO_2 GHGs such as methane, f-gases, nitrous oxide, etc. from building services, industrial processes, or other activities taking place onsite
- Wider sources of emissions other than those directly associated with the buildings, such as:
    - Construction works other than buildings e.g. public realm, landscaping, roads, infrastructure
    - Land remediation works
    - Converting land to settlement
    - Emissions that directly arise from the new development but occur outside of the redline boundary of the site, such as waste and wastewater treatment and occupant travel/commuting

Not only are most of these sources unaccounted for in the typical planning and Building Control process (and therefore difficult for Government or Local Authorities to influence), in many cases there are no industry standard assessment methods for estimating the scale of those emissions. This is essentially a blind spot of the current regulatory and planning landscape.

3.3 How have others defined net zero?

The Government has provided definitions for 'zero carbon', 'net zero ready' and 'nearly zero energy buildings' as part of various regulations and policy initiatives. In recent years, several major industry bodies have also published framework definitions and/or specific technical requirements for achieving net zero buildings. There are also a handful of examples of net zero requirements in adopted or draft Local Plan policies. These are summarised below in order to provide context when considering how EHDC should define 'net zero carbon' new development.

3.3.1 UK Government

Future Homes Standard and Future Buildings Standard: 'Net zero ready'

The Government's proposed FHS and FBS are framed around the concept of new buildings being 'zero carbon ready'. During the 2019 FHS consultation[24], the Government stated its intention that in future, *'All homes will be 'zero carbon ready', becoming zero carbon homes over time as the electricity grid decarbonises, without the need for further costly retrofitting work.'* Similarly, for non-domestic buildings, in the 2021 FBS consultation[25] the Government stated that, *'Buildings built to the Future Buildings Standard will be zero carbon ready, with the ability to decarbonise over time alongside the national grid without any further energy efficiency retrofit work.'*

In this context, the key components of a 'zero carbon ready' building are that the building achieves high standards of energy efficiency, and either has a low carbon (electric) heating system from the outset or is designed to accommodate one at a later date. The expectation is that, if and when the national electricity grid decarbonises, those buildings will have net zero operational CO_2 emissions from energy use. This would mean that both regulated and unregulated operational emissions would ultimately be removed, but that non-operational emissions would be unaffected.

The major drawback of this approach is that it relies on changes taking place in the wider electricity network, for which the timing is highly uncertain – although the Government has announced an ambition for the UK electricity grid to be net zero carbon by 2035.

[Withdrawn] Code for Sustainable Homes: 'Zero carbon'

In 2006, the Government announced that all homes would need to be 'zero carbon' from 2016 onwards, as part of the Zero Carbon Homes policy. Although the policy was withdrawn in 2015, it is nonetheless helpful to consider how the Government defined 'zero carbon'.

Buildings that met the highest standards under the Code for Sustainable Homes (CSH) would have been required to achieve *'zero net emissions of carbon dioxide (CO_2) from all energy use in the home.'* Under the original definition in 2006, renewable energy would have to be supplied, either onsite or offsite (connected via a private wire), enough to meet the operational regulated and unregulated energy demands of the property. This would have meant that both regulated and unregulated emissions would be removed but that, once again, non-operational emissions would be unaffected.

[24] MHCLG, *'The Future Homes Standard: Summary of responses received and Government response'* (2021): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

[25] MHCLG, *'The Future Buildings Standard'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956037/Future_Buildings_Standard_consultation_document.pdf

The Government subsequently announced that unregulated emissions would not be part of the target and that a range of alternative 'allowable solutions', such as delivering energy efficiency measures offsite, could also count towards the target.

Committee on Climate Change (CCC)

> *'New homes should deliver ultra-high levels of energy efficiency as soon as possible, and by 2025 at the latest.'*
>
> *– CCC, 2019*

Although not a definition of net zero per se, in the 2019 report *'UK Housing: Fit for the Future?'*, the CCC made the following eight recommendations for new build homes to be considered compatible with the UK's decarbonisation targets:[26]

- *'By 2025 at the latest, no new homes should connect to the gas grid.'*
- *'Make all new homes suitable for low-carbon heating at the earliest opportunity, through use of appropriately sized radiators and low-temperature compatible thermal stores.'*
- *'New homes should deliver ultra-high levels of energy efficiency as soon as possible and by 2025 at the latest, consistent with a space heat demand of 15-20 kWh/m^2/year.'*
- *'Statutory requirements should be in place to reduce overheating risk in new-build homes.'*
- *'Improve focus on reducing the whole-life carbon impact of new homes, including embodied and sequestered carbon.'*
- *'Improve water efficiency performance in homes.'*
- *'Alongside continued funding for flood defences, strengthen flood resilience measures at property and community level.'*
- *'New developments should enable sustainable travel, which should be a primary consideration from the beginning of the planning process.'*

The CCC also emphasised the importance of implementing these measures from the outset. This is both due to the much higher costs associated with retrofitting, and the fact that carbon emissions over the lifecycle of the building can be much (c. 5-10 times) higher if measures are adopted later.

Many of the CCC's recommendations are echoed in the voluntary targets and best practice measures suggested by UK industry bodies (see next section).

3.3.2 Industry best practice standards and policy recommendations

At the time of writing (November 2022) there is no single agreed industry definition of what net zero carbon means for buildings in the UK. However, an industrial working group has been formed to set out a common definition and agree on relevant targets and metrics. The technical steering group includes, but is not limited to, the Royal Institute of British Architects (RIBA), Building Research Establishment (BRE), Chartered Institute of Building Services Engineers (CIBSE), the Royal Institute of Chartered Surveyors (RICS), the London Energy Transformation Initiative (LETI), the UK Green Buildings Council (UKGBC) and others.[27] It is expected that the work will build on prior research and definitions proposed by member organisations, as summarised below.

Looking first at high-level definitions, UKGBC has developed a framework for net zero carbon buildings with the following definitions: [28]

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[26] CCC, *'UK Housing: Fit for the future?'* (2019). Available at: https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf

[27] For more information, refer to: https://www.nzcbuildings.co.uk/

[28] UKGBC, *'Net Zero Carbon Buildings Framework Definition'* (2019). Available at: https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-framework/

- Net zero carbon construction: *'When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy.'*
- Net zero carbon operation: *'When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset.'*

LETI provides a slightly more detailed definition, making it clear that the target covers all GHGs (not just CO_2) and also referencing specific performance targets: *'A 'Net Zero (Whole Life) Carbon' Asset is one where the sum total of all asset-related GHG emissions, both operational and embodied, over an asset's life cycle […] are minimized, meet local carbon, energy and water targets, and with residual 'offsets', equals zero.'*[29]

Looking at this in more detail, LETI, along with UKGBC, the RIBA and other industry groups, have stipulated 10 key requirements for an operationally net zero carbon building. These are grouped by theme as follows:[30]

Low energy usage

1. Total Energy Use Intensity (EUI) – Energy use measured at the meter should be equal to or less than:
    - 35 kWh/m^2/yr for residential
    - 65 kWh/m^2/yr for schools
    - 75 kWh/m^2/yr for commercial offices
2. Space heating demand for all building types should be no more than 15 kWh/m^2/yr.

Measurement and verification

3. Annual energy usage and renewable energy generation on-site must be reported and independently verified in-use each year for the first 5 years.

Reducing construction impacts

4. Embodied carbon should be assessed, reduced and verified post-construction.

Low carbon energy supply

5. Heating and water should **not** be generated using fossil fuels.
6. The average annual carbon content of the heat supplied should be reported.
7. On site renewable electricity should be maximised.
8. Energy demand response and storage should be incorporated, and the building annual peak energy demand should be reported.

Zero carbon balance

9. A carbon balance calculation should be undertaken annually, and it should be demonstrated that the building achieves a net zero carbon balance.
10. Any energy use not met by on-site renewables should be met by an investment into additional renewable energy capacity off-site OR a minimum 15 year renewable power purchase agreement. A green tariff is not robust enough and does not provide 'additional' renewables.

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[29] LETI, *'Climate Emergency Design Guide'* (2020). Available at: https://www.leti.london/cedg

[30] UKGBC, *'Net Zero Operational Carbon One-Pager'* (2020). Available at: https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2020/02/05150253/UKGBC-Net-Zero-Operational-Carbon-One-Pager.pdf

The Royal Institute of British Architects (RIBA) has also developed a set of voluntary performance targets for operational energy use, water use and embodied carbon.[31] They align with the UKGBC and LETI recommendations in regard to EUI and space heating demand, but adopt a phased approach, setting an interim target for 2025 which is less onerous than the final target that would come into place in 2030. These targets nonetheless aim to achieve significant emission reduction in new buildings by 2030, in order to meet the trajectory necessary to achieve net zero carbon for the whole UK building stock by 2050.

Table 3-1. RIBA 2030 Climate Challenge target metrics for domestic / residential developments

RIBA Sustainable Outcome Metrics	Business as usual (new build compliance approach)	2025 Targets	2030 Targets	Notes
Outcome Energy $kWh/m^2/y$	120 $kWh/m^2/y$	<60 $kWh/m^2/y$	<35 $kWh/m^2/y$	Targets based on gross internal area (GIA) include regulated & unregulated energy consumption irrespective of source (grid/renewables). • Use 'Fabric First' approach • Minimise energy demand. Use efficient services and low carbon heat. • Maximise onsite renewables.
Embodied Carbon $kgCO_2e/m^2$	1200 $kgCO_2e/m^2$	<800 $kgCO_2e/m^2$	<625 $kgCO_2e/m^2$	Use RICS Whole Life Carbon. Analysis should include minimum of 95% of cost, include substructure, superstructure, finishes, fixed furniture, fixtures and equipment (FF&E), building services and associated refrigerant leakage. • Whole Carbon Analysis • Use circular economy strategies • Minimise offsetting & use as last resort. Use accredited, verifiable schemes.
Potable Water Use Litres/person/day	125 l/p/day	<95 l/p/day	<75 l/p/day	CIBSE Guide G

3.3.3 Examples in local planning policy

This study has identified a number of Local Authorities that have adopted, or are proposing to include, requirements for net zero new developments within their Local Plans. A summary is provided in Table 3-2, which shows that there are differences in the definition and scope of net zero policies; more details are provided below. Note that this is unlikely to be an exhaustive list as policies are reviewed regularly.

[31] For more information, refer to the RIBA website at: https://www.architecture.com/about/policy/climate-action/2030-climate-challenge

For example, during the stakeholder consultation process (see Section 6), it was noted that Winchester City Council is seeking to adopt similar policies to those put forth by Bristol and Greater Cambridge.

Table 3-2. Summary of net zero policies in recently adopted and draft Local Plans

	Adopted					Draft		
What is included in the net zero policy?	**GLA**	**Tower Hamlets**	**Sutton**	**Oxford**	**Reading**	**Bristol**	**Greater Cambridge**	**Solihull**
Regulated operational CO_2 emissions	✓	✓	✓	✓	✓	✓*	✓	✓
Unregulated operational CO_2 emissions	✓	X	X	X	X	✓*	✓	X
Embodied or WLC emissions	✓	X	X	X	X	X	✓	X
Non-CO_2 gases	✓	X	X	X	X	X	X	X
Wider sources of emissions	?	X	X	X	X	X	X	X
Offsetting permitted	✓	✓	✓	?	✓	✓	✓	?

** In the Bristol policy, limits on operational emissions are implicitly set due to the use of EUI targets which refer to total operational energy use.*

While it is very encouraging to see more Local Authorities seeking to adopt net zero targets within their Local Plans, EHDC should be aware that a net zero policy put forth by West Oxfordshire District Council as part of the Salt Cross Area Action Plan was rejected by the Planning Inspectorate in May 2022.[32] The policy would have required proposals 'to demonstrate net zero operational carbon on-site' in line with the LETI standard.[33] This decision met with strong opposition from the public along with groups such as the TCPA, which produced a detailed statement explaining its position.[34] Nonetheless, this highlights that there is uncertainty as to how LPAs can respond to their legal obligations in regard to climate change (see Section 2 for further discussion).

Greater London Authority – ADOPTED (2021)

A definition of 'zero carbon' is provided in the Glossary of the GLA London Plan as: *'Activity that causes no net release of carbon dioxide and other greenhouse gas emissions into the atmosphere.'* While this definition explicitly includes GHGs other than CO_2, the quantitative target only covers regulated emissions[35] which (as previously discussed) are limited in scope. Other sources of emissions do <u>not</u> form part of the quantitative target, although they are addressed qualitatively:

[32] The Planning Inspectorate, *'Examination of the Salt Cross Garden Village Area Action Plan'* (2022). Available at: https://www.westoxon.gov.uk/media/5i3bqltb/insp-17-letter-to-council-re-main-modifications.pdf

[33] The Planning Inspectorate, *'Examination of the Salt Cross Garden Village Area Action Plan: Schedule of Proposed Main Modifications'* (2022). Available at https://www.westoxon.gov.uk/media/wdxagt5w/cd7-schedule-of-proposed-main-modifications-salt-cross-sept-2022.pdf

[34] TCPA, *'The Planning Inspectorate's assault on an exemplary Net Zero planning policy fuels the climate crisis'* (2022). Available at: https://tcpa.org.uk/pins-assault-on-an-exemplary-net-zero-planning-policy/

[35] GLA, *'Energy Assessment Guidance'* (2020), Section 4.4. Available at: https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_april_2020.pdf

> *'Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.'*
>
> *'Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.'*

Whole life-cycle (WLC) emissions are further described in the GLA guidance document[36] as follows:

> *'WLC emissions are the total carbon emissions [used as a shorthand term for greenhouse gases measured in units of CO_2e] resulting from the construction and the use of a building over its entire life, including its demolition and disposal. They capture a building's operational carbon emissions from both regulated and unregulated energy use, as well as its embodied carbon emissions - that is, emissions associated with raw material extraction, the manufacture and transport of building materials, and construction; and the emissions associated with maintenance, repair and replacement, as well as dismantling, demolition and eventual material disposal.'*
>
> *'The Mayor's net zero-carbon target for new development continues to apply to the operational emissions of a building. The WLC requirement is not subject to the Mayor's net zero-carbon target; but planning applicants are required to calculate operational and embodied emissions, and demonstrate how they can be reduced as part of the WLC assessment.'*

In terms of the actual policy targets, these are set out in Policy SI 2:

> *'Major development should be net zero-carbon […] A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:*
>
> 1) *through a cash in lieu contribution to the borough's carbon offset fund, or*
> 2) *off-site provided that an alternative proposal is identified and delivery is certain.'*

Within the GLA area, some individual London Boroughs (LBs) have also chosen to adopt net zero standards into their policies for new developments, including the LBs of Tower Hamlets and Sutton.

Tower Hamlets – ADOPTED (2020)

The Tower Hamlets Local Plan 2031 was adopted in January 2020.[37] Policy D.ES7 states that all residential development must be 'zero carbon', which must be:

> *'[…] achieved through a minimum 45% reduction in regulated carbon dioxide emissions on-site and the remaining regulated carbon dioxide emissions to 100% - to be offset through a cash in lieu contribution).'*

Non-residential development is required to achieve a 45% reduction in regulated CO_2 emissions compared with Part L 2013 from 2016-2019, and thereafter achieve 'zero carbon' which is defined the same way as for residential developments.

Sutton – ADOPTED (2018)

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[36] GLA, *'London Plan Guidance: Whole Life-Cycle Carbon Assessments'* (2022). Available at: https://www.london.gov.uk/sites/default/files/lpg_-_wlca_guidance.pdf

[37] London Borough of Tower Hamlets, *'Local Plan 2031'* (2020). Available at: https://www.towerhamlets.gov.uk/Documents/Planning-and-building-control/Strategic-Planning/Local-Plan/TH_Local_Plan_2031_accessibility_checked.pdf

The Sutton Local Plan[38] defines a 'zero carbon dwelling' as one that *'achieves at least a 35% on-site reduction in CO_2 emissions over and above the current Building Regulations (Part L 2013) […] The remaining emissions, to 100%, are offset through CO_2 reduction measures elsewhere either funded through planning contributions or a unilateral undertaking by the developer.'* This aligned with the GLA London Plan in effect at the time. The 35% reduction applies to all residential developments and major non-residential developments, while the requirement to offset remaining emissions to 100% only applies to major residential developments.

Oxford City Council – ADOPTED (2020)

The adopted Local Plan for Oxford includes a requirement for reducing carbon emissions in a phased approach that increases over time, leading up to a net zero requirement for residential buildings.[39] This approach addresses the issue of policies being superseded by later uplifts in Building Regulations.

Up until 2026, the Local Plan will require new residential developments to achieve *'a 40% reduction in carbon emissions from a 2013 Building Regulations (or future equivalent legislation) base case. This reduction is to be secured through on-site renewable energy and other low carbon technologies […] and/or energy efficiency measures. The requirement will increase from 31 March 2026 to at least a 50% reduction in carbon emissions. After 31 March 2030 planning permission will only be granted for development proposals […] that are Zero Carbon.'* For non-residential developments, the same 40% and 50% reductions apply, but the 'Zero Carbon' requirement is not mentioned.

The Glossary of the Local Plan specifies that, *'The Government have stated that Zero Carbon will only apply to those carbon dioxide emissions that are covered by building regulations.'* It does not specify whether offsetting is permitted.

Reading Local Plan – ADOPTED (2019)

Policy H5: Standards for New Housing states:

> *'All major new-build residential development should be designed to achieve zero carbon homes. [and] all other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations.'*

The Reading Local Plan does not provide a definition of 'zero carbon homes'. Based on the reference to Building Regulations, this target is assumed to only cover regulated CO_2 emissions. An accompanying SPD clarifies that offsetting is allowed.[40]

City of Bristol – DRAFT (November 2022)

Draft Policy NZC2 of the Bristol Local Plan states:[41]

> *'Developments will be expected to:*
>
> - *Calculate and report predicted energy use intensity using an operational energy model;*
> - *Minimise the demand for heating, cooling, hot water, auxiliary energy, lighting and unregulated energy consumption through energy efficiency measures; then*
> - *Meet its remaining heat/cooling demand sustainably as set out below; then*

[38] London Borough of Sutton, *'Local Plan 2016-2031'* (2018). Available at: https://drive.google.com/file/d/1Rhwp79G2mPu6dm3npgPVwu9QkNCFodSS/view

[39] Oxford City Council, *'Oxford Local Plan 2036'* (2020). Available at: https://www.oxford.gov.uk/downloads/file/7380/adopted_oxford_local_plan_2036

[40] Reading Borough Council, *'Sustainable Design and Construction SPD'* (2019). Available at: https://consult.reading.gov.uk/dens/consultation-on-the-draft-sustainable-design-and-c/results/sustainable_design_and_construction_spd_adopted_1219.pdf

[41] Bristol City Council, *'Bristol Local Plan Review: Draft Policies and Development Allocations – Further Consultation'* (2022). Available at: https://www.bristol.gov.uk/files/documents/5446-bristol-local-plan-review-nov-22-further-consultation/file

- *Maximise on-site renewable energy generation to achieve a net zero energy balance; and then Meet any outstanding reduction in residual energy use through energy offsetting.*

New development should demonstrate through an Energy Strategy set out as part of its Sustainability Statement how these requirements will be met, including the specific standards set out below.

Development will be expected to:

- *Achieve a maximum 15 kWh/m²/year space heating demand;*
- *Achieve the following standards:*
    - *In the case of new homes and other forms of accommodation, a maximum energy use intensity of 35 kWh/m²/year;*
    - *In the case of major non-residential development, the operational energy/ carbon requirements of BREEAM 'Excellent' consistent with Draft Policy NZC1; and*
- *Provide on-site renewable electricity generation with an output equivalent to at least the annual energy consumption of the development, as calculated using an operational energy model.*

Where it is clearly demonstrated that it is not technically feasible for the development to generate sufficient on-site renewable energy equivalent to at least its own annual energy consumption, the development should provide on-site renewable energy of 105 kWh/m²fp/year – where m²fp is the area of the footprint of the building(s). The remaining operational energy needs of the development should be met by offsetting measures […].'

This marks a change from the previous draft of the Local Plan which used CO_2 emission reduction targets, which have now been replaced with energy use intensity (EUI) metrics 'to reflect latest best practice'. The policy further states that a Passivhaus or higher standard would constitute an alternative route to compliance.

Any development proposals are to be accompanied by an Energy Strategy which specifies the development's EUI and how the above points are set to be actioned. This strategy should include all operational energy use, i.e., regulated and unregulated, and how this is intended to be reduced. While there are no emissions reduction targets for unregulated energy use, the EUI maximum of 35 kWh/m²/year includes all operational energy use.

Greater Cambridge - DRAFT

Among the examples reviewed as part of this study, the draft Greater Cambridge Local Plan sets the most stringent quantitative requirements for reducing operational emissions from new developments. Policy CC/NZ of the draft Local Plan for Greater Cambridge stipulates that all new developments must achieve net zero carbon operational emissions. For large developments (150 homes or 1,000 m² non-residential floorspace), there is also a requirement to calculate and reduce WLC emissions. Additional requirements include:

- Minimising space heating demand
- Not using any fossil fuels for heating
- Not connecting to the gas grid
- Meeting EUI targets
- Providing enough renewable energy to meet the total regulated and unregulated operational energy demands of the development (*'preferably on-plot'*)

Some of these are accompanied by numerical targets that align with the metrics proposed by industry bodies such as LETI. All developments are also required to *'demonstrate use of an assured performance method'* to address the performance gap. Offsetting is *'to only be used in certain* *circumstances'* and if the requirements cannot be met, the development needs to be futureproofed to enable it to become net zero carbon in future.

The draft Local Plan does not clearly define which GHGs form part of the net zero target, although the supporting evidence base suggested that non-CO_2 gases should be included.[16]

Solihull Metropolitan Borough – DRAFT

The Draft Submission version of the Solihull Metropolitan Borough Local Plan was submitted for examination in May 2021. It requires all dwellings to achieve a minimum 30% reduction on Part L 2013 and includes the following text within Policy P9: *'From April 2025, all new dwellings to be net zero carbon'*. It does not provide a definition of 'zero carbon homes' or specify whether offsetting is permitted. Based on the reference to Building Regulations, this target is assumed to only cover regulated CO_2 emissions.

3.4 Summary and recommended definition

When seeking to define 'net zero carbon' development, there is a trade-off between:

- On one hand, trying to account for as many sources of emissions as possible, in the interest of transparency and maximising positive environmental impacts; and
- On the other hand, avoiding the 'scoping in' of sources of emissions that in practical terms may be challenging and/or too costly to estimate, regulate, or monitor.

In a guidance document published in 2021, the Royal Town Planning Institute (RTPI) and Town and Country Planning Association (TCPA) state that, *'Both the TCPA and the RTPI (and other stakeholders) believe that local planning authorities in England are able to set standards above the building regulatory minimum.'*[44] However, despite the clear scientific evidence and legislation in favour of adopting strong policies as soon as possible, there are still risks of a net zero policy being challenged at Examination in Public or subsequently (see Appendix A.1). It is therefore very important to set a net zero carbon development policy that is based on solid evidence and precedent.

Broadly speaking, the emerging "best practice" definition of net zero development is one that:

- Prioritises energy demand reduction measures by setting ambitious quantitative targets;
- Includes regulated and unregulated operational energy demands;
- Requires all energy use to be met with the equivalent amount of renewable power generation either onsite or offsite;
- Acknowledges the importance of estimating and reducing WLC emissions as much as possible, while not necessarily setting quantitative targets at this stage; and
- Places a strong emphasis on taking steps to reduce the performance gap and monitoring actual performance, rather than predicted performance.

Tackling residual carbon emissions by making payments towards an offsetting fund is not considered best practice; LETI suggests that instead, *'Any energy use not met by on-site renewables should be met by an investment into additional renewable energy capacity off-site OR a minimum 15 year renewable energy power purchase agreement (PPA).'* There is ample precedent for Local Plans that require new developments to reduce emissions by a certain amount (%) compared with Part L of the Building Regulations. However, to date, there have been few examples of Local Plans adopting a net zero emission target. Among the examples identified in this review, most targets only cover *regulated operational CO_2 emissions*, although some refer to unregulated, embodied or WLC emissions. Non-CO_2 gases also tend to be excluded; we found only one example of a Local Plan that specifically included other GHGs in the definition of net zero, but these were not included in the quantitative net

[44] RTPI and TCPA, *'The Climate Crisis: A guide for local authorities on planning for climate change'* (2021). Available at: https://tcpa.org.uk/resources/the-climate-crisis-a-guide-for-local-authorities-on-planning-for-climate-change/

zero target. Other sources of emissions from development that are not directly associated with the buildings themselves may be considered indirectly as part of other policies, such as those relating to sustainable transport, green infrastructure, and so on – but again, these are not included in quantitative targets.

Among Local Plan policies, the most expansive definition of 'net zero' is found in the GLA London Plan, although not all sources of emissions included in the definition are subject to the emissions reduction target. Draft Local Plan policies from Greater Cambridge and Bristol have also proposed quantitative targets for unregulated operational CO_2 emissions (for Bristol, this has been changed to an EUI target, which implicitly places limits on unregulated operational CO_2 emissions as well). It is yet to be seen whether these will pass inspection, but it is important to note that they reflect current industry best practice and are best aligned with the CCC's recommendations for how the UK can meet its carbon budgets.

The following table sets out different sources of emissions that could be included in the definition of net zero carbon development in East Hampshire, based on a review of Government policies, industry definitions, and precedents in UK planning policy. They are broadly listed in order of increasing difficulty or level of ambition. Note that, while operational energy demands can potentially be met via provision of onsite renewables, for other sources of emissions it is not considered technically possible to achieve net zero emissions onsite.

Table 3-3. A summary of the different options for defining net zero carbon development (based on the sources of emissions included) in increasing order of difficulty.

Increasingly challenging

What does the definition of 'net zero' include?	Precedent in UK planning policy	Other comments
Net zero **regulated** operational emissions from buildings…	Some examples, most of which include the option to offset emissions	Evidence suggests this is achievable for some domestic developments, but potentially harder to achieve for non-domestic developments
… and **unregulated** operational emissions from buildings…	This review has found no *adopted* Local Plans that include *quantitative* targets for unregulated operational, embodied or whole life-cycle emissions from buildings, although they are referenced in some Local Plans	Requires an operational energy assessment; to date these have not been routinely caried out
… and **embodied or WLC** emissions from buildings…		There are a few case studies of buildings or organisations that have tried to achieve this, but it would require offsetting
… and **wider sources of emissions** from the entire development	No precedents identified	No case studies identified

Based on these findings, our recommendations are as follows:

Recommendation:

A quantitative net zero target should (at least in the short/medium term) be applied to operational CO_2 emissions from buildings only (with a view towards broadening the definition; see Recommendation 2). This should cover both regulated and unregulated energy uses. In effect, this means that 'net-zero carbon development' for East Hampshire's planning area would encompass all sources of emissions related to operational energy use.

In line with industry best practice, this would mean:

- Very high levels of energy efficiency, ideally with a requirement to meet a maximum space heating demand and/or energy use intensity (EUI) target, and monitor actual energy performance in use
- No onsite fossil fuel combustion
- Providing at least enough renewable energy to meet the predicted operational energy demands of the development

Bearing in mind the type of new developments proposed within East Hampshire, this standard is expected to be technically achievable in most cases, though the difficulties with measuring unregulated emissions (mentioned above) will need to be considered in detail. Where it can be clearly shown that it is not achievable, EHDC could consider allowing provision of renewable energy technologies offsite, or some other form of carbon offsetting fund.

In the longer term, the net zero definition should be broadened to include embodied/WLC emissions.

Recommendation:

Require developers to demonstrate that they have taken steps to reduce WLC emissions from buildings. This should ideally include a requirement to calculate WLC emissions using a recognised approach (e.g. RICS). However, subject to viability testing, for smaller developments it may be necessary to use a checklist or other qualitative assessment method. In effect, this means that 'net-zero carbon development' for East Hampshire's planning area would encompass emissions associated with non-operational energy use but in a more qualitative rather than strict quantitative manner.

Although wider sources of emissions are important, due to factors such as the lack of assessment methods and some sources of emissions being outside the LPA's remit, these need to be addressed in other ways, at least in the short/medium term. This can be done through other aspects of the planning system e.g. spatial strategy, housing density, mix of uses, provision of sustainable transport options, protecting greenfield sites, etc. Refer to Section 7 for more information.

4 Options for achieving net zero development

Q2: What are the options available for local plan policies that would achieve net zero carbon development?

This section describes potential policy options for EHDC to consider in regard to net zero development. The main focus is on reducing onsite emissions from the buildings themselves, first through onsite measures and then (as a last resort) through offsetting.

[To avoid repetition, examples of policy wording and details of technical standards have not been included here, but they are provided in Section 3.3.]

4.1 Reducing emissions onsite

4.1.1 General approach

This section briefly summarises some of the key themes related to net zero carbon development that should be addressed as a matter of best practice.

In a 2021 report titled **The Climate Crisis: A Guide for Local Authorities on Planning for Climate Change**, the RTPI and TCPA recommended that, *'Local development plans should develop binding net zero standards for new development, aligned with the energy hierarchy (i.e. prioritising carbon savings from optimal fabric efficiency standards, renewable heat supply, and on-site renewable energy).'* The guidance cited the UKGBC when giving examples of best practice policy approaches. UKGBC's main recommendations, which are intended to support the net zero buildings framework, are set out below.[45]

Table 4-1. Local policy options set out by the UKGBC, for different aspects of the Zero Carbon Buildings Framework.

Zero Carbon Buildings Framework	Local policy recommendation
Reduce embodied carbon	• Local Plan requirements for modelling of whole life carbon impacts for new developments • Extension of Local Plan 'zero carbon' requirements to cover whole life carbon, including offsetting of these impacts
Reduce energy demand	• Local Plan requirements for carbon and energy performance beyond Building Regulations • Local Plan requirements for monitoring and reporting energy performance of new developments for first years of operation
Increase renewable energy supply	• Local Plan requirements for carbon and energy performance above Building Regulations • Local Plan requirements for a minimum percentage of renewable energy on-site • Local Plan requirements for off-site renewable energy solutions as a route to achieving zero carbon where on-site generation is not feasible
Offsetting	• Consistent (national) framework for local offset funds to improve consistency and transparency • Local Plan requirement for new developments to be 'zero carbon' or 'net zero' and offset funds

[45] UKGBC, *'New Homes Policy Playbook'* (2021). Available at: https://www.ukgbc.org/ukgbc-work/new-homes-policy-playbook/.

The 'Energy Hierarchy'

One of the common themes among the various net zero definitions is that they prioritise energy demand reduction as a key first step towards net zero emissions. This includes a 'fabric-first' approach that considers passive design and other measures such as insulation, glazing, and construction details *before* moving on to consider energy efficient services, appliances, and renewable energy supply. In other words, there is an 'energy hierarchy' which sets out the preferred measures that should be adopted.

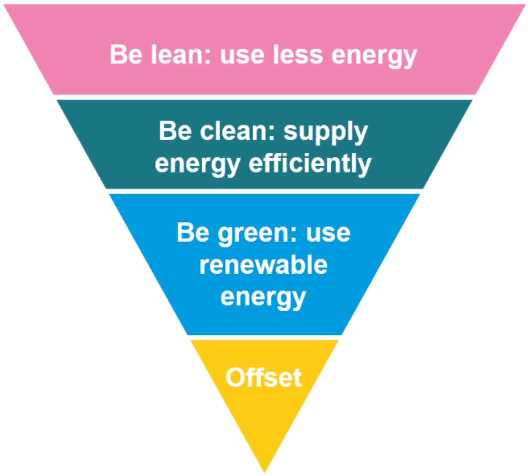

Figure 4-1. GLA London Plan Energy Hierarchy

Several Local Authorities have incorporated this concept into their Local Plan policies, requiring applicants to demonstrate (via a Sustainability Statement or Checklist) that they have maximised opportunities to introduce measures that are higher up the energy hierarchy. The diagram above uses the wording as given in the GLA London Plan.[35]

Energy use targets

In order to avoid a circumstance where a building is inefficient or uses a lot of energy, but still achieves net zero emissions by delivering an equivalent amount of renewable power generation, **it is important to set some form of energy use target**. This approach is used as part of the BREEAM and HQM assessment methods as well as industry best practice standards proposed by the UKGBC, RIBA and LETI; it is also a requirement of achieving the Passivhaus standard. It is also reflected in several Local Plan policies where they ask developers to reduce emissions by a certain amount through energy efficiency measures alone, before counting CO_2 reductions from renewable energy technologies.

Renewable energy

Another consistent theme among the net zero definitions presented in Section 3 is that net zero operational emissions are achieved when **100% of the energy demands of the development are met with renewable energy**, which can be delivered either on-site or elsewhere. The predicted energy demand should not be based solely on Part L compliance calculations, which are not suitable for that purpose (see below).

Estimating and reducing WLC emissions

As will be shown in Section 7, operational emissions account for the minority of total emissions from new development. Therefore, **it is important to minimise construction impacts across the building's lifecycle**.

Performing as designed

It is widely recognised that **buildings often do not perform as designed** (this is known as the 'performance gap'). Tackling this problem requires a variety of strategies, from closer site supervision and quality assurance during construction, to monitoring and reporting actual energy use post-occupancy.

4.1.2 Factors to consider

Local Authorities have taken a variety of different approaches for policies relating to energy use, GHG emissions, and climate change more broadly. It is important to consider not just the overall target, but also details of how the target can be implemented and enforced. The table below sets out some key factors or options for EHDC to consider, indicating the main pros and cons of each one.

Table 4-2. A summary of some of the key factors to consider when developing plans/policies to achieve net zero development.

Option to consider	Comments
Is the requirement qualitative or quantitative?	Relatively easy for developers to claim that qualitative requirements have been met (e.g. 'maximise opportunity for onsite renewables') without going beyond standard practice. This is because compliance with any such requirement would be a matter of judgement, whilst it may be unclear what this would entail and how it would be verified.
If there is a quantitative target, what metric(s) are used?	Some sources of GHG emissions cannot be easily quantified so difficult to set a numerical target for those GHGs. Risk of metrics going 'out of date' or being superseded
Is there some form of offsetting or other 'allowable solution'?	Offsetting can be used to achieve 'net zero' where this cannot be delivered onsite. However, it does not guarantee that the building can actually be net zero in operation by 2050. There are legitimate concerns about the effectiveness and additionality of offsetting schemes, and practical issues EHDC would need to address, including setting a carbon price and management of funds.
Does the policy apply to all developments, or just specific types?	Due to viability implications, Local Plan policies may apply only to major developments or those on specific sites (e.g. greenfield sites, which may have fewer constraints). However, this approach means that a key lever of influence over new buildings would not be utilised.
Does the policy cover CO_2 only, or other GHGs?	Non-CO_2 GHGs are generally small for the proposed development types but nonetheless should be considered as they form part of the targets under the Climate Change Act. A key example would be f-gases used in heat pumps (due to risk of refrigerant leakage). However, they are not included in the Part L assessments so estimating and monitoring would be difficult. Scoping in additional GHGs will make it harder for developments to demonstrate that they are 'net zero', so may simply lead to more emphasis on offsetting.
Is there any reference to third party assessments or other industry standards?	Third party assessments can make it easier for the planning authority to evaluate proposals (less officer time required) and may obviate the need for additional guidance. Passivhaus in particular includes a rigorous certification process that has also been shown to minimise the risk of a performance gap. On the other hand, third-party assessments offer less flexibility for developers to achieve compliance, and are at risk of becoming 'out of date' quickly (e.g., if the standard is superseded by Building Regulations or otherwise cancelled).
Does the policy allow for an uplift in standards at a future date?	The policy wording could specify that a higher target will apply to developments after a future date (e.g. requiring buildings to be net zero from 2025 rather than from the date of the Plan being adopted). This would allow developers time to plan for future changes. The disadvantage is that there is a GHG emissions penalty for delaying

	the introduction of higher standards (see Section 7). Another risk is that this could be superseded by national policy announcements.
Is it based on the proposals 'as designed' or 'as built'?	If relying on modelled estimates, particularly Building Regulations England Part L (BREL) reports, it is almost certain that the buildings will not perform as predicted. To date, operational energy assessments have not been regularly carried out at design stage. RIBA recommends setting targets for operational energy use based on meter readings – see notes below on monitoring and reporting.
Are there any requirements for monitoring or reporting actual performance?	The GLA requires monitoring and reporting for some schemes, but there are legal issues to address e.g. the need for future building occupants to comply with monitoring energy data.
How to handle transitional arrangements for long-term/phased developments?	There is a need to ensure that developments can be held to the best practice standards in place at the time they are built even if permission is granted years before.
Are all of the requirements contained in the policy wording, or are they elaborated on in an SPD/SPG?	Since SPDs and SPGs can be updated more easily than Local Plan policies, some authorities use these to set more detailed standards – the key advantage being that they can be updated to reflect changes in best practice, Building Regulations, etc. The trade-off is that they are material considerations rather than part of the development plan.

4.1.3 In-house assessment vs. third party assessment schemes

A major overarching issue when considering different policy options is that they may place additional burdens on both the developers/applicants and the LPA itself. Broadly, there are two ways that EHDC could check that proposals comply with energy or GHG performance standards. One option would be to require developers to submit calculations and then assess these in-house. For example, the GLA has developed its own energy assessment guidance that developers must follow.[35] Anecdotally, however, many planning departments do not have enough technical expertise to review information on energy, sustainable design and GHG emissions. Given that EHDC intends to adopt an ambitious net zero policy, it will be crucial to ensure that there are sufficient resources allocated so that compliance can be assessed, enforced and monitored. Some Local Authorities hire external specialists to help with this process.

An alternative approach might be to give developers the option of showing compliance via some sort of third party assessment scheme. In this case they would simply be asked to show proof of certification, and EHDC would not need to review detailed energy statements. The major disadvantage of this approach is that, depending on which assessment scheme is used, the assessment may only consider operational emissions, thus setting up a potential conflict with EHDC's definition of net zero development.

EHDC resources needed to implement net zero policies

Whether EHDC chooses to adopt a policy that requires the use of bespoke net zero metrics or third-party assessment schemes, applications will need to be evaluated by individuals who are competent to assess them. This is a specialist field of knowledge that would require dedicated officer resource.

Depending on the policies adopted, the type of qualifications that are necessary might include:

- Understanding of third-party assessment schemes e.g. BREEAM, HQM, Passivhaus or other certification schemes
- Experience of energy modelling and building physics e.g. SAP or BRUKL calculations
- Expertise in lifecycle carbon assessments, material science or engineering in order to evaluate WLC emissions or proposed construction materials
- Ability to monitor planning applications and conduct post-occupation surveys
- Ability to collect and interpret energy data to contribute towards the development of future standards or benchmarks
- Knowledge of how to design, set up and administer offsetting scheme(s), which may relate to energy efficiency improvements, renewable energy systems, or nature-based solutions
- Awareness of the wider policy and legal position regarding GHG mitigation and building performance standards

This is a challenging area for Local Authorities, recognising the constraints on officer time and resources along with budget cuts. Research commissioned by UK100, a network of local government leaders, has identified the lack of planning officers' time, capacity and knowledge as one of the barriers to net zero carbon development.[47] However, it will need to become a priority going forward in order for EHDC to successfully implement the net zero carbon development policy that the Council has committed to.

BREEAM and HQM

In the UK, the most commonly recognised third party assessment schemes are those developed by the BRE, namely BREEAM (which is used for non-domestic buildings and domestic refurbishments) and HQM (which is only for domestic new buildings). These rate how well buildings perform against a wide range of sustainability criteria; they are intended to prompt a holistic approach to sustainable design and are not just focused on GHG emissions. In order to achieve different ratings, buildings must achieve a minimum number of points or credits across topic areas such as energy and emissions, materials, water efficiency, waste, transport, and so on.

For credits relating to energy use and emissions, both BREEAM and HQM use a unique metric, the 'Energy Performance Ratio', that accounts for operational energy demand, primary energy consumption, and CO_2 emissions. This is to avoid a situation where a building can use a large amount of energy while still claiming to perform well because it includes low or zero carbon energy technologies. To achieve higher ratings under either BREEAM or HQM, buildings must achieve a certain level of improvement against Part L 2013. The minimum requirements get more challenging for buildings seeking to achieve better ratings.

Although the energy and emissions criteria is not directly comparable to Part L performance, Part L compliance calculations underpin the Energy Performance Ratio, meaning that only regulated CO_2 emissions are a mandatory part of the assessment. Applicants do not have to estimate the total (regulated and unregulated) operational energy use for the building unless they are seeking to achieve the highest ratings.

Passivhaus

Developed by the Passivhaus Institute in Germany, the Passivhaus standard is a voluntary energy efficiency standard for new buildings. Its equivalent for retrofits is the EnerPHit standard. Broadly

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[47] Quantum Strategy & Technology Ltd. on behalf of UK100, *'Power Shift: Research into Local Authority powers relating to climate action'* (2021). Available at: https://www.uk100.org/sites/default/files/publications/Power_Shift.pdf

speaking, the aim of Passivhaus is to deliver buildings that require little or no supplementary heating or cooling due to the use of ultra-high fabric efficiency. Unlike BREEAM and HQM, Passivhaus certification is not based on Part L compliance modelling, and instead uses specialist software, the Passivhaus Planning Package (PHPP), to estimate energy use. In addition to using more detailed modelling software, the design and construction is reviewed by an independent certifier and the quality control onsite is far beyond standard practice in the UK. The result is that in addition to delivering buildings with extremely low energy demands, Passivhaus projects exhibit a much smaller 'performance gap' compared with typical buildings.[48]

Achieving this level of performance is very difficult from a technical standpoint. It requires the use of construction methods and building services that are not commonly used in the UK (particularly for domestic buildings), such as mechanical ventilation with heat recovery (MVHR).[49]

To avoid increasing build costs, Passivhaus principles need to be incorporated into the design process from the outset.

[48] Passivhaus Trust, *'UK Passivhaus and the energy performance gap'* (2020). Available at: https://www.passivhaustrust.org.uk/UserFiles/File/Technical%20Papers/2020%2006_Passivhaus%20and%20the%20Performance%20Gap_University%20of%20Bath_Rachel%20Mitchell%20and%20Sukumar%20Natarajan.pdf

[49] MVHR ensures that the airtightness requirements for Passivhaus buildings do not result in dampness and mould, as the ventilation system provides a constant supply of filtered, pre-warmed fresh air. At the same time, MVHR systems extract stale, moist air. This means that occupants do not need to open windows to 'air out' the house and achieve good indoor air quality.

4.2 Addressing residual emissions

Q3: What are the feasible options for offsetting carbon emissions in East Hampshire that cannot be avoided through new development?

Q4: What are benefits and drawbacks of each offsetting option in helping development in EHDC's planning area to achieve net zero carbon status?

It is possible that on-site measures will not be able to reduce all operational GHG emissions to zero. Where there are residual emissions, EHDC could potentially require developers to offset these by undertaking GHG mitigation actions elsewhere, even though this is considered a last resort for achieving overall GHG emission reductions.

4.2.1 What is carbon offsetting?

Carbon offsetting means compensating for residual GHG emissions by making equivalent reductions of emissions elsewhere or increasing carbon storage.[50] This can be achieved through technological means (e.g., Carbon Capture and Storage, or CCS), nature-based measures (e.g., tree planting), or financial schemes (e.g., offsetting funds to finance emissions reductions elsewhere). On a global scale, the IPCC recently notes that, *"The deployment of CDR [Carbon Dioxide Removal] to counterbalance hard-to-abate residual emissions is unavoidable if net zero CO_2 or GHG emissions are to be achieved"*.[51]

Potential co-benefits of nature-based measures

Nature-based measures can realise multiple benefits from a single piece of land. Aside from offsetting GHG emissions, carefully planned and well-executed nature-based measures could also:

- Contribute towards biodiversity net gains (BNG) to address the ecological emergency
- Reduce sources of nitrogen pollution on a particular site (e.g. when converting agricultural land to woodland), or help to prevent it from reaching protected sites (e.g. when creating new wetlands)
- Increase the adaptative capacity of the land, e.g., in the form of sustainable drainage systems (SuDS) to protect against flooding or by mitigating the urban heat island if trees are planted in urban areas

As such, the carbon offsetting benefits should not be the sole focus of such measures, but rather be considered alongside other positive impacts.

In the case of UK Local Authorities, carbon offsetting is relevant where a net zero target has been set, as in the case of new developments, but where for technical or financial reasons, emissions cannot easily be mitigated on-site. The remainder of this section focuses on carbon offsetting as it relates to Local Authorities.

Note: Typical examples of carbon offsetting projects undertaken by UK local authorities include retrofitting energy efficiency measures to existing buildings, deploying renewable energy technologies to replace use of grid electricity, tree planting, or paying for carbon credits. None of these offer a long-term solution for land-use planning to the challenge of GHG mitigation:

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[50] For more information, refer to: https://www.offsetguide.org/understanding-carbon-offsets/what-is-a-carbon-offset/

[51] IPCC, *'Climate Change 2022: Mitigation of Climate Change – Summary for Policymakers'* (2022). Available at: https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf

- Retrofitting: All avoidable sources of emissions will need to be reduced to zero anyway by 2050, so those energy efficiency measures would not represent additional savings.
- Renewable energy: The carbon savings are calculated based on the amount of grid electricity that is *displaced*, so once the grid is net zero, there would be no additional savings.
- Tree planting: There is limited available land, and to reach net zero, carbon offsetting via tree planting, along with other GHG removal measures, will need to be reserved for hard-to-abate sources of emissions like heavy industry and agriculture.

4.2.2 Best practice principles

Many targets for net zero developments are defined in a way that allows some form of carbon offsetting. This approach is particularly common among Local Authorities in Greater London.[52] However, as a matter of best practice in carbon management, offsetting should be understood a last resort after all direct mitigation options have been exhausted. Considering the economy as a whole, the CCC recommends that it should be reserved for 'hard to abate' sectors, such as aviation and heavy industry.[53] There is evidence that low or medium rise domestic developments can achieve net zero regulated emissions without offsetting but that it is more challenging for non-domestic or higher density developments.[56,57]

While mitigation action should be prioritised over offsetting, it is also important to note that the NPPF focuses heavily on avoidance over mitigation. In essence, options to avoid impacts in the first place should be exhausted before compensation is considered. As such, best practice would first see avoidance prioritised, then mitigation, and then offsetting as a last resort.

It is important, therefore, to prioritise direct emissions reductions onsite. The new London plan, for example, stipulates that a minimum of 35% of emissions reductions must occur on-site.[55] While it is good practice to set such a "minimum" standard, it has been found that developers generally only target this minimum, as it is often less costly to pay into an offsetting fund compared to implementing on-site measures.

As such, it is important that carbon offsetting projects are effective, and adhere to certain best practices, as set out in Table 4-3. (Note that this list is consolidated from several sources in order to capture the range of recommendations set out by various organisations and codes of practice.)

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[52] GLA, *'Carbon Offset Funds: Guidance for London's Local Planning Authorities'* (2018). Available at: https://www.london.gov.uk/sites/default/files/carbon_offsett_funds_guidance_2018.pdf

[53] CCC, 'Net Zero - Technical Report - Climate Change Committee (theccc.org.uk)

[56] Bioregional, Etude, Currie & Brown and Mode, *'Greater Cambridge Net Zero Carbon Evidence Base: Non-technical summary'* (2021). Available at: https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-09/Greater%20Cambridge%20Local%20Plan%20Net%20Zero%20Carbon%20Evidence%20Base%20-%20Non%20Technical%20Summary%20FINAL.pdf This study examined several building types – a three-storey semi-detached house, a two-storey terrace, a four-storey block of flats and a school – and found that all of them could achieve net zero emissions on-site when constructed to the LETI standard (see p. 19). Other building typologies with higher energy demands or more storeys were not modelled in detail, but the authors concluded that these were likely to require additional off-site renewables (see p. 20).

[57] Aecom on behalf of the Royal Borough of Kensington & Chelsea, *'Evidence Study on Greening Issues'* (2021). Available at: https://planningconsult.rbkc.gov.uk/gf2.ti/f/1308098/108488197.1/PDF/-/RBKC_evidence_study_on_greening_issues_210720.pdf Section 4.7.2 of the RBKC report demonstrates how an increase in floor area relative to roof space may make it challenging for flats above 3 storeys to achieve net zero onsite. However, the calculation was based on a flat parapet roof, which (as shown in Section 4.5.3 of that report) generates significantly less electricity than other roof geometries. This suggests that a different roof shape could enable a taller development to achieve net zero.

Table 4-3. Criteria to ensure the quality of carbon offsets[59,60,61,62,63]

Criteria	Explanation
Additional	Ensuring that the measure would have not occurred otherwise
Permanent	Keeping CO_2 out of the atmosphere for ≥100 years
Viable	Ensuring that the measure can be implemented and is quantifiable
Accurate	Both the baseline emissions of the project and the CO_2 savings realised by the offset should be monitored as accurately as possible, avoiding overestimates. Part of ensuring accurate estimates of the offsetting effect is to avoid double counting and minimise leakage (see below).
Verifiable	Verification of the offset should be carried out by an accredited third party, according to set standards.
Transparent	Ensuring clear documentation of the implementation of the offset as well as regular monitoring and reporting on the measure.
Designed to minimise leakage	Minimising increases in emissions elsewhere as a result of emission reduction actions in the area of interest.
Designed to maximise co-benefits	Maximising positive effects (e.g., job creation or increased biodiversity) which were not the primary goal of a certain project or policy but occur alongside the main target.

4.2.3 Types of carbon offsetting projects

There are two general mechanisms for offsetting carbon emissions:

1) **Avoidance** – activities that reduce emissions by preventing their release into the atmosphere.
2) **Sequestration/removal** – activities that pull carbon out of the atmosphere.

Specific options can then be categorised into:

Technological solutions

Technological solutions to carbon offsetting rely on carbon dioxide removal and storage technologies, such as BECCS (Bioenergy with Carbon Capture and Storage), DACCS (Direct Air Carbon Capture and Storage). It is important to note, however, that these technologies not yet fully mature, and the timescales for commercialisation are uncertain.[51]

Nature-based solutions

Nature-based solutions tend to aim at maximising storage of "green" (i.e. land-based) and/or "blue" (i.e. ocean-based) carbon, via measures such as tree planting, peatland restoration, salt marsh restoration,

[59] For more information, refer to: https://www.offsetguide.org/high-quality-offsets/

[60] International Carbon Reduction & Offset Alliance, 'ICROA Code of Best Practice' (n.d.). Available at: https://www.icroa.org/code

[61] The Carbon Trust, *'The Carbon Trust three stage approach to developing a robust offsetting strategy'* (n.d.). Available at:https://www.sustainabilityexchange.ac.uk/files/ct_offset_strategies.pdf

[62] UN Framework Convention on Climate Change, *'Guide for Peer Review of National GHG Inventories'* (2017). Available at: https://unfccc.int/files/national_reports/non-annex_i_natcom/application/pdf/final_guide_for_peer_review_report_final_webupload.pdf

[63] IPCC, *'Climate Change 2014: Synthesis Report'* (2014). Available at: https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf

and sea grass or kelp forest regeneration. Nature-based solutions might also involve the diversification of land use and agriculture or the avoidance of land use change.

Among these options, woodland creation and peatland restoration are the most well-recognised in the UK; there are formal schemes available that can be used to quantify and validate the outcomes, which is not the case for all of the examples listed.

Case study: Adur & Worthing Councils – Kelp Forest Regeneration

Adur and Worthing Councils (referring to the joint management structure of Adur District Council and Worthing Borough Council, both in West Sussex) are working alongside the Sussex Kelp Restoration Project, neighbouring local authorities, and other partners to support the restoration of natural kelp forests in the coastal waters (out to 4km from the coast) between Selsey and Shoreham. This is an innovative and pioneering project, and the Councils aim to become the first in the UK to lease the seabed for this purpose.

This is an example of enhancing blue carbon storage, which can act to offset hard-to-abate residual emissions occurring elsewhere. Furthermore, kelp forests act to protect against coastal erosion (by absorbing wave power) and also provide a crucial habitat for numerous marine species, meaning this project will not only help offset emissions through carbon storage, but also maximises other environmental co-benefits.

The project is also supported by the recent Nearshore Trawling Byelaw (introduced by Sussex Inshore Fisheries and Conservation Authority) which acts to protect over 300 square kilometres of seabed off the Sussex coast from trawling and thus will protect the regenerated kelp forest. The scheme has been awarded £79,000 in funding from Defra and the Environment Agency, with this money coming from the £10 million Natural Environment Investment Readiness Fund. [65]

Financial mechanisms

In the context of the UK planning system, this option usually involves payments to offsetting funds in lieu of onsite reductions. Historically, these payments have normally gone towards other local projects, such as energy efficiency or renewable energy projects. The principle is that the carbon reductions from these measures will be equivalent to the residual emissions produced on-site. In this sense, financial schemes work at a local level. However, they do not work at a national scale since the net zero target would require all sectors to reduce emissions to zero anyway – so, they do not provide additionality.

More broadly, there are numerous examples of financial offsetting schemes whereby an organisation can purchase carbon credits on the basis that these will go towards projects such as woodland creation. For instance, the Woodland Carbon Code (WCC) is a carbon credit scheme backed by the UK Government.[66]

A problem with relying on financial mechanisms in the long term is that, over time, more and more organisations will be making deep cuts in their own emissions, and many will turn to offsetting to achieve this. This will reduce the number of options available and increase the price of carbon credits significantly. To achieve true net zero, eventually all sectors of the economy will need to make deep and expensive cuts, and not just rely on this form of offsetting.

[65] Adur and Worthing Councils, *'Bid to restore climate tackling seabed kelp forest gets government seal of approval with major grant'* (2021). Available at: https://www.adur-worthing.gov.uk/news/archive/pr21-106.html

[66] For more information, refer to: https://www.woodlandcarboncode.org.uk

4.2.4 Summary of options

The table below explores the pros and cons of a range of offsetting options for East Hampshire. Note that some of these options, like peatland restoration or blue carbon storage, could utilise carbon offset funding but would need to be delivered outside of the Local Authority boundary since there are no local opportunities available.

Table 4-4. Summary of different offsetting options and their performance against a range of factors.

	Carbon Capture and Storage (CCS)	Woodland creation	Peatland restoration	Land use diversification	Blue carbon storage	Energy efficiency	Renewables – onshore wind	Renewables - PV
Local opportunities	East Hampshire is not an area identified by the Government for a CCS cluster so the main opportunity would be to host a pilot project/R&D initiative.	Some agricultural land offers possibility for woodland creation.	No peat bogs within East Hampshire but there are some other wetland sites nearby that could be of interest.	Some agricultural land offers possibility for diversification, which could include agroforestry schemes, adding hedgerows, or converting field margins to grass strips.[70,71]	Possible collaboration with local authorities along the south coast, e.g., the Sussex Kelp project.[72]	Various opportunities to improve the existing building stock.	Limited opportunities – SDNP poses most significant constraint.[73]	Various opportunities for rooftop solar PV, limited opportunities for solar farms due to the SDNP.[74]
Mechanism	Removal	Removal/sequestration				Avoidance	Avoidance	
Permanence	Dependent on storage method. High for mineralisation, slightly less so for injection into geologic formations.[75]	Risk of reversal from processes such as wildfires, disease, degradation, future land use change, etc.[75]			Risk of reversal from future disease, degradation, changes in marine environment, etc.	Permanent for the lifespan of the building element.	The system will continue to provide renewable electricity over its operational lifespan, but the CO_2 reductions are based on the amount of grid electricity that is displaced. So, in the UK, where the grid is decarbonising, the CO_2 savings from new renewables will decrease over time.	
Verification method	Storage site monitoring, both before CO_2 storage and during, allows for verification of the amount of CO_2 stored.[76]	Verification could be performed by evaluating the project against the WCC requirements, and verification of these by the Organic Farmers and Growers (OF&G) or the Soil Association.[77]	The Peatland Code is a voluntary certification standard for UK peatland projects which provides verification of climate benefits. The verification process includes a site survey and assessment of the restoration plan.[78]	No standard method at present.	No standard method due to the novelty of kelp forest projects in the UK, the Sussex Wildlife Trust uses eDNA for monitoring.[79]	Verification involves compilation of a reference baseline and post-retrofit monitoring of energy consumption to decipher energy savings.[80]	Generating capacity and carbon intensity (compared to alternative fuel) of the system is used to calculate avoided emissions.	Generating capacity and carbon intensity (compared to alternative fuel) of the system is used to calculate avoided emissions.

[70] https://www.researchgate.net/publication/229915836_Managing_field_margins_for_biodiversity_and_carbon_sequestration_A_Great_Britain_case_study

[71] https://besjournals.onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2007.01433.x

[72] https://www.bluemarinefoundation.com/projects/sussex-kelp/

[73] https://cdn.easthants.gov.uk/public/documents/Final%20East%20Hants%20Renewable%20Energy%20and%20Low%20Carbon%20Study%20(1).pdf

[74] https://cdn.easthants.gov.uk/public/documents/Final%20East%20Hants%20Renewable%20Energy%20and%20Low%20Carbon%20Study%20(1).pdf

[75] https://www.climateworks.org/blog/addressing-critical-challenges-in-carbon-dioxide-removal/

[76] https://www.bgs.ac.uk/discovering-geology/climate-change/carbon-capture-and-storage/

[77] https://www.woodlandcarboncode.org.uk/landowners-apply/4-verification-ongoing-check-of-project-sequestration

[78] https://www.iucn-uk-peatlandprogramme.org/sites/default/files/2019-07/PeatlandCode_v1.1_FINAL_0.pdf

[79] https://sussexwildlifetrust.org.uk/what-we-do/living-seas/kelp

[80] https://www.energy.gov/sites/default/files/2014/05/f15/emv_ee_program_impact_guide.pdf

	Carbon Capture and Storage (CCS)	Woodland creation	Peatland restoration	Land use diversification	Blue carbon storage	Energy efficiency	Renewables – onshore wind	Renewables - PV
Financial incentives	Some UK Government funding available but likely to focus on selected CCS 'clusters'[81]	Various funding options are available in the UK: £10,000/ha of new woodland and additional contributions for nature recovery (up to £2,800/ha), flood risk reduction (£500/ha), water quality improvements (£400/ha), riparian buffers (£1,600/ha), proximity to settlements (up to £500/ha) and recreational access (up to £2,200).[82] Some woodland products can be harvested for profit, but this impacts environmental benefits.	Possible funding through the Nature for Climate Fund following a 2020 announcement that £640 million will be invested in tree planting and peatland restoration.[83] Natural England and Defra Peatland Restoration Fund for up to 75%-85% of the cost.[84]	Financial support depends on the specific type of land use diversification.	No funding mechanisms in place, reliance on donations, crowdfunding, etc.[85]	Reduced energy consumption can support reduction in energy bills.	Feed-in-Tariffs historically provided ongoing payments to renewable electricity producers.[86] Now replaced with the option to sell surplus electricity through the Smart Export Guarantee (SEG).[87] Use the electricity on council-owned sites to reduce impacts of price hikes.	
Cost effectiveness	Expected to be low in the medium term, high in the long term, but dependent on process type, separation technology, transport technique and storage site.[88]	High – when environmental, social co-benefits of forests are considered, the global average cost of sequestration can turn negative.[89]	When summing up costs and benefits, abatement costs can turn negative.[90]	Depends on the specific type of land use diversification.	Currently only run for climate change and biodiversity benefits using donations (regarding Sussex Kelp specifically).	On average more cost-effective than renewables.[91]	Onshore wind and solar are currently the cheapest form of power generation globally[92] but note that the £/tCO_2 saved will increase over time as the carbon savings decrease, due to electricity grid decarbonisation.	

[81] https://www.gov.uk/government/publications/design-of-the-carbon-capture-and-storage-ccs-infrastructure-fund/the-carbon-capture-and-storage-infrastructure-fund-an-update-on-its-design

[82] https://www.gov.uk/guidance/england-woodland-creation-offer

[83] https://www.gov.uk/government/publications/budget-2020-documents/budget-2020

[84] https://www.gov.uk/guidance/nature-for-climate-peatland-grant-scheme

[85] https://www.oceanographicmagazine.com/news/sussex-seabed-restoration-project-seeks-funding/

[86] https://www.ofgem.gov.uk/environmental-and-social-schemes/feed-tariffs-fit/tariffs-and-payments

[87] https://www.ofgem.gov.uk/publications/smart-export-guarantee-guidance-generators

[88] https://pdf.sciencedirectassets.com/280851/1-s2.0-S2211467X18X00042/1-s2.0-S2211467X18300634/main.pdf?

[89] https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP(2021)17&docLanguage=En

[90] https://peatlands.org/assets/uploads/2019/06/ipc2008p432-436-schagner-is-peatland-restoration-a-cost-effective-measure-for.pdf

[91] https://www.aceee.org/blog/2018/12/renewables-are-getting-cheaper-energy

[92] https://www.iea.org/reports/world-energy-outlook-2021

	Carbon Capture and Storage (CCS)	Woodland creation	Peatland restoration	Land use diversification	Blue carbon storage	Energy efficiency	Renewables – onshore wind	Renewables - PV
Main co-benefits	Green jobs. Potential to utilise captured carbon in manufacturing (e.g., enriching concrete).[93]	Ecosystem and biodiversity co-benefits including but not limited to: improved water quality, air quality, habitat creation, soil structure, reduced flood risk, better resilience to extreme weather events, less erosion, etc.				Lower energy bills and more comfortable homes (i.e., positive impacts on fuel poverty).[94]	Green jobs. Air quality benefits from avoided use of fossil fuels.	
Spatial impacts	N/a - CCS plants can are usually placed at existing industrial plants.	Large land areas required to have a significant impact on CO_2 emissions. Competes with alternative land uses e.g. agriculture, new developments, etc.			No spatial impacts on land, limits trawling area in the ocean (possible conflicts with fishing industry).	No significant spatial impacts.	Individual turbines have a small footprint so can be co-located with agricultural land.	Solar farms can take up a lot of space (not an issue for rooftop solar).
Visual impacts on wider landscape	N/a - CCS plants are usually co-located with existing industrial plants.	Depends on the scale but generally positive or neutral visual impacts on landscape.			N/a - not visible above water.	Minimal impacts on the landscape but potential impacts at an individual building/neighbourhood level.	Possible negative visual impacts on landscape.	Possible negative visual impacts on landscape.
Local opportunities	East Hampshire is not an area identified by the Government for a CCS cluster so the main opportunity would be to host a pilot project/R&D initiative.	Some agricultural land offers possibility for agroforestry schemes, possibly afforestation on grassland.	Thursley and Ockley Bog lies approx. 0.1km from the East Hampshire District boundary, so could be a site of interest.[95]	According to a Land Availability Assessment (2021), East Hampshire has developable land that could be diversified.[96]	Possible collaboration with local authorities along the south coast, e.g., the Sussex Kelp project.[97]	Various opportunities across the existing building stock.	Limited opportunities – SDNP poses most significant constraint.[98]	Various opportunities for rooftop solar PV, limited opportunities for solar farms due to the SDNP.[99]
Other practical considerations	Potential for trade-offs with other land use, as BECCS in particular requires large amounts of land to grow biofuels.[100]	Land ownership. Adequate space must be available.	Land ownership. Policy barriers regarding site protection (biodiversity considerations). Lack of skilled labour.[101]	Land use diversification may reduce land available for development.	Difficulties arising from the lack of regulation or marine land (e.g., trawling), sediment runoff and dredge soil disposal have adverse impacts on kelp growth, and engagement needed with the fishing community[102]	Building retrofits can cause disruption to building occupants.	Adequate space must be available.	Adequate space must be available (less of an issue for rooftop solar).

[93] https://solutions.borderstates.com/benefits-of-carbon-capture-and-storage/

[94] https://iea.blob.core.windows.net/assets/10128d72-2171-4be4-9634-5cb4fcb21feb/low_income_energy_efficiency.pdf

[95] https://easthants.oc2.uk/docfiles/183/habitats_regulations_assessment.pdf

[96] https://cdn.easthants.gov.uk/public/documents/LAA%20results%202021%20Final.pdf

[97] https://www.bluemarinefoundation.com/projects/sussex-kelp/

[98] https://cdn.easthants.gov.uk/public/documents/Final%20East%20Hants%20Renewable%20Energy%20and%20Low%20Carbon%20Study%20(1).pdf

[99] https://cdn.easthants.gov.uk/public/documents/Final%20East%20Hants%20Renewable%20Energy%20and%20Low%20Carbon%20Study%20(1).pdf

[100] https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/BECCS-deployment---a-reality-check.pdf

[101] Bonn, A., Reed, M.S., Evans, C.D., Joosten, H., Bain, C., Farmer, J., Emmer, I., Couwenberg, J., Moxey, A., Artz, R. and Tanneberger, F., 2014. Investing in nature: Developing ecosystem service markets for peatland restoration. Ecosystem Services, 9, pp.54-65

[102] https://www.bluemarinefoundation.com/projects/sussex-kelp/

4.2.5 Practical considerations

There are a variety of practical considerations if EHDC wishes to set up a carbon offsetting fund. These include, but are not limited to:

- **What is the mechanism for requiring developer contributions?**

  To date these have usually been done via S106 agreements. The Government proposed, in its 2020 Planning White Paper, to overhaul the system of developer contributions; it is possible that changes to the funding of infrastructure will take place but it is uncertain how this will affect the current operation of S106.[103] Changes may affect the ability of Councils to require offset fund payments. Developer contributions may need to be augmented by agreements between LPAs where cross-boundary working is required for implementation purposes.

- **What is the cost of carbon?**

  The Government sets out every two years what value it expects to be placed on carbon emissions in public policy decisions (with the latest revision in September 2021), but the price has increased significantly over time.[104] EHDC would need to undertake further work to identify a suitable carbon offset price for the District that incentivises on-site measures without making schemes unviable. In recent years £60/tCO_2 has been the price set by the GLA and several London-based Local Authorities, but this has risen to £95/tCO_2 for the GLA as a whole, with some Boroughs setting prices even higher.

  The GLA has issued guidance for Local Authorities on how to set a suitable price which, although targeted at Councils based in London, is nonetheless useful as a reference point.[52] The guidance states: *'LPAs should develop and publish a price for offsetting carbon based on either: a nationally recognised carbon pricing mechanism; or the cost of offsetting carbon emissions across the LPA. The price set should not put an unreasonable burden on development and must enable schemes to remain viable.'*

- **How will the fund be set up and administered?**

  Anecdotally, many local authorities have encountered challenges in terms of administering carbon offsetting funds. A survey conducted by the GLA in 2020 found that the majority of funds secured had not yet been collected, and those that had been collected had mostly not been spent.[52] Some of the key issues included a lack of staff resource to administer the funds, challenges with developing a pipeline of projects, and needing to wait for enough funds to be collected before significant projects could be initiated. EHDC has previously identified some of these issues in relation to the Whitehill & Bordon Quebec Park Carbon Offset Fund.

[103] Levelling-up and Regeneration Bill 2022. Available at: https://publications.parliament.uk/pa/bills/cbill/58-03/0169/220169.pdf

[104] BEIS, *'Valuation of greenhouse gas emissions: for policy appraisal and evaluation'* (2021). Available at: www.gov.uk/government/publications/valuing-greenhouse-gas-emissions-in-policy-appraisal/valuation-of-greenhouse-gas-emissions-for-policy-appraisal-and-evaluation

How much carbon can be offset by tree planting in East Hampshire?

Nature-based solutions such as tree planting can support climate mitigation action by sequestering hard-to-abate emissions (e.g., from industry and agriculture) as well as climate adaptation action (e.g., through natural flood management). They can also offer a variety of co-benefits in terms of biodiversity and habitat creation and mitigate against nitrogen to achieve nutrient neutrality. However, the scale of potential GHG removals is very small compared with the scale of current GHG emissions.

To give an example: EHDC has committed to planting 120,000 trees as part of their response to the climate emergency, which the Council declared in 2019. This will be carried out in cooperation with the Woodland Trust, landowners, parish and town councils, schools, and communities.[107] This target would require 75 hectares (ha) of land to be made available, or 0.15% of East Hampshire's total area. Assuming 100 years of growth, this would sequester around 0.3-0.4 ktCO_2e per year – which is 0.05% of East Hampshire's annual emissions.[108] This is illustrated on the chart below.

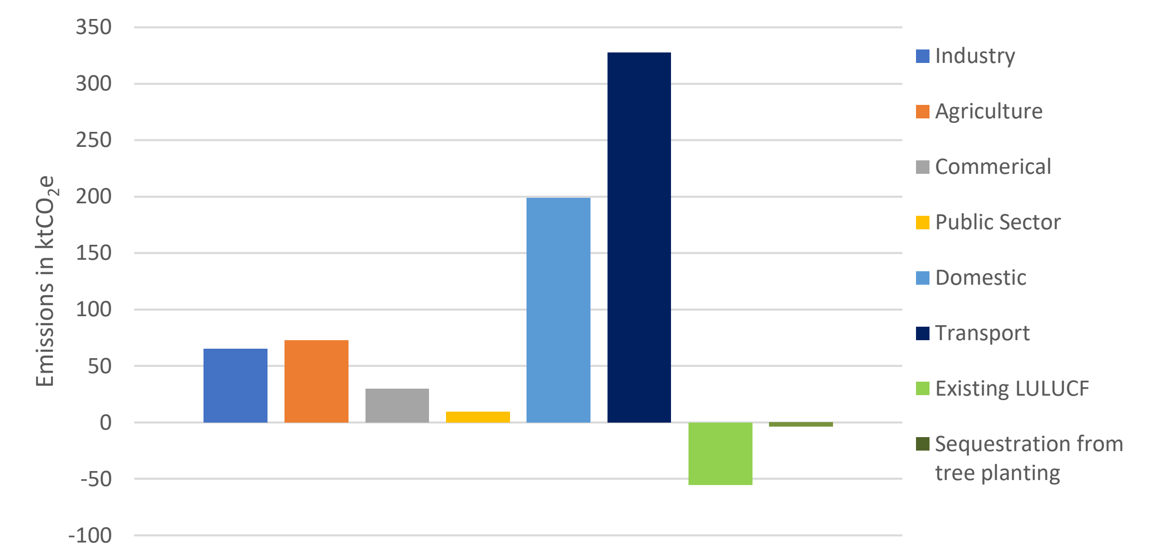

Figure 4-2. GHG emissions in East Hampshire, 2019, with additional sequestration from tree planting target shown for context. Sources: BEIS, NAEI, WCC

In other words, although tree planting and nature-based solutions are important, they are not a scalable solution for substantially tackling the climate crisis.

[107] For more information, refer to: https://www.easthants.gov.uk/planning-services/heritage-and-trees/tree-planting-initiative

[108] Based on calculations using the WCC spreadsheet tool: https://www.woodlandcarboncode.org.uk/ Note, in practice it is not simply enough to plant trees; it is also crucial to select the right location, species mix, and adopt a suitable maintenance regime over very long timescales.

5 Cost implications of net zero policies

Q6: Working with EHDC's viability consultants and local representatives from the development industry, what are the implications for build costs associated with achieving net zero carbon development?

5.1 Introduction

As set out in Section 2, from a scientific, legal and policy standpoint there is clear justification for EHDC to require new developments to be net zero carbon. Sections 3 and 4 explored the energy and GHG performance standards that are likely to be feasible in East Hampshire. This section considers the cost implications of achieving those standards, recognising that:

> *"The powers in the Planning and Energy Act 2008 that enable local authorities in England to set targets for on-site renewable energy generation and energy efficiency standards beyond the Building Regulations remain in place, and local authorities can require such measures, **subject to the viability test**."* – TCPA and RTPI [emphasis added]

In addition to the capital costs, this section provides information on the broader costs and benefits to developers, building owners and occupants, and EHDC as a planning authority.

5.2 Methodology

We have derived cost estimates for the proposed policy options based on a literature review of publicly available research from organisations such as the CCC, UK Green Building Council, Passivhaus, and the Building Research Establishment (which oversees the BREEAM and HQM schemes). We have also referred to published viability assessments from other Local Authorities that have sought to implement similar policies.

Broadly speaking, these references fall into the following categories:

- Estimates based on modelled building archetypes, assumptions about the mix of unit types in new developments, and cost data from industry sources
- Case studies examining the cost of real projects

It is important to acknowledge that the actual cost of development will depend on a wide range of factors, including but not limited to:

- Site location, topography, and access
- Ground conditions
- Construction methods
- Design complexity
- Utility connections
- Standard of finishes, fixtures and fittings

Moreover, the cost of labour and materials depends on market conditions, and these recently reached a 40-year high due to factors such as inflation and the war in Ukraine.[109] Assessing the impacts of these factors is outside the scope of this study. Relatedly, this approach does not account for the likelihood that the costs of some features, particularly heat pumps, are likely to come down in the future.

[109] RICS, '*Construction materials cost increases reach 40-year high*' (2021). Available at: https://www.rics.org/uk/news-insight/latest-news/news-opinion/construction-materials-cost-increases-reach-40-year-high/

5.3 Results

The following results are grouped according to the standard of energy or GHG performance that was being assessed.

When interpreting the cost information in the following sections, it is important to note that most of the sources are making a comparison against Part L 2013, and do not necessarily reflect the increase in standards that was brought in by changes to Part L in 2021. Because the baseline has changed in terms of both costs and energy and emissions performance, the headline figures (% uplift or extra-over costs) will, in practice, be lower than those reported in the source material.

5.3.1 'Ultra-high' energy efficiency standards

Research carried out by Currie & Brown and AECOM on behalf of the CCC in 2019 examined the costs of introducing tighter standards for new buildings in the UK.[110]

In the context of the study, 'ultra-high energy efficiency' was defined as 'a space heating demand of 15 kWh/m^2/year or less as modelled by SAP 2012' which, as the authors note, 'is similar to a Passivhaus level of performance.'

The authors of the study modelled a variety of domestic and non-domestic building archetypes, using SAP 2012 and SBEM 5.5, respectively. The capital costs of achieving different standards were based on internal benchmarks from Currie & Brown, published cost data and information provided by suppliers and households, reflecting typical costs for Q4 2017.

The study found that buildings with ultra-high energy efficiency standards and air source heat pumps 'represent a 1-4% uplift on build costs relative to a home built to current regulations' (i.e. Part L 2013).

The study included several other notable findings relevant to MSDC:

- Achieving this level of performance was found to be more cost-effective than tightening fabric efficiency to a lesser standard (20-30 kWh/m^2/year) because the more efficient buildings saw a significant savings in the cost of radiators and heating distribution systems.
- Retrofitting those buildings at a later date would cost up to five times as much as if the buildings were constructed to a high standard at the outset.
- Buildings constructed to an ultra-high energy efficiency standard that are fitted with a gas boiler and retrofitted with a heat pump ten years later were projected to emit around 3 times as much carbon as those fitted with a heat pump at the outset, or up to six times as much if the heat pump was installed after fifteen years. This represents a significant source of avoidable GHG emissions.

The study also considered the impacts of improving on the performance of non-domestic buildings by 15-25% and found that the cost uplift was in the region of 1-2% even when heat pumps were included.

5.3.2 Net zero carbon / LETI standard

In 2020, UKGBC published a report on the feasibility of achieving the LETI zero carbon standards for new buildings.[111] The study explored alternative performance standards for two developments, both of which were real projects that were at design stage when the study was carried out. These were high-rise (16-18 storey) buildings located on urban sites, one residential and one office block. The authors noted that, due to the site locations, there were some specific constraints that impacted the results.

[110] Currie & Brown and AECOM on behalf of the CCC, *'The costs and benefits of tighter standards for new buildings'* (2019). Available at: https://www.theccc.org.uk/publication/the-costs-and-benefits-of-tighter-standards-for-new-buildings-currie-brown-and-aecom/

[111] UKGBC, *'Building the Case for Net Zero: A feasibility study into the design, delivery and cost of new net zero carbon buildings'* (2020). Available at: https://www.ukgbc.org/ukgbc-work/building-the-case-for-net-zero/

Both performance standards achieved very high energy efficiency, used no fossil fuels for heating and matched the total energy demand with an equivalent amount of on-site PV. The 'Intermediate' performance standard included slightly lower standards for fabric efficiency than the 'Stretch' standards, representing targets for 2025 and 2030 respectively.

For the office building, the cost uplift of the intermediate target was 6.2% while the uplift for the stretch target was 8-17% depending on the design changes adopted. For the residential building, the intermediate target increased costs by 3.5% while the stretch target increased them by 5.3%.

A small number of other Local Plan viability assessments have considered the cost implications of achieving net zero carbon new developments in recent years. Key examples include a Local Plan evidence base study for Greater Cambridge, and a study to support the production of a Climate Emergency DPD for Cornwall Council. Both studies were based on modelled building archetypes, with cost information provided by Currie & Brown, as in the CCC (2019) study.

The Cornwall study[112] assessed the impact of introducing the following requirements for new buildings:

- Limiting space heating demand to 15-30 kWh/m^2/year
- Prohibiting fossil fuel use and limiting total energy use to 35-40 kWh/m^2/year
- Requiring the total energy consumption to be matched with on-site renewables (in this case, the study authors assumed it would be solar PV)

The study assessed the cost of achieving these standards in relation to Part L 2021 for six domestic building archetypes, and found that, for a typical semi-detached house, 'The additional costs of achieving a net zero compliant dwelling are modest, ranging from 2.1% to 3.8%.' [113]

The Greater Cambridge study[114] modelled three housing archetypes (semi-detached, terraced, and block of flats) and a school, all meeting the LETI standard for net zero carbon buildings. Compared with Part L 2013, the cost uplift to meet this standard was:

- Semi-detached house: +10% (£12,880)
- Terraced house: +13% (£13,985)
- Block of flats: +5% (£302,735)
- School: +3% (£208,865)

Notably, the reduction in running costs for the different typologies ranged from 50-60%, equating to several hundred pounds per year for the domestic buildings, and £13,500/year for the school.

These two studies were published in the same year and followed the same estimation approach, but they use different baselines (Part L 2021 and 2013) so are not directly comparable. More recently, an assessment carried out on behalf of Winchester City Council tested two domestic building typologies and found that the cost uplift compared with Part L 2021 was c. 5-6%. This study was also carried out by Currie & Brown.

5.3.3 Passivhaus

The Passivhaus Trust published a report in 2019 that reported on the actual costs incurred by 12 case study developments that went out to tender between 2010 and 2018.[115] Of these, five developments

[112] Three Dragons on behalf of Cornwall Council, *'Climate Emergency Development Plan Viability Assessment Update'* (2021). Available at: https://www.cornwall.gov.uk/media/vtigrrk3/sd06-ce-dpd-viability-report-nov-2021.pdf

[113] Note that the study compared a range of policy scenarios against different baselines. The policy under consideration by Cornwall Council included a 19% improvement against Part L 2013 via energy efficiency improvements and a further 20% improvement using on-site PV. This is roughly equivalent to the standards of Part L 2021 and the costs of meeting the two standards would be almost the same (£171,924 versus £172,024). Refer to Appendix B of the Cornwall study for more information.

[114] Currie & Brown, *'Greater Cambridge Local Plan: Cost Report'* (2021). Available at: https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-08/NetZeroCostReport_GCLP_210831.pdf

[115] Passivhaus Trust, *'Passivhaus Construction Costs'* (2019). Available at: Passivhaus Construction Costs (passivhaustrust.org.uk)

consisted of 1-9 homes, five consisted of 10-30 homes and two consisted of more than 30 homes. Most were affordable rent or council houses, and typologies were dominated by terraced houses and flats.

Across these projects, the extra-over costs compared with the baseline were roughly 9%. However, the authors noted that costs decrease with experience: 'Exeter City Council, with nearly 9 years' experience, are now building Passivhaus at a premium of just 8% over baselline [and] the steady-state projection of Passivhaus adoption at scale is around 4%.'

The main differences in the costs of Passivhaus developments compared with the baseline were associated with the higher cost of materials for walls and roof structures, windows and doors, MVHR systems, airtightness testing, and site supervision to ensure adequate build quality. The authors noted that the latter costs are not necessarily unique to Passivhaus buildings, because in principle, 'this level of supervision will be required for all projects if the performance gap is to be successfully closed.'

These prices reflect a comparison against Part L 2013 standards, so the total uplift will be lower when compared against Part L 2021 or 2025. It is also worth emphasising that, for some projects, the costs could be much lower. A study carried out by AECOM in 2021 and presented at the 25th International Passivhaus Conference found that the uplift could be as low as 1-2%. This was based on two case study projects where the teams worked with Passivhaus designers to 're-imagine' the schemes.[116]

5.3.4 BREEAM and HQM

The BRE has carried out several studies in the past decade to assess the increase in capital costs associated with achieving different ratings; results from a 2016 report are shown below.[117] However, as noted previously in Section 4.1.3, both BREEAM and HQM consider a range of sustainability topics aside from GHG emissions, so higher ratings do not directly indicate better performance in this regard. (As of 2015, the average BREEAM accredited scheme achieved a 22% reduction in regulated CO_2 emissions compared with typical practice.[118])

Increase in capital costs for different building types and certification levels

	Education	Industrial	Retail	Office	Mixed Use
Rating	**School**	**Industrial**	**Retail**	**Office**	**Mixed Use**
Very Good	0.2%	0.1%	0.2%	0.2%	0.15
Excellent	0.7%	0.4%	1.8%	0.8%	1.5%
Outstanding	5.8%	4.8%	10.1%	9.8%	4.8%

Source: Tata Steel, British Constructional Steelwork Association Limited, AECOM, Cyril Sweett, The Steel Construction Institute, Development Securities PLC, 2012.

Since HQM is a relatively new form of assessment, there is little in the way of example costs associated with undertaking HQM assessments. *'As with other schemes within the BREEAM family, costs will partly depend on the targeted rating. A one-star home represents a home that is better than one that meets the minimum requirements set by building regulations and a five star rating is an outstanding development that goes well beyond standard practice, as with BREEAM.'*[119]

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[116] AECOM, *'Debunking the myth that Passivhaus is costly to achieve'* (2021). Available at: https://aecom.com/without-limits/article/debunking-the-myth-that-passivhaus-is-costly-to-achieve/

[117] BRE, *'The value of BREEAM: A review of latest thinking in the commercial building sector'* (2016). Available at: https://tools.breeam.com/filelibrary/Briefing%20Papers/BREEAM-Briefing-Paper----The-Value-of-BREEAM--November-2016----123864.pdf

[118] BRE, *'Assessing carbon emissions in BREEAM'* (2015). Available at: https://tools.breeam.com/filelibrary/Briefing%20Papers/Assessing-Carbon-Emissions-in-BREEAM--Dec-2015-.pdf

[119] BRE, *'Cost of undertaking an HQM Assessment'* (2017) Available at: https://kb.breeam.com/knowledgebase/cost-of-undertaking-hqm-assessment/

5.4 Summary of results

The table below summarises the headline findings from the different sources that were reviewed. The studies used different reporting metrics; where possible, we have endeavoured to calculate equivalent figures to enable like-with-like comparison, and those numbers are highlighted in grey. However, in some instances it was not possible to calculate equivalent figures, and those fields have been left blank.

Table 5-1. Cost and viability information

Source	Description	Capital costs (£/m²)	Extra over costs (£/m²)	£ uplift (£/unit)	% uplift	Standard assessed	Compared with…
FHS	Detached	-	£56	£6,520	-	Part L 2021	Part L 2013
FHS	Semi-detached	-	£58	£4,850	-	Part L 2021	Part L 2013
FHS	Mid-terrace	-	£56	£4,740	-	Part L 2021	Part L 2013
FHS	Flats	-	£38	£2,260	-	Part L 2021	Part L 2013
FHS	Average	-	-	£4,620	-	Part L 2021	Part L 2013
Passivhaus Trust	Terrace	£1,529	£176	-	13%	Passivhaus	Part L 2013
Passivhaus Trust	Terrace	£1,296	-£26	-	-2%	Passivhaus	Part L 2013
Passivhaus Trust	Flats	£1,453	£120	-	9%	Passivhaus	Part L 2013
Passivhaus Trust	Terrace/Semi	£1,751	£339	-	24%	Passivhaus	Part L 2013
Passivhaus Trust	Flats	£1,807	£384	-	27%	Passivhaus	Part L 2013
Passivhaus Trust	Terrace	£2,070	£548	-	36%	Passivhaus	Part L 2013
Passivhaus Trust	Flats	£1,542	£189	-	14%	Passivhaus	Unknown
Passivhaus Trust	Terrace	£1,517	£175	-	13%	Passivhaus	Part L 2013
Passivhaus Trust	Terrace	£2,035	£528	-	35%	Passivhaus	Part L 2013
Passivhaus Trust	Terrace/Flats	£1,966	£488	-	33%	Passivhaus	Part L 2013
Passivhaus Trust	Semi-detached	£1,927	£456	-	31%	Passivhaus	Part L 2013
Passivhaus Trust	Terraced	£1,954	£474	-	32%	Passivhaus	Part L 2013
CCC	Detached	£1,430	£59	£6,900	4%	15 kWh/m²/year	Part L 2013
CCC	Semi	£1,522	£57	£4,800	4%	15 kWh/m²/year	Part L 2013
CCC	Low rise flat	£1,389	£29	£2,000	2%	15 kWh/m²/year	Part L 2013
CCC	High rise flat	£2,390	£26	£1,300	1%	15 kWh/m²/year	Part L 2013
UKGBC	High-rise office	£3,320	-	-	6%	Intermediate target	Part L 2013 (assumed)
UKGBC	High-rise office	£3,370	-	-	8%	Stretch target (v1)	Part L 2013 (assumed)

Source	Description	Capital costs (£/m²)	Extra over costs (£/m²)	£ uplift (£/unit)	% uplift	Standard assessed	Compared with…
UKGBC	High-rise office	£3,660	-	-	17%	Stretch target (v2)	Part L 2013 (assumed)
UKGBC	High-rise residential	£2,810	-	-	4%	Intermediate target	Part L 2013 (assumed)
UKGBC	High-rise residential	£2,860	-	-	5%	Stretch target	Part L 2013 (assumed)
Cornwall	Semi	£1,553	£13	£1,196	1%	30 kWh/m²/year	Part L 2021
Cornwall	Terrace	£1,465	£31	£2,609	2%	30 kWh/m²/year	Part L 2021
Cornwall	Bungalow	£1,634	£20	£2,115	1%	30 kWh/m²/year	Part L 2021
Cornwall	Detached	£1,513	£7	£1,030	1%	30 kWh/m²/year	Part L 2021
Cornwall	Low rise flats	£1,824	£51	£1,786	3%	30 kWh/m²/year	Part L 2021
Cornwall	Medium rise flats	£2,077	£56	£4,436	3%	30 kWh/m²/year	Part L 2021
Cornwall	Semi	£1,582	£42	£3,790	3%	15-20 kWh/m²/year	Part L 2021
Cornwall	Terrace	£1,507	£73	£6,134	5%	15-20 kWh/m²/year	Part L 2021
Cornwall	Bungalow	£1,681	£66	£7,058	4%	15-20 kWh/m²/year	Part L 2021
Cornwall	Detached	£1,553	£48	£6,894	3%	15-20 kWh/m²/year	Part L 2021
Cornwall	Low rise flats	£1,845	£71	£6,698	4%	15-20 kWh/m²/year	Part L 2021
Cornwall	Medium rise flats	£2,087	£63	£5,277	3%	15-20 kWh/m²/year	Part L 2021
Greater Cambridge	Semi-detached	-	-	£12,880	10%	15-20 kWh/m²/year	Part L 2013 (assumed)
Greater Cambridge	Mid terrace	-	-	£13,985	13%	15-20 kWh/m²/year	Part L 2013 (assumed)
Greater Cambridge	Block of flats	-	-	£302,735	5%	15-20 kWh/m²/year	Part L 2013 (assumed)
Greater Cambridge	School	-	-	£208,865	0%	55 kWh/m²/year	Part L 2013 (assumed)
Winchester	Semi-detached	£1,535	£85	-	5.8%	LETI	Part L 2021
Winchester	Detached	£1,508	£68	-	4.8%	LETI	Part L 2021

Appendix A.5 shows the same results, adjusted so that they all provide a comparison against a Part L 2021 baseline. Those should be interpreted with caution because full cost calculations were not carried out.

The results presented above suggest a range of potential cost outcomes for delivering ultra-high efficiency or net zero carbon development. The ones that are likely to be most relevant to EHDC[120] are those from the Cornwall and Winchester, which suggest a cost uplift of 3-6% compared against Part L 2021, depending on the dwelling typology in question.

5.5 Other costs and benefits

… for developers

- Additional costs to prepare planning documents which might require consultancy fees
- Avoided costs of gas connections and infrastructure, and fewer trades needed onsite

… for planning authorities

- If adopting a carbon offsetting scheme, this provides a source of revenue to carry out beneficial projects (although resources are needed to administer these)
- More officer resource required to review applications – depending on how the policy is assessed, monitored or enforced

… for building owners or occupants

- Much lower energy bills
- Higher property or rental value
- Lower maintenance bills due to not having gas boilers
- Less risk of moisture, condensation and mould (leading to additional health benefits)
- Better thermal comfort
- No risk of gas leaks or carbon monoxide poisoning

[120] Considering the development typologies likely to come forward, the need to compare results against Part L 2021, and the fact that these studies specifically looked at metrics based on the LETI standard.

6 Stakeholder consultation

Q7: What do representatives of local communities and the development industry think of the policy options?

6.1 Introduction

To assess the opinions of the local communities and development industry, a stakeholder consultation was carried out in the form of an online survey. This was followed by two virtual focus groups. An overview of the consultation process, and key findings, is provided below.

6.2 Online survey

The link to the survey was distributed via email to a list of stakeholders which was supplied by EHDC, with some additional suggestions provided by Ricardo. The online survey ran from 15/07/22 to 26/08/22.

The survey totalled 17 questions aimed at understanding the stakeholders' views in the Council's initial policy options, and more broadly, how they think the Local Plan could best contribute to reducing Greenhouse Gas (GHG) emissions. This was inquired through a mixture of closed and open questions with the goal to receive comparable answers across the respondents while also allowing the stakeholders to voice more complex views and provide background for their answers.

Two respondents only answered the first question and did not complete the rest of the survey; their responses have been removed. Separately, two responses were received via email rather than via the online form. Where possible, these have been incorporated into the results and graphs below.

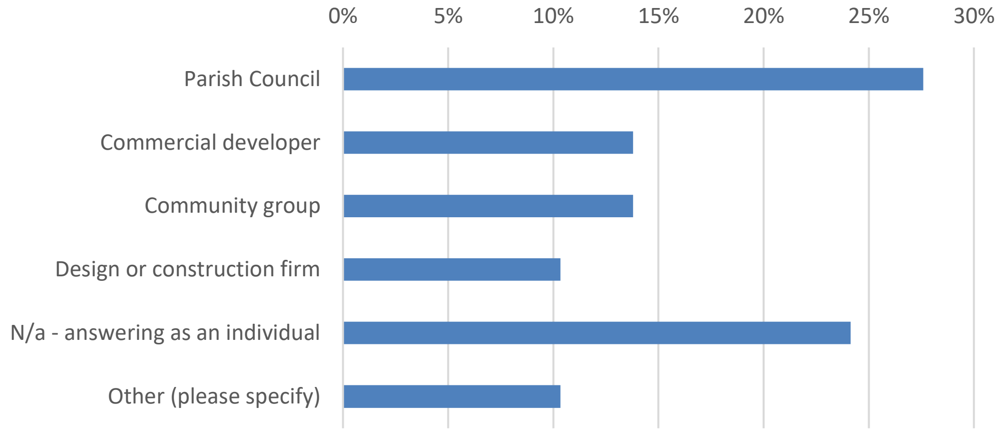
Headline Messages

- A large majority (81%) of respondents believe that EHDC is right to require new development to go above and beyond the minimum requirements of the Building Regulations.
- The components that most respondents thought were important components of Net Zero were that the development should be highly energy efficient (92%), the development should include renewable energy technologies on site (83%) and that the development should utilise construction materials and techniques that are low carbon (83%).
- 57% of respondents agree with the council's proposed definition of Net-Zero, 13% didn't know.
- The major challenges to implementing a Net-Zero policy were identified as cost implications (70%), the availability of skilled tradespeople (70%), and technical feasibility (52%).
- There was majority support for every single type of development to be applicable for the proposed Net-Zero policy (Major Development 96%, Minor Development 91%, Refurbishments 78%, Changes of use 61%, and Householder Applications 61%).
- There was also majority support for every single group to be applicable for the proposed Net-Zero policy (Public sector development 100%, Commercial entities 95%, Private individuals 82%).
- There was not majority support for any individual measure to prove a development is Net-Zero.
- Opinions were divided on whether offsetting should be considered an acceptable form of reaching Net-Zero (45% in favour, 36% against, 18% unsure). Additional renewable energy installations elsewhere in East Hampshire was the most popular form of offsetting (56% support).

A more detailed description of the survey results is provided below.

Question 1: There was a range of different groups represented by the survey participants. The majority of participants were from Parish Councils; however, a notable 24% chose to show any affiliation to a group therefore the true representation is difficult to determine (see Figure 6-1).

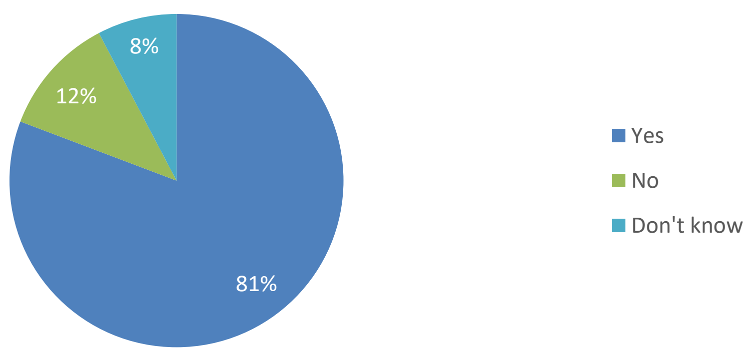
Figure 6-1. Question 1: I am representing a...



Question 2: This question asked survey participants to state which organisation they represent. For data protection reasons, the information has been provided to EHDC separately.

Question 3: The vast majority of respondents agreed with EHDC's proposal that new developments should go above and beyond the minimum requirements of the Building Regulations to help the district achieve net zero carbon emissions (see Figure 6-2).

Figure 6-2. Question 3: EHDC believes that new developments should go above and beyond the minimum requirements of the Building Regulations to help the District achieve net zero carbon emissions. Do you agree with this proposal?

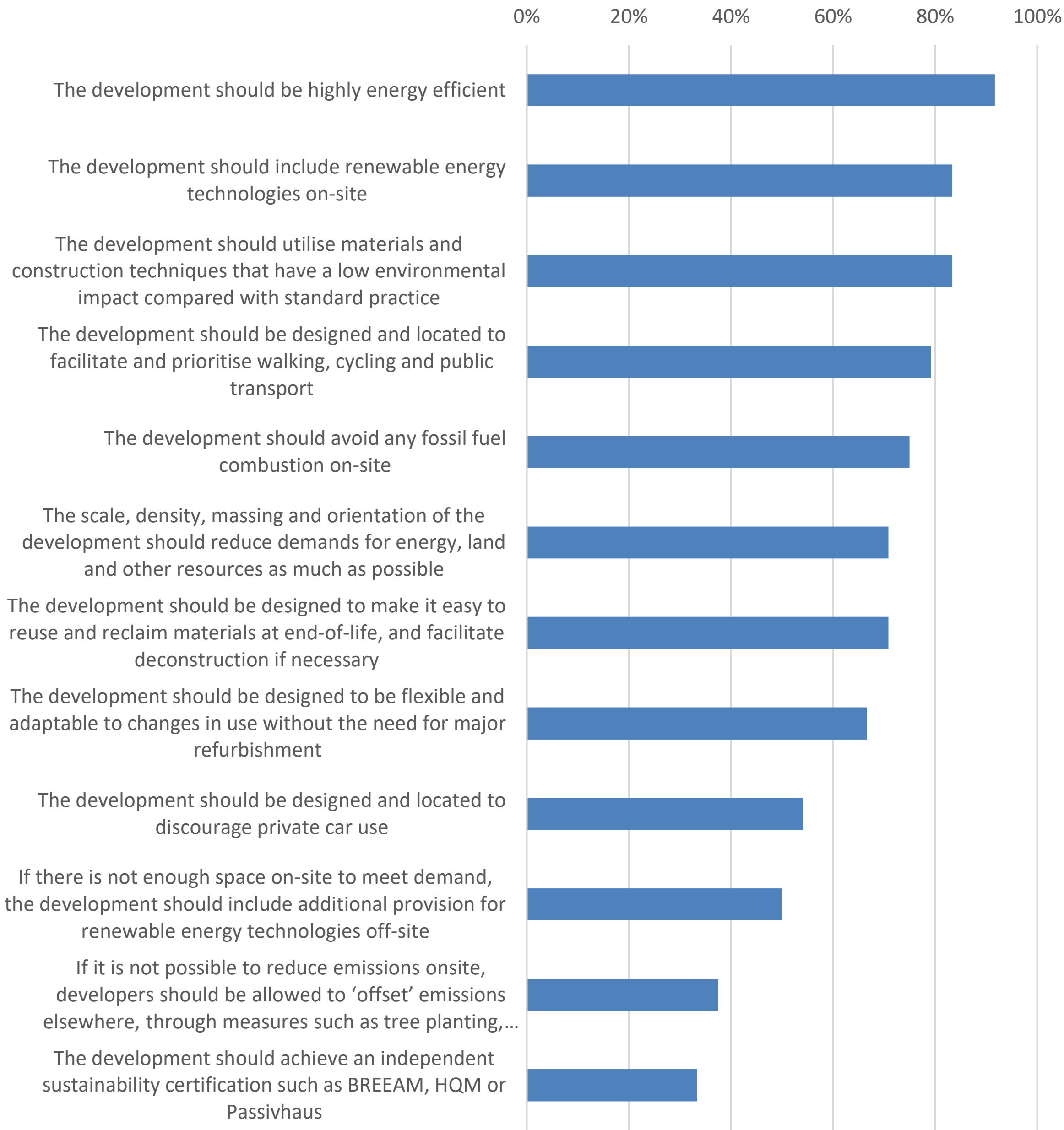


Representatives from community group A had this to say: "We [are] delighted that EHDC has decided to push developers to go beyond the Building Regulations. We have been asking them to do this for years!" Representatives from community group B also agreed with the proposal and added "and of course safeguard occupants against future climate change effects!"

Commercial developer A disagreed with the proposal, stating that, "The building regulations are designed to be an acceptable standard. They also allow for transitional arrangements for developers to be able to meet the targets. Whilst we are committed to delivering the Part L shift from traditional techniques to modern it is significant one and takes time for the business to learn and grow. Furthermore, should policy go beyond building regulations it opens up viability arguments as developers may struggle to meet the additional targets among all the other requirements – potentially reducing the affordable housing delivery, quality of build etc."

Question 4: This question further explored which components for net zero carbon development are important to the respondents. A large majority of respondents (92%) indicated that the development should be highly energy efficient, that the development should include renewable energy technologies on-site (83%) and that the development should utilise materials and construction techniques that have a low environmental impact compared with standard practice (83%). There was less agreement on allowing offsets if emissions cannot sufficiently be reduced on site (38%) and on achieving independent sustainability certifications such as BREEAM, HQM or Passivhaus (33%) (see Figure 6-3).

Figure 6-3. Question 4: Which of the following do you think are important components for net zero carbon development in East Hampshire? (Check all that apply)



A respondent from community group C noted, “This is a very encouraging list of components and we welcome all but the [option related to offsetting].” They further added that, “In relation to off-site provision of renewable energy technologies, we feel that policies should first aim to maximise on-site potential. New builds can be designed to maximise solar PV, incorporate ground source heat pumps, create microgrids with neighbouring buildings, district heating, even make use of foundations. A principle to maximise self-sufficiency in new builds would help to build resilience as the effects of climate change materialise.”

This notion was echoed by community group B who added that “The latter (offsetting) could easily be used by developers as an excuse for not reducing emissions in the build. They need no excuses.”

Community group A provided some further insight into why sustainability accreditations may have not been a popular choice among respondents: “We are not in any way against independent sustainability certification, but don't want this to impede progress. And EHDC must NOT give developers the opportunity to renege on their commitments by carbon offsetting. Energy efficiency projects on existing homes would be worth considering.”

Question 5: The respondents were presented with a definition of ‘net zero carbon’ as follows:

“The Council is proposing that ‘net zero carbon’ in this context shall refer to all sources of greenhouse gas (GHG) emissions arising from energy use on-site. This includes both ‘regulated’ and ‘unregulated’ emissions.*

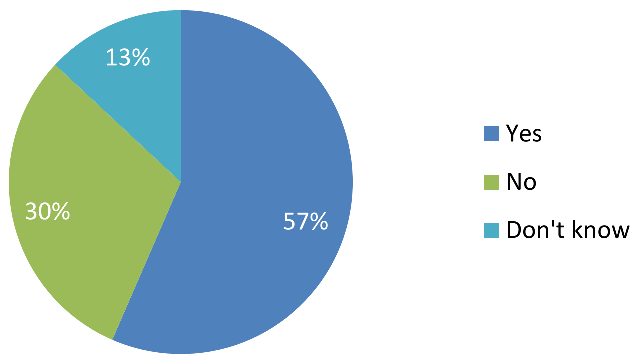
In line with industry best practice, this would also mean:

- Very high levels of energy efficiency
- No onsite fossil fuel combustion
- Providing at least enough renewable energy to meet the predicted operational energy demands of the development

**Regulated emissions are those resulting from fixed building services and fittings, including space heating and cooling, hot water, ventilation, fans, pumps and lighting) which are subject to control via UK Building Regulations. Unregulated emissions are those resulting from other systems such as electrical appliances, IT equipment, lifts, escalators, cooking appliances, and so on. In very simple terms, regulated emissions are usually associated with systems that are in place when the occupant moves in, and unregulated emissions are usually associated with things that occupants plug in afterwards.”*

The majority of respondents (57%) agreed with this definition (see Figure 6-4). However, there was some criticism from respondents, with some saying that the definition went too far and others stating that it did not go far enough.

Figure 6-4. Question 5: Do you agree with EHDC's definition of net zero?



Among those who indicated that the definition goes too far, a few respondents noted concerns around including unregulated emissions. Commercial developer B noted that the "Definition should not include the unregulated emissions as this is virtually impossible to enforce and report on to achieve planning consent or clear a planning condition." Commercial developer C further added that "We believe that it is easy to take positive action against regulated emissions, achieving the widely-supported UKGBC definition of Net Zero Ready. This is because the regulated emissions are accurately calculated through existing methods developed and updated regularly. There is currently no calculator or agreed methodology for unregulated emissions, and we therefore believe that the decarbonisation of unregulated emissions should be in line with the decarbonisation of the energy industry."

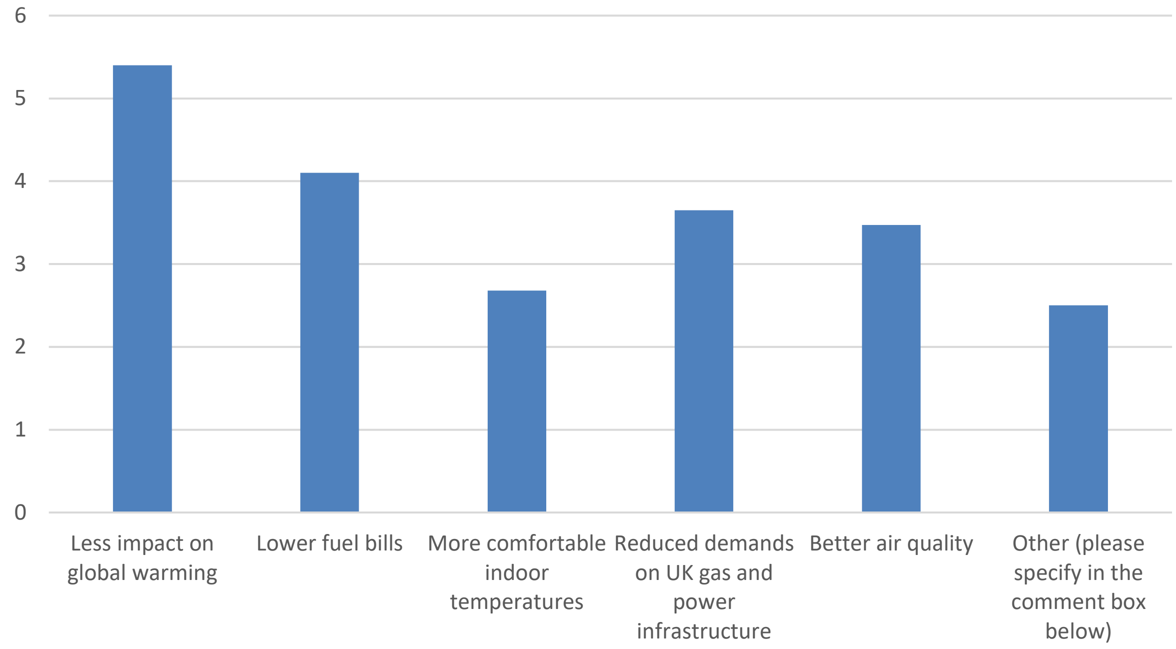
Throughout the survey, but particularly in regard to Question 5, some respondents highlighted their belief that the policy should be broadened to address embodied carbon as well as operational carbon. For example, an architectural design practice noted that, "The definition should be expanded to include embodied energy, energy and transport demands, etc. The carbon cost of just building a development is the largest proportion of the carbon footprint."

Question 6: Respondents ranked a selection of potential benefits from net zero carbon developments in order of importance to them. The potential benefits to choose from were:

- Less impact on global warming
- Lower fuel bills
- More comfortable indoor temperatures
- Reduced demands on UK gas and power infrastructure
- Better air quality
- Other (user input)

The strongest agreement by far could be observed for the important benefit being "less impact on global warming", with 82% of respondents positioning this at the top of the list. The ranking for the other options was more mixed as can be seen in the figure below (see Figure 6-5). The results below exclude two responses that were provided in a separate format.

Figure 6-5. Question 6: Potential Benefits of net zero carbon developments.

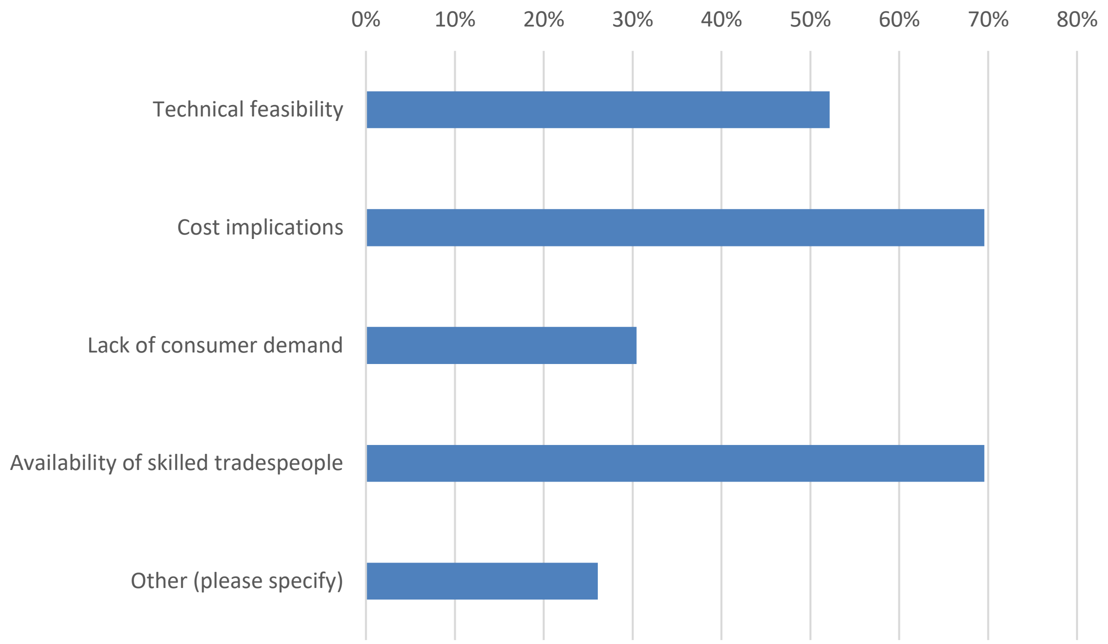


Question 7: This offered an opportunity for respondents to list additional benefits not included in Question 6. Six people responded to this, and their answers included: Improved energy security (2), reducing the impact of climate change on nature and biodiversity, more resilient communities, better adapted to a changing climate, helping development of green industries, and more comfortable indoor temperatures and better air quality.

Question 8: This question asked about perceived challenges to implementing a net zero carbon development policy. The most commonly chosen answers were cost implications and availability of skilled tradespeople (70% respectively). Lack of consumer demand was the lowest priority concern with 30% of respondents selecting this option (see Figure 6-6).

Community group A further added that “The challenges are very real. EHDC needs to embark on a major public education campaign.” Community group C noted that, “The lack of trained MCS installers is well known. Another challenge is the growing consensus that it is OK for net zero targets to be met to a large extent through offsets and related payments, because this approach allows developers to avoid confronting the scale and nature of change needed for construction to be aligned with 1.5 C of warming. There is also poor understanding of what can constitute a scientifically valid carbon offset in terms of restoring atmospheric carbon.”

Figure 6-6. Question 8: What do you perceive as the major challenges of implementing a net zero carbon development policy? (Check all that apply)

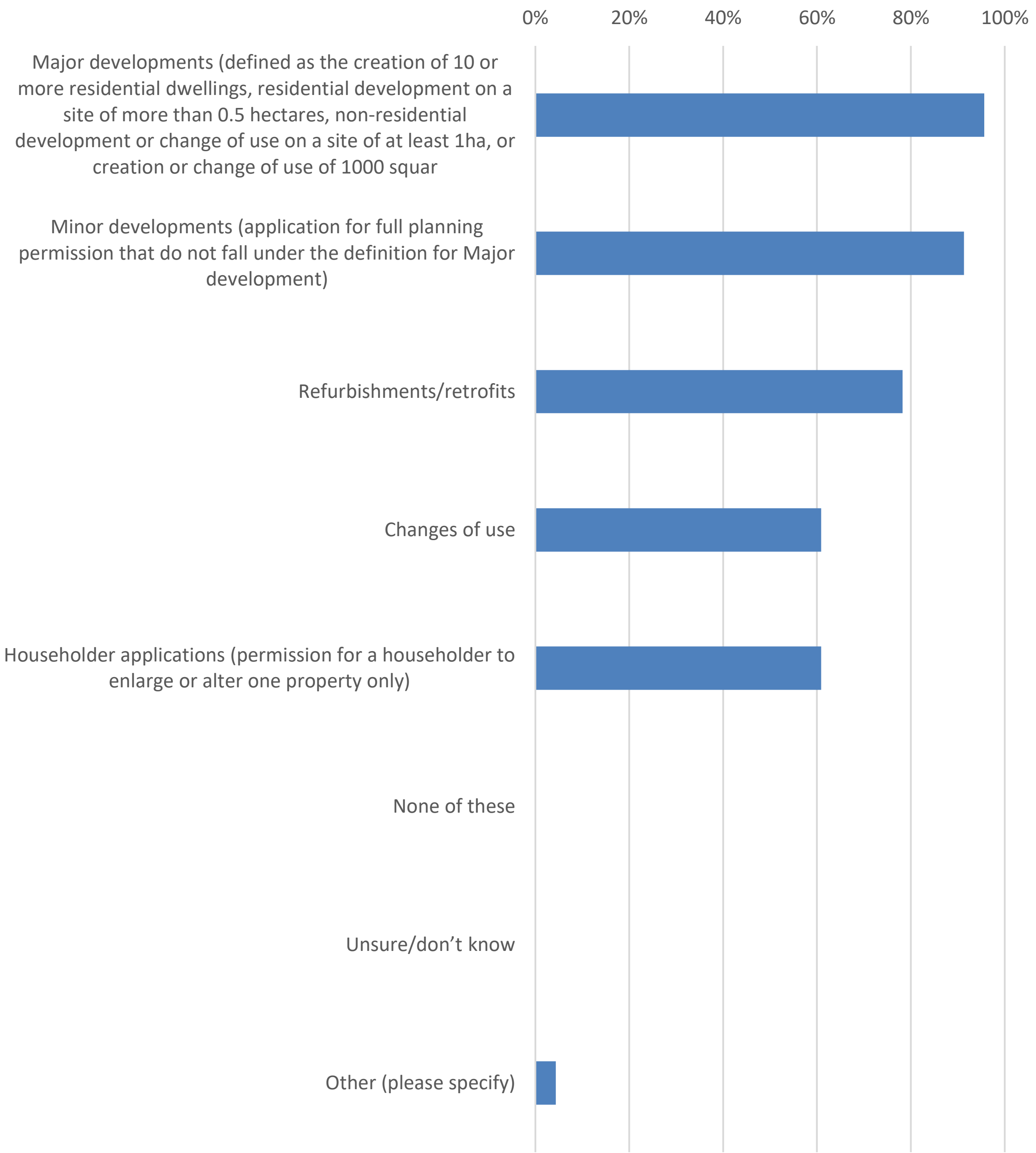


Questions 9 and 10 asked respondents to indicate what types of developers, or developments, a net zero policy should apply to.

As part of Question 9, there was majority support for every single type of development to be applicable for the proposed net zero policy (Major Development 96%, Minor Development 91%, Refurbishments 78%, Changes of use 61%, and Householder Applications 61%) (see Figure 6-7).

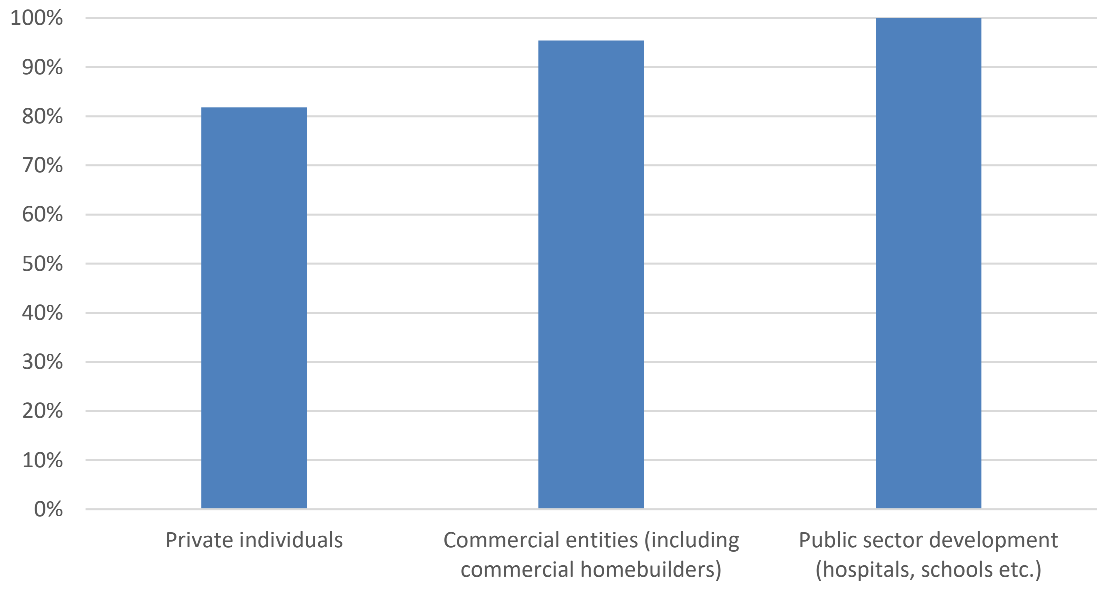
Commercial developer D added that, “All new development should be net zero plus. And the embodied carbon and carbon cost of the construction process should be part of that calculation. Refurbishments and retrofit should be undertaken instead of demolition and rebuild – the embodied carbon of an existing development is very important in this process. Too much redevelopment involves significant demolition, whereas creative reuse and repurposing should be considered as a first part of that process.”

Figure 6-7. Question 9: What type of developments do you think a net zero carbon requirement should apply to? (Check all that apply)



Question 10 also indicated that there was majority support for every single group to be subject to the proposed net zero policy (see Figure 6-8). This included 100% support for it to apply to public sector developments. This was reinforced in the comments; for instance, the respondent from commercial developer B observed that, "Public sector should be seen to be leading the way and demonstrating delivery of net zero projects. The Council should be providing clear leadership with industry experts." Community Group C echoed this sentiment saying that public sector developments should "aim to be exemplars."

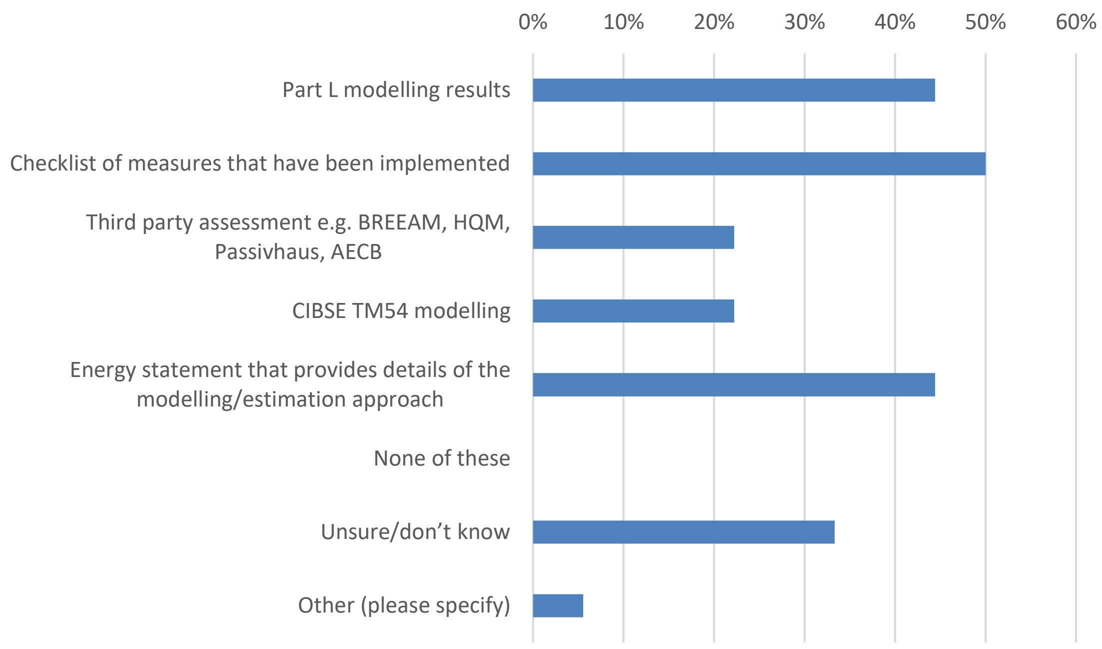
Figure 6-8. Question 10: Which of the following groups do you think that net zero requirements should apply to? (Check all that apply)



Question 11: This question asked about how developers could demonstrate compliance with the net zero requirement. Respondents were given a list of options that they would consider suitable. Opinions were split; there was not majority support for any individual measure (see Figure 6-9).

Commercial developer C explained that “There are many ways to build a zero-carbon home, and we strongly believe in our ability to create homes that enable communities to life low carbon lifestyles without being restricted to definitive certifications such as Passivhaus.” Community group C added that “whichever standards are chosen to measure homes against, they will only be as good as their enforcement.”

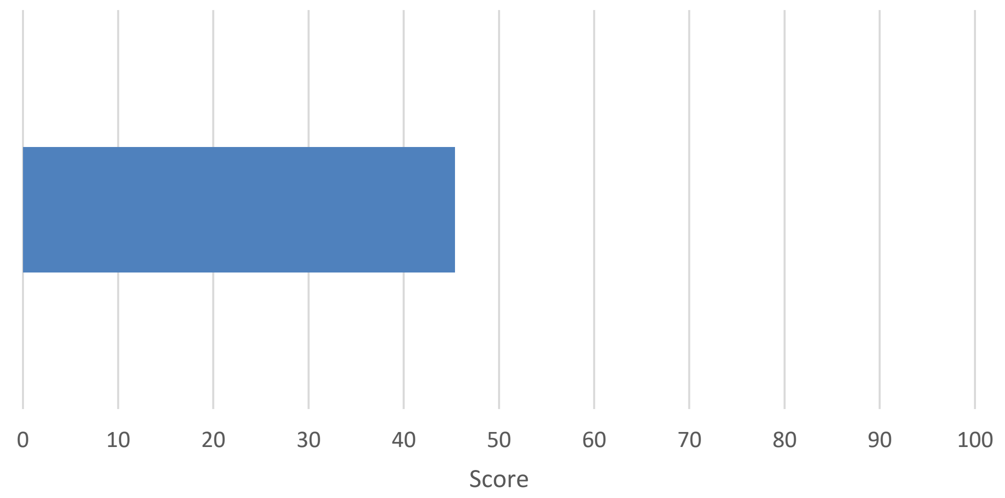
Figure 6-9. Question 11: How should developers/applicants be asked to prove that their buildings are net zero in operation? (Check all that apply)



Question 12: The respondents were asked to share their views on external accreditation for a development via a sustainability standard, such as HQM, BREEAM, or Passivhaus. The response options were presented in form of a sliding scale from 1-100, with 1 being very negative, 50 being neutral / no opinion, and 100 being very positive.

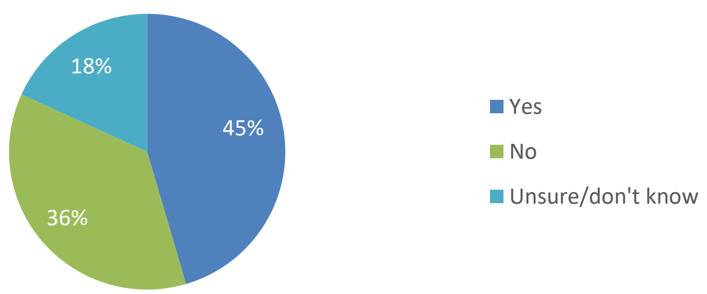
The resulting score of 45 suggests a predominantly neutral opinion among the respondents (see Figure 6-10). The data shows that while mid-range values were the most common, there were also a few outliers of 100 and <5. The results below exclude two responses that were provided in a separate format. Those responses indicated general support for external accreditations.

Figure 6-10. Question 12: What are your views on external accreditation for a development via a sustainability standard, such as HQM, BREEAM, or Passivhaus?



Question 13: The respondents were split on whether carbon offsetting should be permitted for developments that cannot achieve net zero carbon emissions via on-site measures (see Figure 6-11).

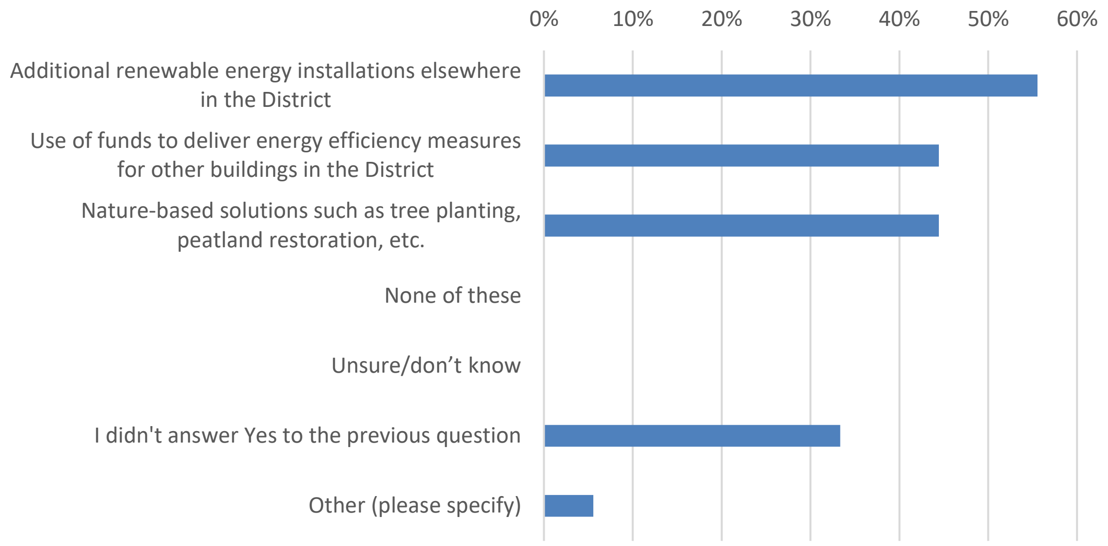
Figure 6-11. Question 13: Do you think that carbon offsetting* should be permitted for developments that cannot achieve net zero carbon emissions via on-site measures? **Carbon offsetting means compensating for residual GHG emissions by making equivalent reductions.*



The respondent from Parish Council A expressed concerns that they are “not certain how good some offsetting schemes are” and that they are “concerned about tokenism”. Several respondents expressed a sentiment against offsetting but admitted some limited applications, such as Parish Council B: “In the main I think this would set an unacceptable precedent to enable developers to work around the standards set. There may be an argument for this with conversions or developments of older or listed buildings, but it would have to be the exception not the rule.” Similar notions were expressed by commercial developer C: “Generally no, we believe it should be delivered on site. There may be exceptions, such as retrofits or areas where there is genuinely no suitability for renewables – for example pitched roof apartments with ground conditions that don't allow GSHP."

Question 14: Of those who believe that offsetting is acceptable, the preferred option selected was additional renewable energy installations elsewhere in the District (56%) followed by using of funds to deliver energy efficiency measures for other buildings in the District (44%) and nature-based solutions such as tree planting, peatland restoration, etc. (44%) (see Figure 6-12).

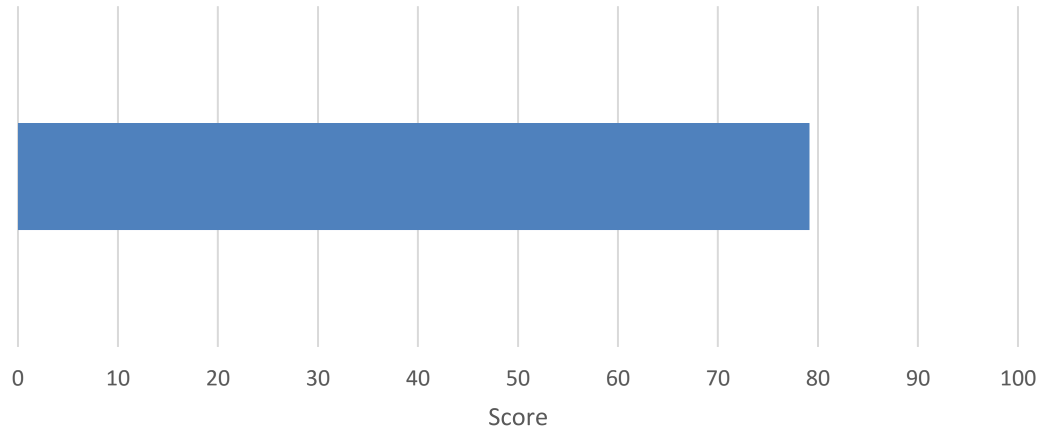
Figure 6-12. Question 14: If you answered yes to the previous question, what types of carbon offsetting projects do you think are acceptable? (Check all that apply)



A representative from a neighbouring LPA added it always needs to be ensured "that these projects would not have happened anyway without these contributions, to avoid double-counting emission reductions."

Question 15: This question asked the respondents whether they think that developments in East Hampshire should be required to calculate, and take steps to reduce, whole life-cycle carbon emissions. This was introduced by a brief overview of the status quo and potential issue: "At present, developers in the UK are not usually required to estimate the whole life-cycle carbon emissions from their buildings. This means that a significant proportion of emissions from development – potentially the majority of emissions – are not considered as part of the planning process."

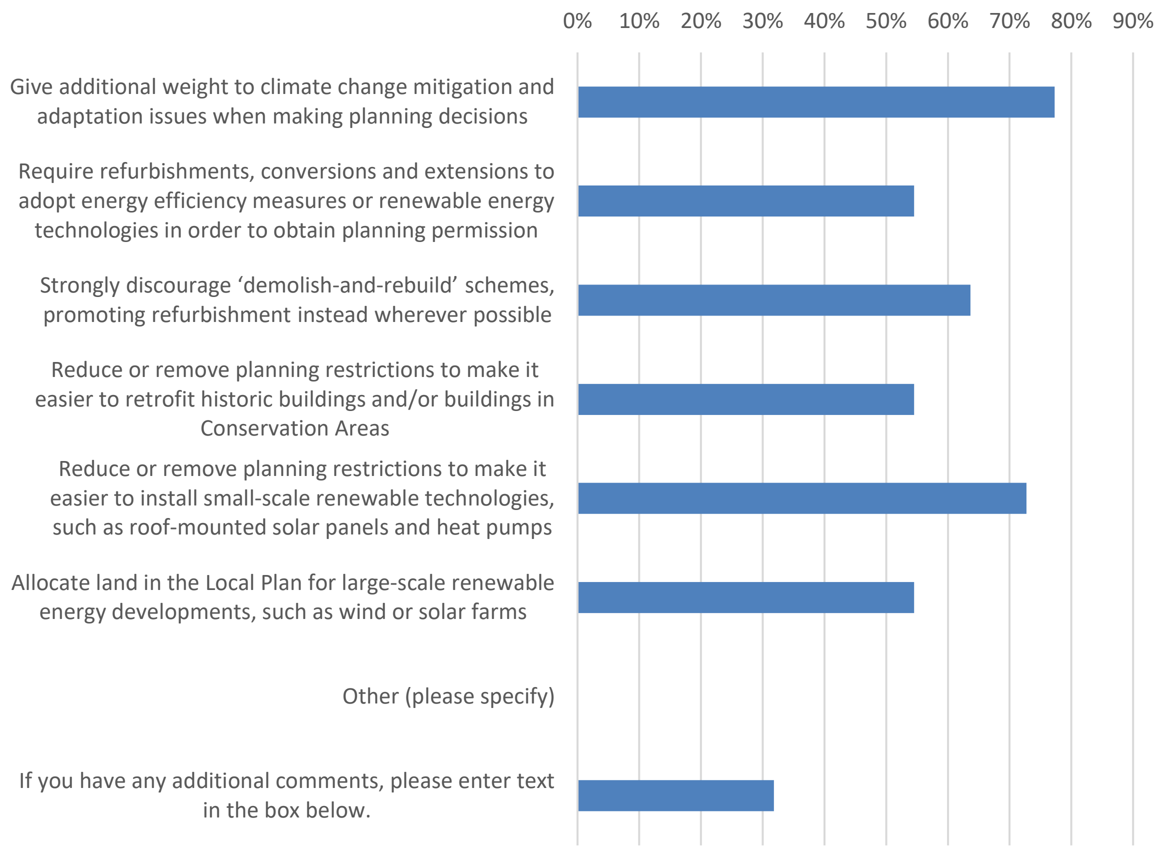
Figure 6-13. Question 15: Do you think that developments in East Hampshire should be required to calculate, and take steps to reduce, whole life-cycle carbon emissions?



As with question 12, this question was presented as a sliding scale from 1-100, with 1 being strongly disagree, 50 being neutral / no opinion, and 100 being strongly agree. Figure 6-13 shows a value of 79 which suggests that respondents predominantly agreed, but not strongly. The results above exclude two responses that were provided in a separate format. One respondent didn't answer this question, the other indicated strong agreement.

Question 16: The respondents asked if they would support any additional measures, following modelling carried out by Ricardo Energy & Environment which has shown that, although it is important to set GHG emission standards for new developments, reaching net zero carbon across the whole District will not be possible unless there are also radical reductions in GHG emissions from our existing buildings and energy supply. There was majority support was all additional measures, in particular reducing or removing planning restrictions to make it easier to install small-scale renewable technologies, such as roof-mounted solar panels and heat pumps (73%) and giving additional weight to climate change mitigation and adaptation issues when making planning decisions (72%) (see Figure 6-14).

Figure 6-14. Question 16: Would you support any of the following measures? (Check all that apply)



Community group A noted that "This is a very good list tackling the very important subject of retrofitting existing buildings. A major retrofit programme is required urgently and funding needs to be found for this. The first principle of giving additional weight to climate change is where change would start."

Parish Council B added that "There is strong concern that the current standards constrain those wishing to retrofit older buildings. As an example the Town Hall is grade 2 listed and has been advised by the conservation officer that double glazing and air source heat pump would not get LBC, which prevents the council from reducing its carbon footprint in its own properties."

6.3 Virtual focus groups

After the online survey was complete, two focus groups were carried out, to provide stakeholders with an opportunity to discuss their comments in more detail. The meetings were held on 18/10/22 and 20/10/22. Each lasted an hour and a half and was hosted virtually on Microsoft Teams. Invitations were sent to the same list of stakeholders that were invited to participate in the online survey. These were split into two groups as follows:

- Focus group 1 comprised representatives from the development industry, design and construction firms, and neighbouring planning authorities
- Focus group 2 comprised representatives from parish councils and other local community groups

The purpose of splitting the groups in this way was to allow stakeholders representing the construction industry and planning authorities to engage in a more in-depth discussion about the technical requirements and methods of demonstrating compliance.

Each meeting started with a short presentation from a Ricardo team member to provide background and context on the study along with a summary of the policy options under consideration. Then, the majority of each session consisted of a structured discussion facilitated by EHDC and Ricardo team members.

Notes from the sessions are provided in Appendix A.4.

7 GHG implications of spatial strategy options

Q8: How do each of the spatial strategy options for the emerging East Hampshire Local Plan perform in terms of minimising greenhouse gas emissions?

7.1 Introduction

At the time of commissioning this evidence base study, East Hampshire District Council intended to provide Ricardo with a series of spatial options to reflect its 'reasonable alternatives' for the Local Plan's development strategy, which would have been defined through the Council's sustainability appraisal process. The study question: 'How do each of the spatial strategy options for the emerging East Hampshire Local Plan perform in terms of minimising greenhouse gas emissions?' would then have been answered to help inform EHDC's sustainability appraisal of its reasonable alternatives.

However, due to delays in the plan-making process, EHDC could not supply reasonable alternatives from its sustainability appraisal. Instead, a series of bespoke spatial strategy options, based on the known availability of land for development, were formulated by EHDC and supplied to Ricardo. These options covered a range of possible housing requirements, from less than to more than the Government's estimates of housing need applied to EHDC's planning area. The spatial options *do not* necessarily represent options for the Local Plan, but instead enable EHDC to consider the potential impacts of formulating its reasonable alternatives in different ways and to understand the degree to which (e.g.) differences in the quantum of housing development might impact GHG emissions.

The revised approach from EHDC enables Ricardo to address the question in a manner that is meaningful for the Council, by highlighting key sensitivities (e.g. quantum of development, timing of development, location) that emerge from the modelling work.

The objectives for addressing the question are to:

- Estimate the potential scale of GHG emissions from different sources;
- Undertake a like-with-like comparison of GHG emissions from seven spatial strategy options;
- Explain the implications, both for the future definition of a spatial strategy and the Local Plan more broadly; and
- Use this information to inform the recommendations in Section 8.

GHG emissions are not the sole criterion for identifying a spatial strategy option as a 'reasonable alternative' for the Local Plan, through the sustainability appraisal process. However, this analysis will help EHDC to make an informed decision about the appropriateness of the spatial strategy options, which could influence its thinking on reasonable distributions of new homes in light of the Council's environmental ambitions and obligations.

7.1.1 Approach to estimating GHG emissions

At present, there is no standardised methodology for comparing the full GHG impacts of different spatial strategy options for a Local Plan; it is a new and expanding field of study. Because most of the sites are at a very early stage of being considered for development, there was also no detailed design information available for any of the sites.

With that in mind, this assessment has included the following steps:

1. Agree with EHDC which strategy options will be assessed
2. Identify the main sources of GHG emissions associated with the types of new developments under consideration, and whether they are likely to vary depending on the spatial strategy

chosen[121]

3. Quantify the GHG impacts of each source of emissions where possible, using bespoke energy and/or emissions benchmarks along with GIS mapping
4. Describe the potential *scale and direction* of impacts from other sources where quantification is not possible, either due to lack of data or because the results would not provide a like-with-like comparison

This approach has been used to provide an indicative ranking that compares seven spatial strategies in terms of their relative GHG emissions.

7.1.2 Scope of this assessment

This assessment considers a broad range of emissions associated with new developments, including some that occur outside of the site, District, or UK boundary. The reason for this is to try and obtain a full picture of the impacts, before considering suitable mitigation options and – crucially – identifying whether any of those are within EHDC's ability to influence in its role as an LPA.

It is therefore necessary to employ caution when comparing these results against other sources of information, because it may not be a like-for-like comparison.

If and when the proposed new development is brought forward, some of these emissions would be reflected in changes in the local authority (LA) GHG inventory[122] for East Hampshire. However, that is not the case for all sources of emissions.

Operational energy use and emissions from the new developments will be included in the GHG inventory for East Hampshire as reported in the LA GHG dataset.

Operational energy use and emissions from any vehicles associated with the new developments will be included only for the portions of the journeys undertaken within East Hampshire.

The majority of emissions from water supply, waste and wastewater treatment will be included in East Hampshire's LA GHG inventory, but it is possible that some emissions would be allocated to other Local Authorities due to data limitations.

Non-operational GHG emissions are expected to largely fall outside of East Hampshire, assuming most construction products and materials are manufactured elsewhere. Therefore, these would *not* generally contribute towards East Hampshire's GHG baseline. In fact, some may not appear within the UK GHG inventory at all.

For non-operational GHG emissions, the main exceptions would be emissions from vehicles or energy use taking place during construction, maintenance or decommissioning of the buildings. However, those would not necessarily be reported within the same sector as emissions from energy use in the buildings themselves. For example, if a local contractor drives to and from a house to carry out repair work, the fuel they use onsite would be classified within the industrial/commercial sector, not the domestic sector.

F-gas emissions (for example, due to refrigerant leakage) are not included in the LA GHG dataset and have been estimated separately for the purpose of this study.

[121] Assuming that the type, quantity, phasing and design of the buildings is the same, but those buildings are located in different places.

[122] This refers to the Local Authority Greenhouse Gas emissions inventory, published annually (two years in arrears) by BEIS: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics-2005-to-2020

7.1.3 Limitations

<u>The results presented in this chapter represent a 'best estimate' at the potential emissions arising from new development, based on available data and benchmarks. The purpose of the analysis is not to predict the future, but merely to indicate the order of magnitude and relative scale of different sources of emissions, to inform the selection of reasonable alternatives for the Local Plan strategy and recommend policy responses.</u>

Other key limitations are listed below.

- The actual quantity, type and phasing of development in East Hampshire is subject to change. There are often delays to the development process and some Local Authorities struggle to deliver the required amount of new housing in a given timeframe. This would have a potentially large impact on the model. In particular, many of the results will scale directly with changes in the assumed quantity of development. However, the *relative* impact of different sources of emissions will not change as much as the headline figures, and the order of magnitude is unlikely to change, so many of the key messages and recommendations from this work will remain unchanged.
- This analysis is focused on trying to assess the impacts of location, quantity, type and phasing of development, i.e. the spatial strategy options. There are many other variables that affect GHG emissions from new development, including but not limited to weather, energy prices, consumer behaviour, technological changes, electricity grid decarbonisation, population and economic trends. These have been held constant in the modelling so the impact of location, quantity, type and phasing of development is better understood.
- Because most of the sites are at a very early stage of development, there is no design information available, which makes it impossible to undertake a detailed GHG emissions assessment. Benchmarks have been used to represent typical or average values, but it is important to understand that, even for buildings of the same type, energy use can vary by ±50% or more.

7.1.4 New development assumptions

EHDC provided information on the anticipated amount, type and phasing of future development for the following spatial strategy options:

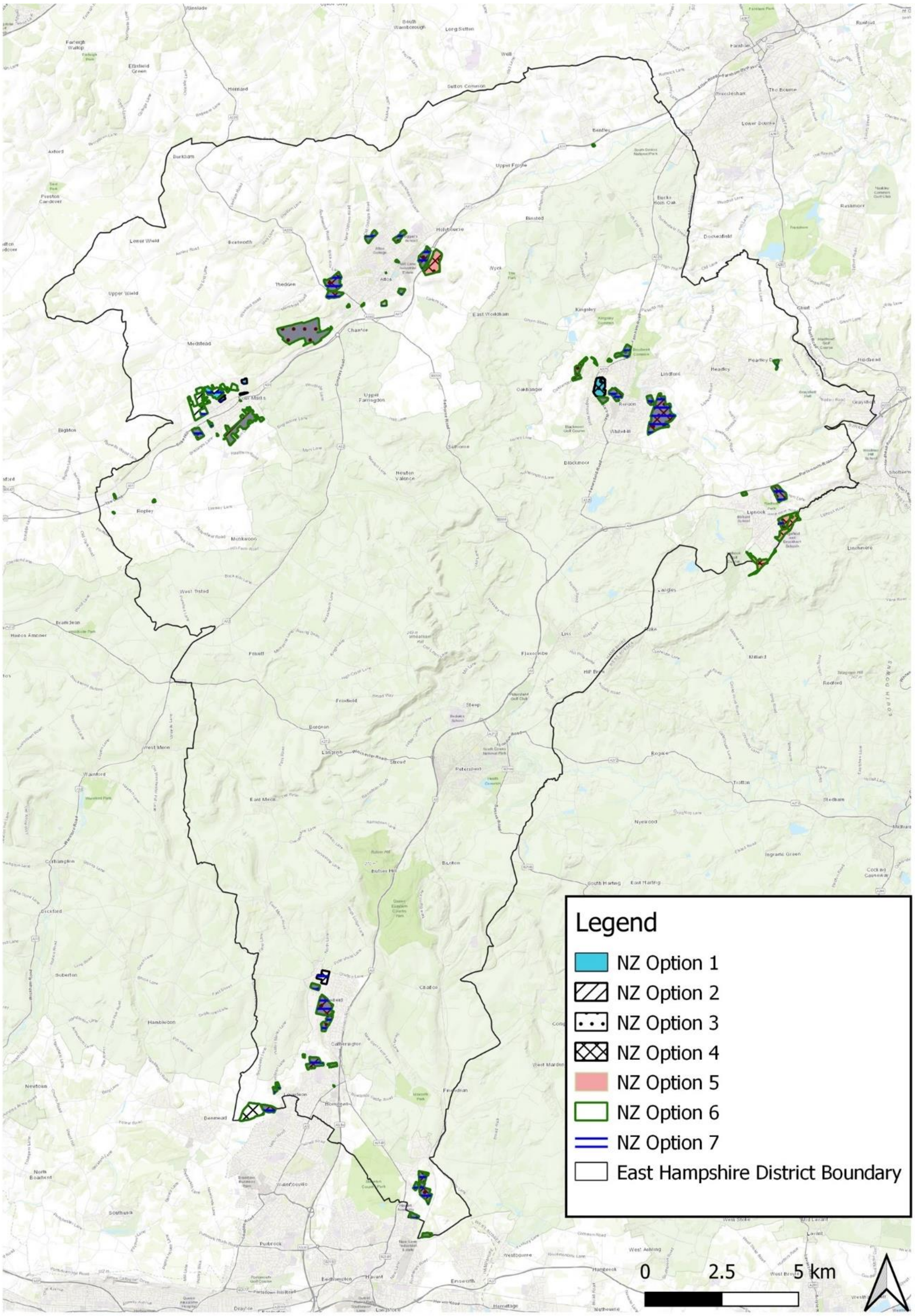
- Option 1: Dispersed - Northwest focus
- Option 2: Four Marks & South Medstead focus
- Option 3: Alton focus
- Option 4: Dispersed - Northeast and South focus
- Option 5: Highest Growth - Alton focus
- Option 6: Highest Growth - Many large development sites
- Option 7: Lowest Growth - Few large development sites

Many of the development sites under consideration are included in multiple spatial strategy options, as illustrated in Figure 7-1 (below). In other words, most of the options share a "core" set of sites that account for the majority of future new build development. NB: at the time of writing, <u>none</u> of these sites are being proposed by the Council for development. They are simply notional sites for technical consideration through the Local Plan process.

EHDC supplied the following information for each site:

- Type of development – domestic, schools, offices, health clinics, retail, etc.
- Quantity of development – number of dwellings or m^2 floorspace per use category per site
- Phasing – EHDC supplied estimates of the 5-year period when each site might come forward
- Site location and boundaries – based on GIS data

Figure 7-1. Spatial strategy options assessed



The graphs below show the cumulative number of new dwellings and the cumulative amount of non-domestic floorspace in each of these seven options. The anticipated phasing of new development was provided in 5-year "chunks"; the totals for each 5-year period were annualised (divided by 5) for the purpose of modelling.

Figure 7-2. Cumulative number of new dwellings

Figure 7-2

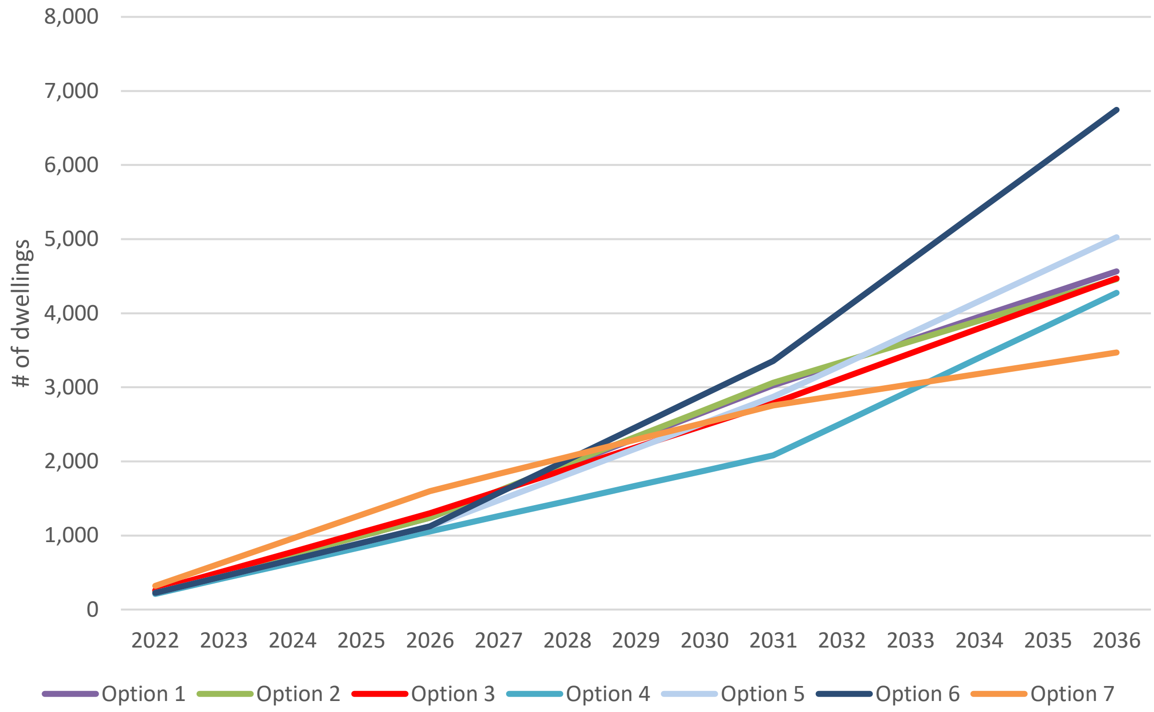
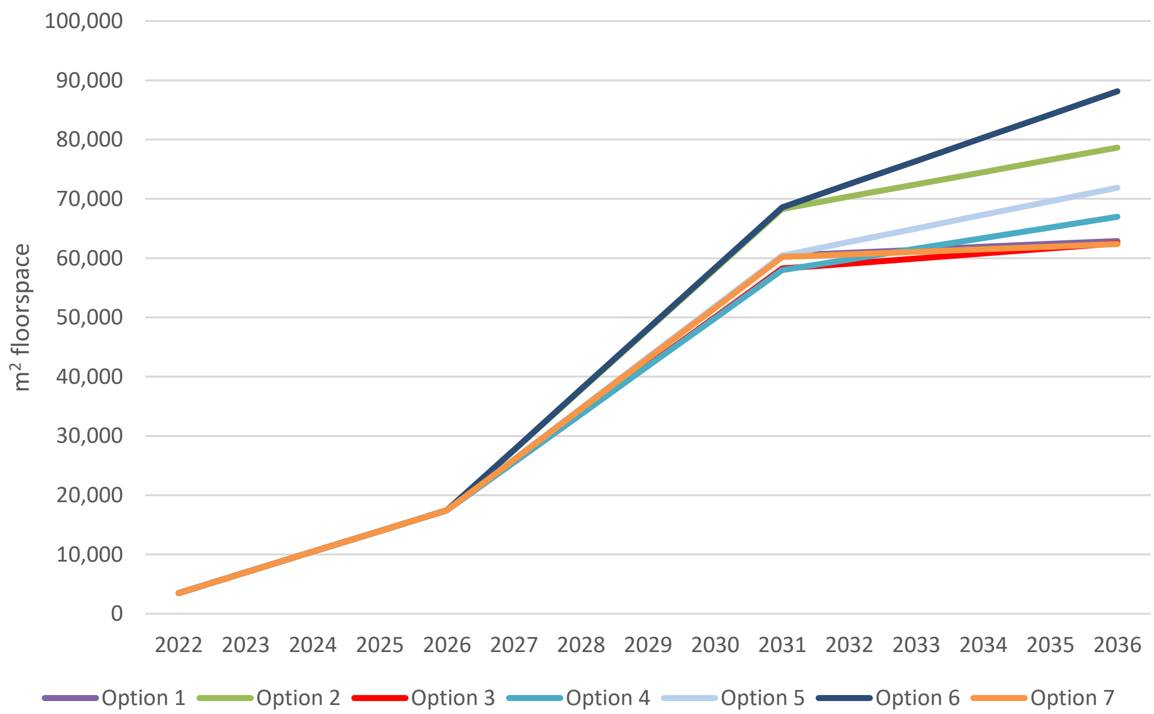


Figure 7-3. Cumulative new non-domestic floorspace



7.1.5 Sources of emissions considered

As explained in Section 3 and illustrated in Figure 3-1(see p. 10), there are a wide range of emissions associated with new developments and the built environment more broadly. The table below lists those have been considered in this assessment.

Source of emissions	Has this been quantified?	Comments on quantification method	Location specific?	Comments on impact of site location
Buildings – Operational energy use	Yes	A benchmarking approach has been used to estimate emissions from these sources, details of which are provided in Section 7.2.2.	No	For the purpose of this assessment we have assumed that the design of the buildings in the new developments would be exactly the same regardless of where they are located. Therefore, the site location or spatial strategy option has no impact on these calculations.
Buildings – Embodied carbon	Yes		No	
Transport – Operational energy use of cars	Yes		Yes	Sites in more rural locations have been assumed to result in higher annual car mileage than those in more urban locations, even if the number of new dwellings is the same. The difference in annual mileage is based on analysis of the National Travel Survey.
Transport – Operational energy use of other vehicles or travel modes	No	A review of available benchmarks found that estimating commercial vehicle movements would require more detailed information about the proposed development types than was available during this project.[123]	Yes	This would be expected to vary based on site location but has not been quantified as part of this study.
Transport – Embodied carbon of roads and other infrastructure	No	This review did not identify any industry standard benchmarks or estimation method that is suitable for use given the lack of design information.	Yes	As above.

[123] Commercial vehicle movements vary significantly based on the building use category, which is not known at this stage. To give an example, benchmarks from the Low Emission Partnership supply annual HGV trip rates for different types of retail development. For non-food retail the benchmark is 0.17 trips per m^2 floor area, whereas for a shopping centre the benchmark is 4.60 trips per m^2 floor area – nearly 30 times higher. Source: Low Emission Partnership, *'Using the Low Emission Toolkit to support Emission Assessment of Development Sites'* (2015).

Transport – Indirect impacts on transport emissions or travel behaviour outside of the development site	No	In principle, the proposed new developments could change existing patterns of travel behaviour, e.g. if new shops were located close to residential neighbourhoods that previously had to drive farther to access them. These impacts are highly uncertain and have therefore not been assessed.	Yes	As above.
Water supply to domestic developments	Yes*	Estimates based on GHG conversion factors and per capita averages, details of which are provided in Section 7.3. Emissions from non-domestic developments were not quantified due to the lack of information about the type and quantity of non-domestic development.	No	We have assumed that the design of the building is the same regardless of site location, i.e. the same water efficiency standard is met.
Waste and wastewater treatment for dwellings	Yes*		No	These emissions are estimated on a per capita basis. We have assumed that the design of the buildings, and therefore the average number of occupants per dwelling, is the same regardless of the site location.
Conversion of land to settlement	Yes*	Order of magnitude estimates have been provided for context but not incorporated into the main model.	Yes	Emissions vary widely depending on many factors, including but not limited to the current land cover, underlying soil conditions, type of intervention (digging, removal of trees/vegetation, etc.), design and maintenance of landscaping.
Non-CO_2 gases	Yes*	Non-CO_2 GHG emissions associated with energy use, waste and wastewater treatment are included in the estimates (see rows above). Order of magnitude estimates of emissions from F-gases used in domestic heat pumps have also been provided.	See notes	See previous rows regarding emissions from energy use, waste and wastewater treatment. Emissions from F-gases (refrigerant leakage) are not assumed to vary by location.

** A quantitative estimate has been provided but not incorporated into the main model.*

For more information on each source of emissions, refer to Section 3.

7.1.6 Historic and current (baseline) energy use and GHG emissions

Estimates of energy consumption and GHG emissions at a local authority level (henceforth referred to as 'LA GHG data') are compiled by Ricardo on behalf of BEIS and published annually. That data has been used as the baseline to assess area-wide energy use and emissions in East Hampshire. For more information on the methodology, please refer to the relevant technical reports.[124,125]

7.2 Energy use and emissions from buildings and cars

7.2.1 Overview

An Excel-based energy and emissions model has been developed to estimate the energy use and emissions associated with the embodied carbon of buildings, operational energy use in buildings, and operational energy use for car travel by residents of the new domestic developments.

Two scenarios have been modelled, to highlight the potential scale of emissions reductions that could be achieved by adopting higher standards within the Local Plan.

Scenario A: Minimum standards

This scenario assumes that the new developments are constructed to meet the minimum standards stipulated by Part L of the Building Regulations. Developments completed in the 0-5 year timeframe are assumed to meet Part L 2021 while developments completed after that point are assumed to meet the FHS.

Scenario B: Net zero carbon development

This scenario assumes that the new developments are constructed to meet the following higher standards:

- 100% reduction (net zero) operational energy use in buildings as per LETI targets
- 40% reduction in embodied carbon from buildings as per LETI targets
- 15% reduction in operational energy use for transport based on analysis of National Travel Survey

Note that the assumptions used in Scenario B are intentionally ambitious, and have been chosen to represent best practice. They are based on LETI targets and analysis of the National Travel Survey, so are considered achievable in principle, but would be challenging based on typical industry practices.

Emissions associated with commercial vehicle movements have been excluded due to lack of information on the specific types of non-domestic building uses that will be provided. Emissions from water supply, waste and wastewater treatment, and refrigerant leakage have been excluded because calculations indicate that these are comparatively very small (see Section 7.4) and, as stated previously, this model is intended only to provide a rough estimate of emissions. Emissions from land use change are addressed separately in Section 7.3.1.

[124] BEIS, *'Subnational Consumption Statistics'* (2022). Available at: [Subnational Consumption Statistics methodology and guidance booklet (publishing.service.gov.uk)]

[125] BEIS, *'UK Local and Regional Greenhouse Gas Emissions: 2005 to 2020'* (2022). Available at: [UK local and regional greenhouse gas emissions, 2005 to 2020: technical report (publishing.service.gov.uk)]

7.2.2 Benchmarks used

For the purpose of this analysis, we have used the following benchmarks:

Table 7-1. Benchmarks used to estimate emissions from buildings and cars

<table>
<tr><th>Category</th><th>Benchmarks used</th></tr>
<tr><td>Buildings – operational energy</td><td>Existing buildings: Energy benchmarks for domestic buildings are based on the median domestic gas and electricity consumption statistics for East Hampshire[124] and energy benchmarks for non-domestic buildings are based on CIBSE ‘Typical Practice’ benchmarks.

Recent new builds: Benchmarks taken from BEIS research[126] into the annual energy use of domestic properties first occupied between 2015-2017. Energy benchmarks for non-domestic buildings are based on CIBSE ‘Good Practice’ benchmarks. EHDC supplied data on ‘Employment’, ‘Health’ and ‘Town centre’ floorspace which have been modelled as follows:
• ‘Employment’ is modelled using benchmarks for offices
• ‘Health’ is modelled using benchmarks for health centres and clinics
• ‘Town centre’ is modelled as the average of clothes shops and small food shops
Future new builds: For domestic properties, FHS standards are based on recent new builds, with adjustments made to reflect uplifted Part L standards (assuming 25% lower space heating demand) and use of heat pumps. Energy benchmarks for non-domestic buildings are based on CIBSE ‘Good Practice’ benchmarks with heat demand assumed to be met by heat pumps instead of fossil fuel boilers.[127]

Net zero operational carbon buildings: Energy consumption is based on the LETI EUI target of 35 kWh/m^2/year.

We have assumed that existing buildings, recent new builds and those constructed to Part L 2021 use gas boilers for heating whereas those constructed to the FHS or LETI standards use heat pumps.</td></tr>
<tr><td>Buildings – embodied carbon</td><td>Benchmarks from the GLA’s Whole Life-cycle Carbon Assessment Guidance.[36]</td></tr>
<tr><td>Transport – operational energy</td><td>Benchmarks are based on sub-national road transport fuel consumption statistics for East Hampshire[124] with scaling factors for rural/urban locations based on analysis of the National Transport Survey.[129]</td></tr>
</table>

Note that the benchmarks for buildings include regulated *and* unregulated energy use.

The benchmarks for dwellings, shown in the chart below, highlight that there is a large difference between the average performance of the existing stock compared with FHS or LETI standard homes.

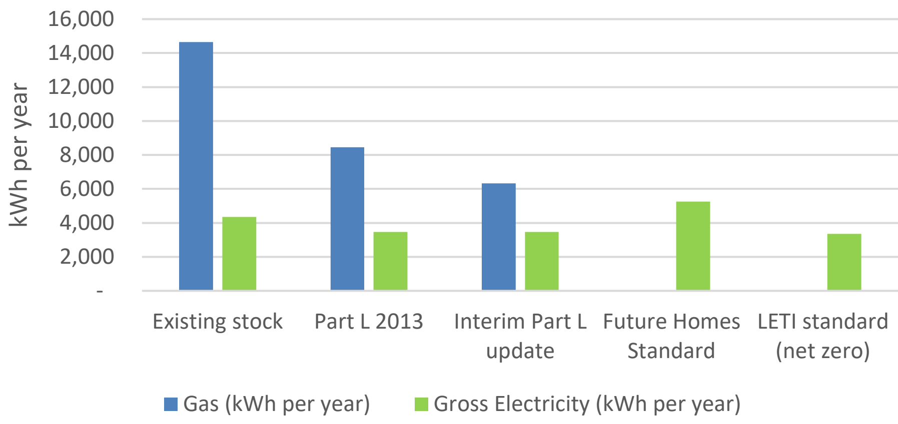
[126] BEIS, *‘Energy consumption in new domestic buildings 2015-2017’* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/853067/energy-consumption-new-domestic-buildings-2015-2017-england-wales.pdf

[127] The benchmarks that have been used reflect the actual energy consumption of recent new builds so there is no need to correct for the performance gap.

[129] Department for Transport, *‘National Travel Survey’* (2022). Available at: https://www.gov.uk/government/statistics/national-travel-survey-2021

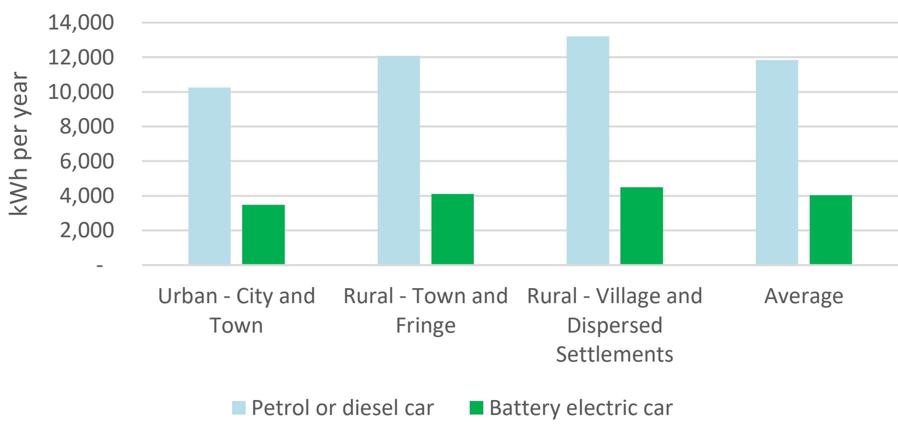
Achieving these uplifted performance standards will require a step-change in design and construction methods.

Figure 7-4. Annual gas and electricity consumption in dwellings



The benchmarks for energy use in cars, shown in the chart below, demonstrates that although site location has an impact – higher annual mileage for properties in more rural locations – the shift to EVs may have an even bigger impact. This is an example of the benefits of technological change, although (as mentioned previously) it is still crucial to locate and design developments to minimise the need for private vehicle travel due to wider impacts e.g., embodied carbon, battery production, and electricity demands.

Figure 7-5. Annual road transport fuel consumption in cars



7.2.3 Calculating annual and cumulative emissions

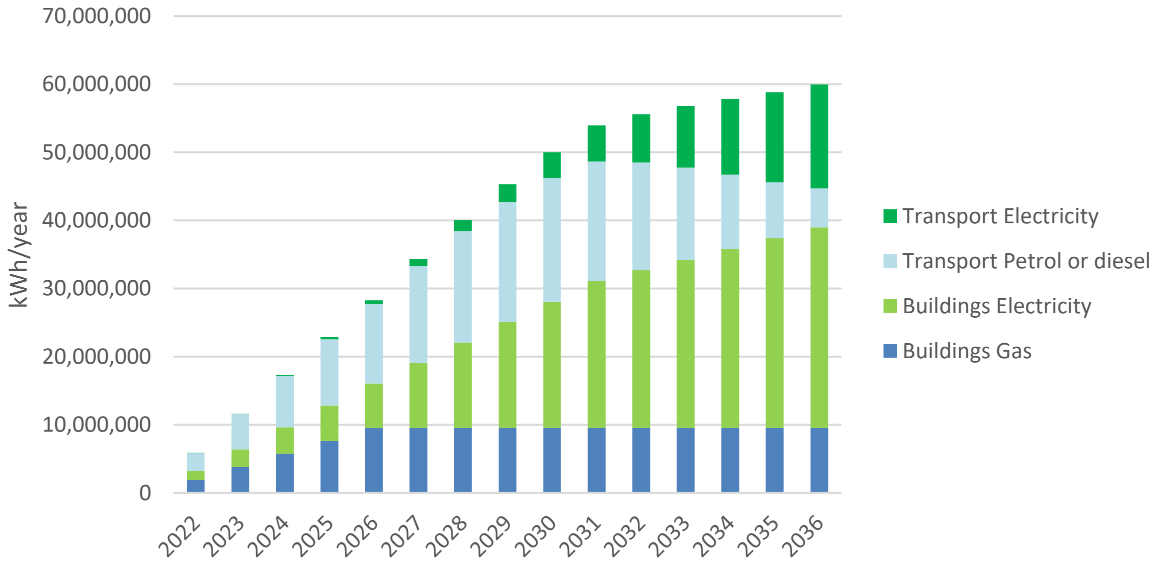
The graphs below show sample outputs for spatial strategy Option 1 to demonstrate how these benchmarks have been used to calculate annual and cumulative emissions:

First, the benchmarks are multiplied by the quantity of new development per year to derive annual energy use. In the graph below:

- Annual gas consumption increases up to 2025, then holds constant, because any additional new buildings constructed after that time are assumed to use heat pumps once the FHS is introduced.
- Annual emissions from electricity use in new buildings increases year-on-year as new domestic buildings are constructed. After 2025, this includes electricity used for heating.
- The number of cars increases over time as new domestic buildings are constructed; however, this model assumes that due to consumer demand, in future those vehicles are increasingly

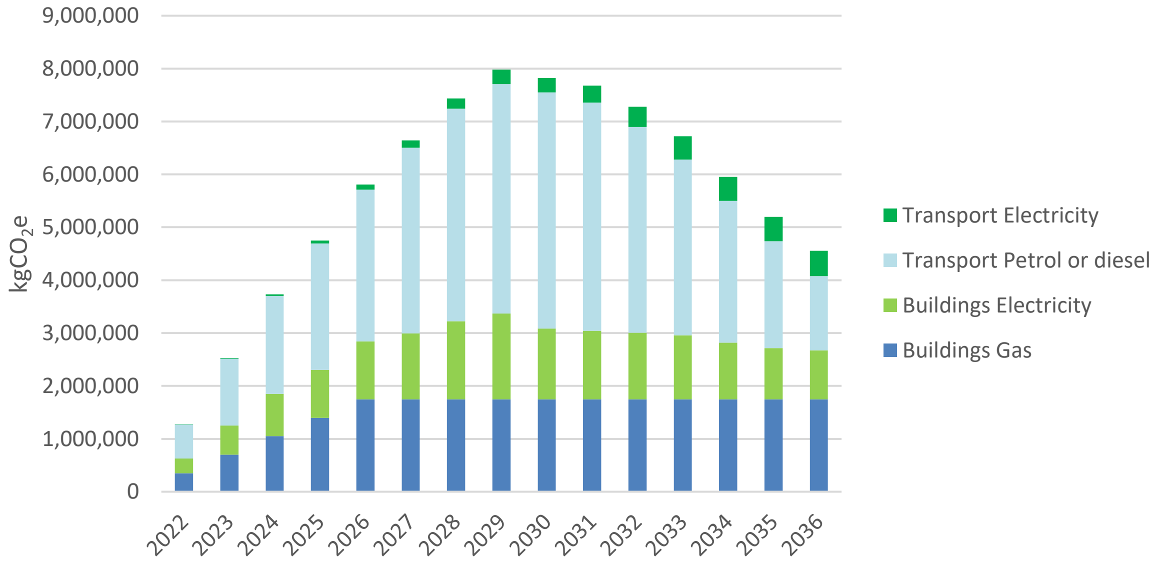
likely to be EVs. Because EVs are much more efficient than combustion engines, this means that fuel consumption in cars appears to level off, even though new cars are still being added.

Figure 7-6. Additional energy use from buildings and cars (Option 1)



Second, annual energy use in buildings and transport is converted to GHG emissions (kgCO₂e per year) using BEIS GHG conversion factors for company reporting.[130] In the graph below, electricity use is continuing to increase, but the emissions factor for electricity is decreasing due to grid decarbonisation. Therefore, emissions from electricity do not scale with changes in electricity use. (The emission factor for electricity is a major sensitivity within the model as will be discussed in Section 7.2.5.)

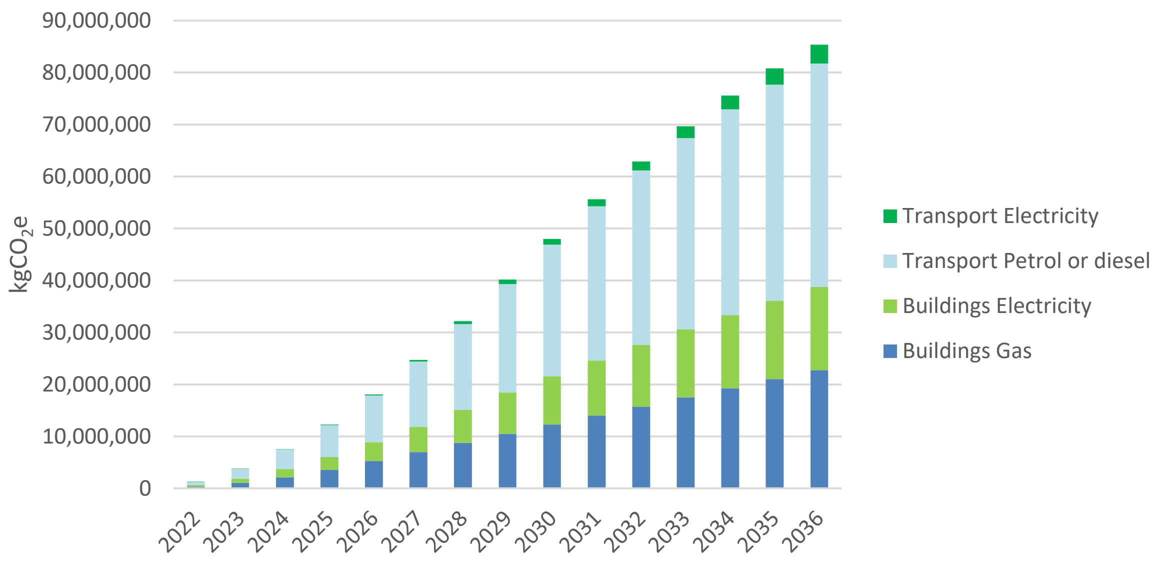
Figure 7-7. Annual operational GHG emissions from buildings and transport (Option 1)



Finally, annual emissions are added together to obtain an estimate of cumulative emissions from each spatial strategy option.

[130] BEIS, *'Greenhouse gas reporting: Conversion factors 2022'* (2022). Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

Figure 7-8. Cumulative operational GHG emissions (Option 1)



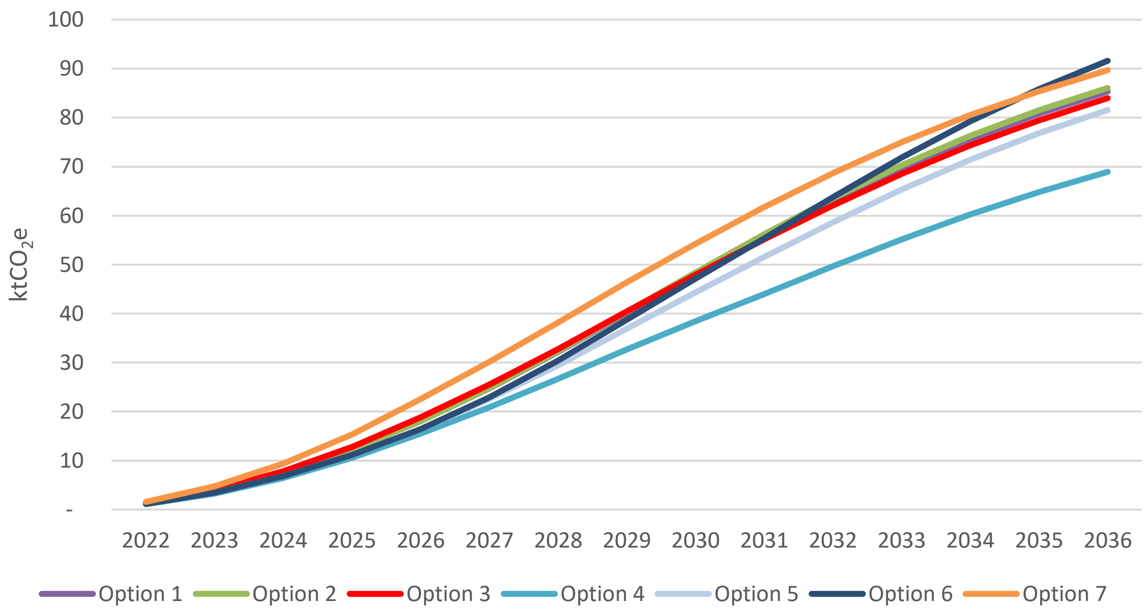
Embodied carbon emissions are presented separately because they do not necessarily occur in the year that the development is constructed.

7.2.4 Results

Scenario A results

The graph below presents a comparison of the cumulative operational GHG emissions from buildings and cars for all seven spatial strategy options in Scenario A, where new development simply meets the standards set out in the Building Regulations.

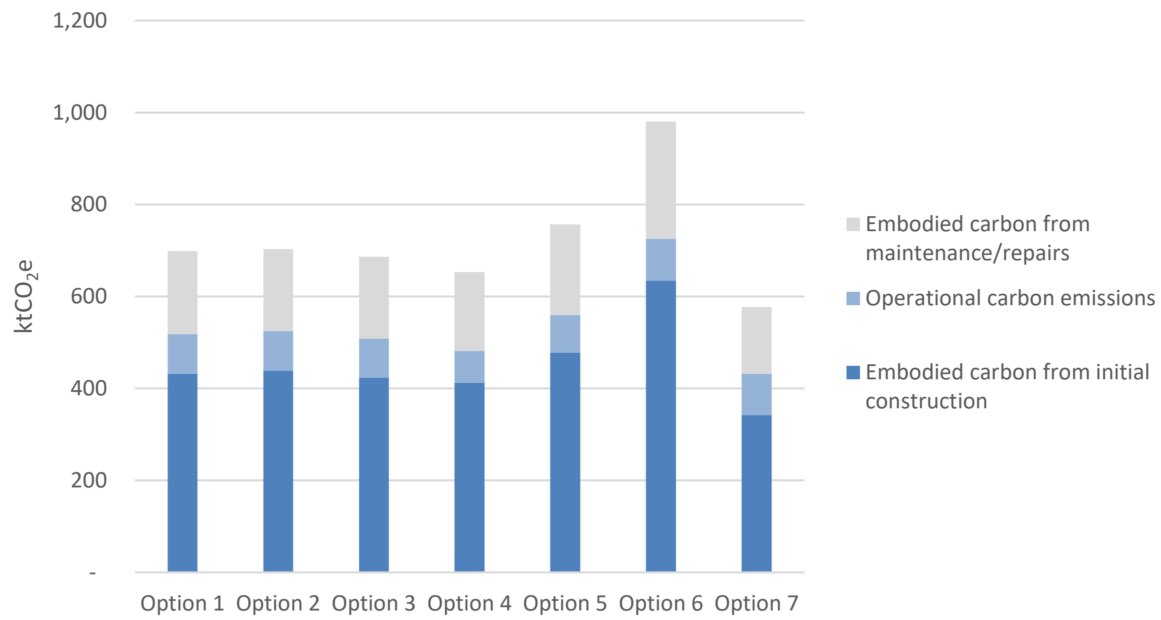
Figure 7-9. Cumulative operational GHG emissions from 2022-2036 – Scenario A



In this scenario, cumulative operational emissions in the period 2022-2036 range from roughly 69 $ktCO_2e$ (Option 4) to 92 $ktCO_2e$ (Option 6), with an average of around 84 $ktCO_2e$.

The graph below shows the estimated cumulative operational and embodied GHG emissions from Scenario A as of 2036.

Figure 7-10. Cumulative GHG emissions as of 2036 – Scenario A



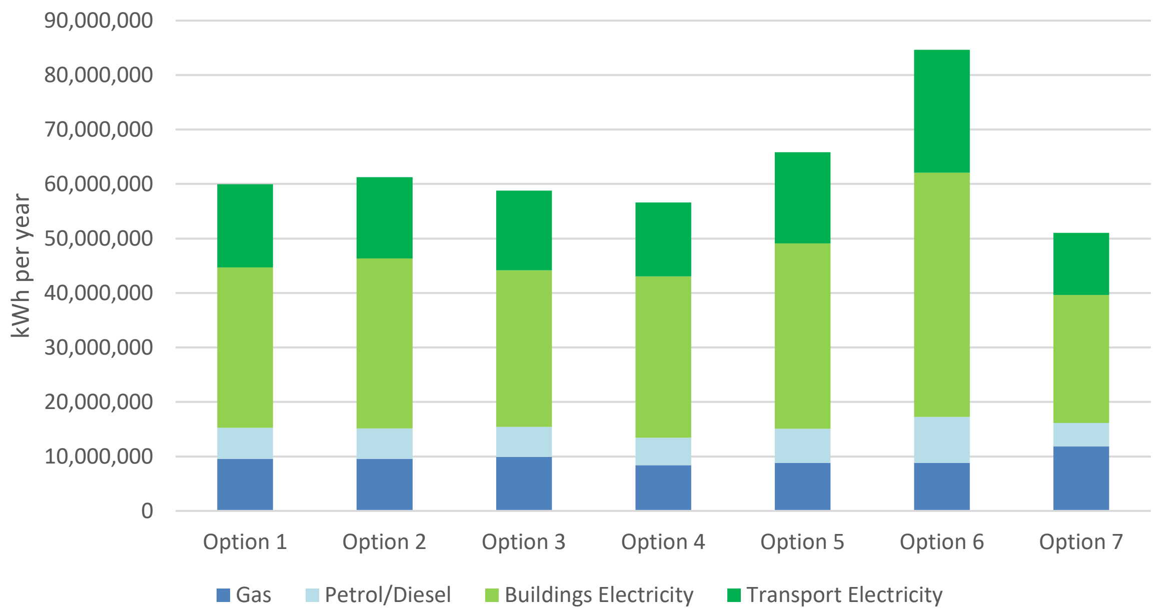
When interpreting the above graph, note the following:

- The embodied carbon estimates include emissions associated with building maintenance, repairs and decommissioning. Given that relatively few of the buildings will be more than 10 years old in 2036, this should be understood as an upper estimate of emissions from those activities.
- During the lifespan of the developments, operational emissions will come to represent a larger proportion of the total, although embodied carbon is likely to remain the dominant source of WLC emissions.

According to this calculation, cumulative emissions in the period 2022-2036 could range from roughly 536 ktCO_2e (a low estimate for Option 7 that excludes emissions from maintenance/repairs) to nearly 890 ktCO_2e (a high estimate for Option 6). For context, this is similar to the total annual emissions for East Hampshire as a whole in 2019 (650 ktCO_2e).

Operational emissions in this model are associated with fuel consumption in buildings and cars. The chart below shows the quantity of additional fuel consumption for each spatial strategy option in 2036 in Scenario A. The proposed amount of new development is estimated to add, on average, roughly 10 GWh per year of gas, 6 GWh per year of petrol/diesel and 47 GWh of electricity consumption to the current District totals (although clearly this is subject to assumptions about uptake of heat pumps an EVs). For context, this is equivalent to around 2% of fuel consumption in East Hampshire in 2019.

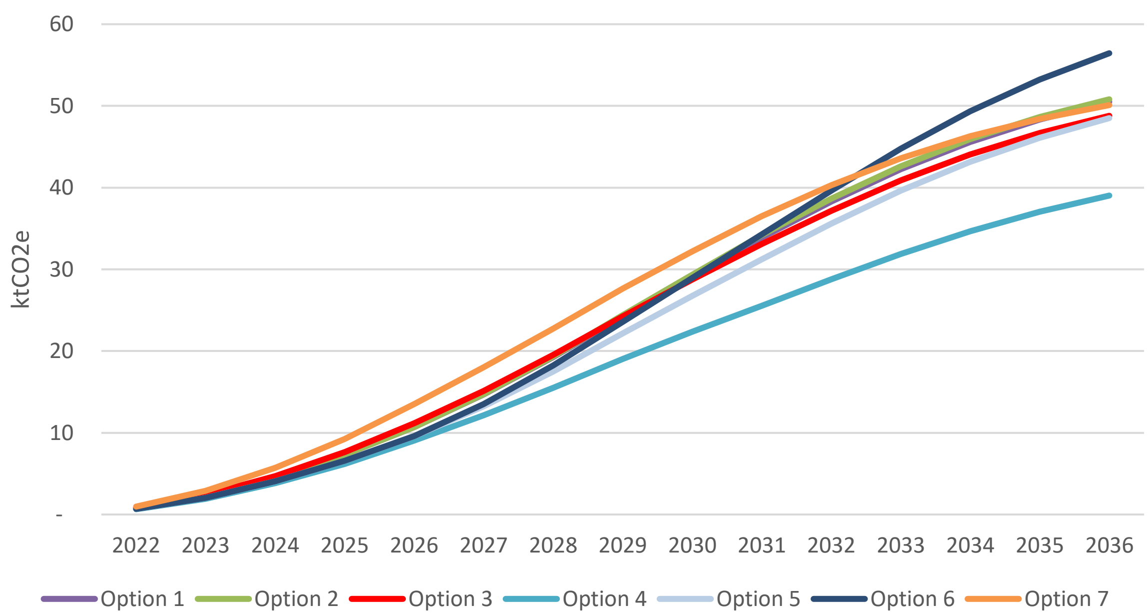
Figure 7-11. Additional annual fuel consumption by 2036 – Scenario A



Scenario B results

The graph below presents a comparison of the cumulative GHG emissions from buildings and cars for all seven spatial strategy options in Scenario B, where new development is constructed to achieve net zero operational emissions, new buildings reduce WLC emissions by 40% on average, and developments are designed and located to facilitate sustainable travel choices, reducing car mileage by 15%.

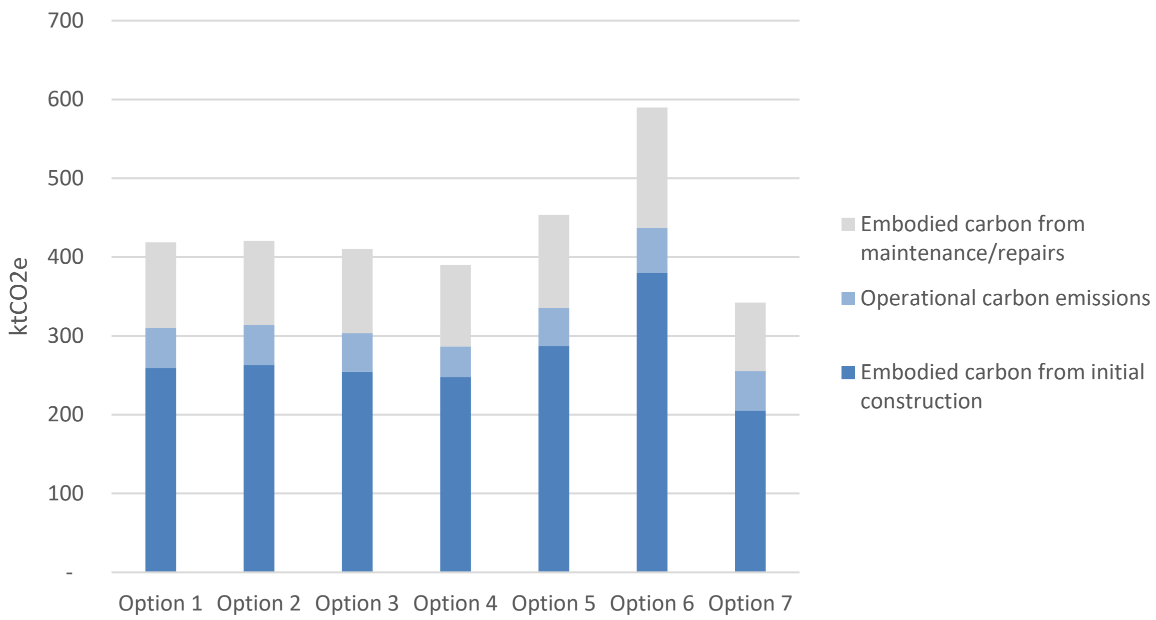
Figure 7-12. Cumulative operational GHG emissions from 2022-2036 – Scenario B



In this scenario, cumulative operational emissions in the period 2022-2036 range from roughly 39 $ktCO_2e$ (Option 4) to 56 $ktCO_2e$ (Option 6), with an average of around 49 $ktCO_2e$.

The graph below shows the estimated cumulative operational and embodied GHG emissions from Scenario B as of 2036.

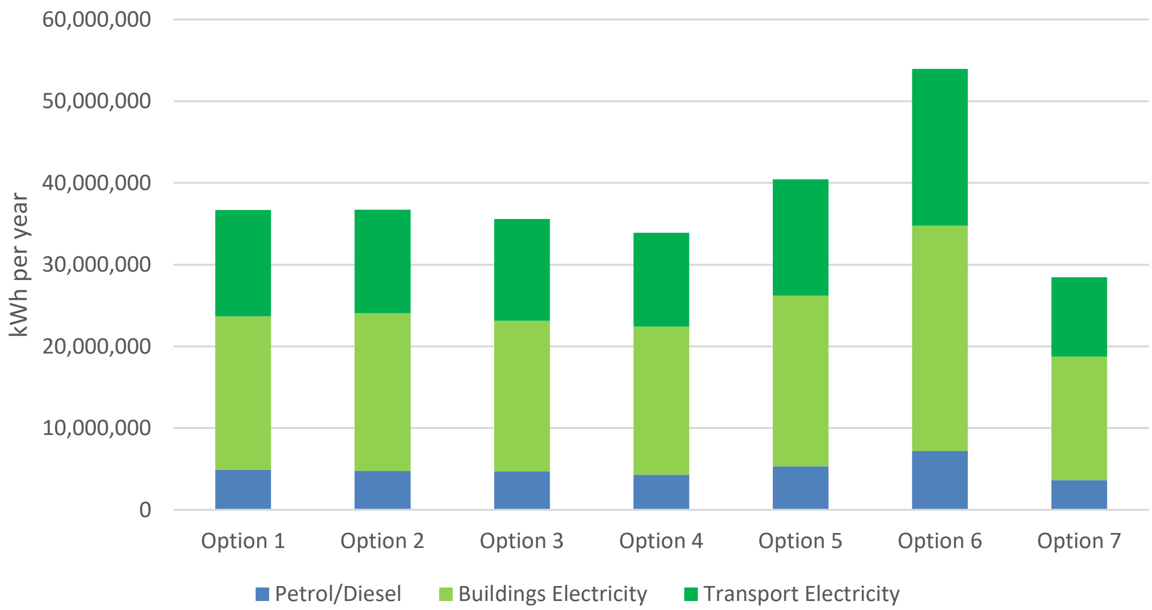
Figure 7-13. Cumulative GHG emissions as of 2036 – Scenario B



According to this calculation, cumulative emissions in the period 2022-2036 could range from roughly 256 $ktCO_2e$ (a low estimate for Option 7 that excludes emissions from maintenance/repairs) to 590 $ktCO_2e$ (a high estimate for Option 6). For comparison, this is less than the total annual emissions for East Hampshire as a whole in 2019 (650 $ktCO_2e$).

In addition, as shown in the chart below, there would be a significant reduction in fuel consumption compared to Scenario A, particularly net electricity use. In Scenario B, the proposed amount of new development is estimated to add, on average, roughly 5 GWh per year of petrol/diesel and 33 GWh of electricity consumption. If the developments meet 100% of their own electricity demands onsite, then this could fall to c. 15-20 GWh.

Figure 7-14. Additional annual fuel consumption by 2036 – Scenario B



7.2.5 Discussion

Comparing different sources of emissions

The cumulative operational emissions for Option 1 shown in Figure 7-8 broadly reflect the results for all other seven spatial strategy options. They show that, by 2036, operational emissions are dominated by the petrol/diesel used in cars, and gas used in buildings. This is despite the fact that a phase-down of petrol/diesel vehicles was modelled, and that only buildings constructed in the next 0-5 years will use gas boilers. It suggests that, even though annual emissions will start to decline as the grid decarbonises (as shown in Figure 7-7) there is significant 'carbon penalty' for using fossil fuels.

A significant portion of operational emissions can therefore be avoided by minimising reliance on fossil fuels. In the case of buildings, this is an argument in favour of prohibiting the use of gas boilers or other fossil fuel heating systems as soon as possible. For transport, this indicates the need to locate and design developments to avoid the need for car travel in the first place, while also providing infrastructure to facilitate EV uptake, e.g. EV charging points and car clubs.

Total emissions, meanwhile, will be dominated by embodied carbon. Embodied carbon is to a large extent determined by design choices made at an early stage of development, and therefore EHDC has a window of opportunity to influence this via the planning process. On the other hand, this presents a challenge because, as discussed previously, there would likely be challenges with adopting a quantitative target for reducing embodied carbon. It is strongly recommended that the Council should seek to adopt such targets in future if and when it is practical to do so.

Another important point to note is that the operational GHG emissions estimates are also highly sensitive to assumptions about electricity grid decarbonisation. As shown below, if we assume there is no change in the emission factor for electricity in the future, the cumulative operational GHG emissions could be more than 50% higher than shown. Delivering 'net zero ready' homes (i.e. homes that meet the Government's Future Homes Standard) creates a risk that those developments will not achieve net zero operational emissions, if the grid does not decarbonise at the rate that the Government hopes it will. The on-site provision of renewable energy technologies (to meet the electricity demands of new buildings) is therefore important for mitigating risks related to slower national grid decarbonisation.

Figure 7-15. Cumulative operational emissions by 2036, with and without the effects of electricity grid decarbonisation – Scenario A

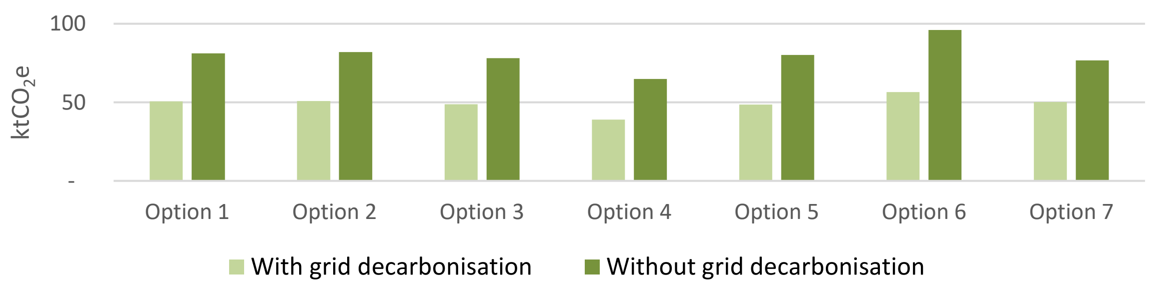


Figure 7-15 affirms the need to:

- Meet energy demands via on-site renewables wherever possible; and
- Work to achieve a step-change in the deployment of large-scale renewable technologies within East Hampshire, as this will contribute towards grid decarbonisation.

Comparing the spatial strategy options

Among the sources of emissions assessed, this analysis suggests that Options 7 and 4 are likely to have the lowest emissions overall, while Option 6 is likely to have the highest emissions. Emissions from the remaining four options were relatively similar.

The factors that were found to influence emissions from the different spatial strategy options were:

- **Quantity of development** – Options with fewer homes and/or less non-domestic floorspace are likely to have lower emissions overall. This is mostly due to the lower embodied carbon from construction, although operational emissions will also be lower.
- **Phasing of development** – Developments that are completed later in the Local Plan period were found to have lower emissions; however, this is solely due to assumptions about the energy performance standards of those buildings (see below).
- **Energy performance standards for buildings (and when these are introduced)** – There is a GHG emissions penalty if higher standards for buildings are delayed even by a few years. In our model, this is primarily due to the continuing operation of gas boilers in homes constructed between 2022 and 2025. Similar results have been demonstrated by the CCC[110] which has found that, even if buildings that are initially fitted with gas boilers switch to heat pumps, emissions are 3-6 times higher than if they were fitted with heat pumps at the outset

Option 6 shows the highest emissions by 2036 because it includes significantly more development. Conversely, emissions from Option 7 are lower because it includes the least amount of new development. The reason that Option 4 appears to perform so well is because more of the development is assumed to come forward in the 10-15 year timescale, i.e. it is assumed to meet higher performance standards in Scenario A.

Note, embodied carbon emissions from roads and other infrastructure have not been quantified in this study but could be significant, because materials such as concrete, steel and cement have high carbon footprints. This would suggest that sites that are in more remote locations, or those with a more dispersed masterplan layout, would have higher emissions. Similarly, there was not enough information to quantify emissions from vehicles other than private cars, which means there is greater uncertainty in these estimates for spatial options that include more non-domestic development.

7.3 Other sources of emissions

This section provides an overview of other sources of emissions associated with the creation of new developments which are not quantified in the previous section. Nonetheless, some of these emission sources can have a substantial impact on the carbon footprint and wider sustainability of developments.

7.3.1 Conversion of land to settlement

A large amount of carbon is stored in soil. Different land uses, such as forestry, agriculture, pasture, and settlement, result in carbon being stored or released at different rates, and *changes* in land use can therefore cause a net increase or decrease in carbon emissions.[131] For example, conversion of agricultural land or pasture to new settlements will release CO_2 to the atmosphere. Across East Hampshire, forest/woodland and grassland are currently net carbon sinks, while croplands and settlements are net carbon emitters (see Table 7-2).[125]

Table 7-2. LULUCF emissions in East Hampshire (2020). Source: BEIS

	Forest land	Cropland	Grassland	Settlements	Indirect N_2O	Total (Net Emissions)
$ktCO_2e$	-57.3	15.7	-19.1	11.0	0.4	-49.3

The Land Use Change, Land Use, and Forestry (LULUCF) subset[132] of the LA GHG data provides a more detailed breakdown of these emissions. It shows that, across England as a whole, around 10,280 ha of land was converted to settlements in 2019, resulting in emissions of approximately 187 $ktCO_2e$.

[131] Defra, *'Safeguarding our Soils'* (2009). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69261/pb13297-soil-strategy-090910.pdf

[132] CEH on behalf of BEIS, *'UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019 – Detailed emissions and removals from land use, land-use change and forestry'* (2021). Available at: https://naei.beis.gov.uk/reports/reports?report_id=1025

On a national scale, therefore, the average emissions from converting land to settlements were around 18 tCO_2e/ha. This is an average representing a wide range: where land has been converted to settlement through deforestation (removal of trees), emissions per hectare were around 336 tCO_2e/ha on average, while the average for non-forest sites was closer to 5 tCO_2e/ha.

<u>These metrics cannot be directly applied to individual sites due to the number of variables involved.</u> However, assuming typical development densities of 10-40 dwellings per hectare, these numbers suggest that emissions from conversion of land to settlement are generally quite small compared to embodied carbon but in a worst-case scenario could be of a similar order of magnitude to ten years of operational emissions from an individual dwelling.[133]

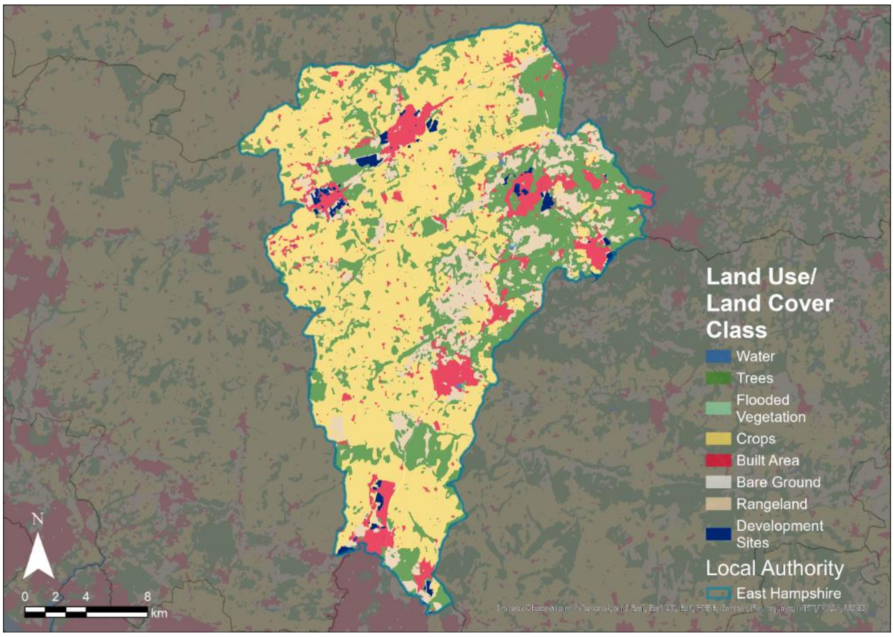
The emissions impact classification of land use changes can be found below. This only acts as a rough guide and that any new developments would need to consider a variety of factors such as demolition works, site remediation, infrastructure provision, soil types and biodiversity considerations.

Table 7-3. Qualitative indication of emissions from land use change

Current land cover	Emissions from land conversion to settlement will tend to be…
Forests/Trees	High
Grassland/Rangeland	Medium
Cropland	Low
Bare Ground	Low
Built Areas	Low

To get an insight into the potential impacts as they relate to the spatial strategy options, a map of land cover in East Hampshire, taken from the Esri living atlas (2021)[134] was overlayed with maps of the development sites (see below). Definitions of land cover classifications are provided in Appendix A.8. ***<u>Note that this only provides a rough indication of land cover; all information would need to be validated through site surveys.</u>***

Figure 7-16. Land Cover Map of East Hampshire. Source: Esri

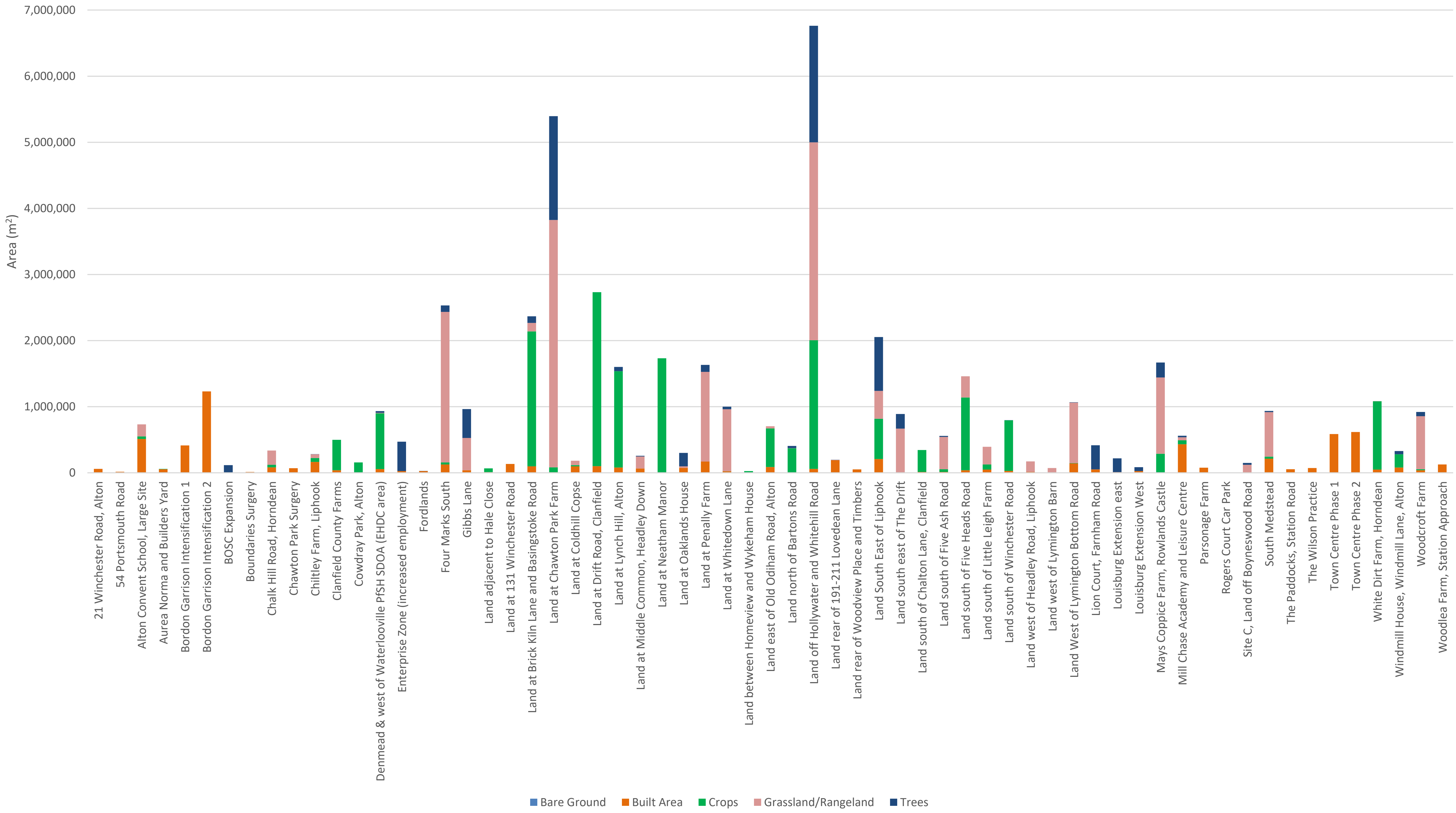


[133] EPC data suggests that regulated emissions from recent new builds are around 2-3 tCO_2e per dwelling per year; see Appendix A.6.

[134] For more information, refer to: https://www.arcgis.com/home/item.html?id=30c4287128cc446b888ca020240c456b

The figure below shows the results of the land cover analysis for all 67 sites. Without details of the proposed landscaping strategy or masterplan layout, and without validating the land cover via site surveys, it is not possible to assess which spatial strategy option is likely to have the highest emissions from land use change. Sites that currently include significant areas of trees or grassland will not necessarily result in higher emissions if these areas are conserved. However, in general, emissions from land use will likely be higher for options that involve *removing* larger areas of trees or grassland, or if there is a high degree of soil disturbance, particularly of carbon-rich soils.[135]

Figure 7-17. Land cover analysis for 67 development sites. Source: Esri and EHDC



135 Forestry Commission, *'Reducing greenhouse gas emissions from forest civil engineering'* (2013). Available at: https://cdn.forestresearch.gov.uk/2013/01/fctn020.pdf

7.3.2 F-gas emissions from domestic heat pumps

Fluorinated gases (F-gases) are a category of GHGs that include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). They are used as refrigerants in a variety of applications, including refrigerators, air conditioning and heat pump equipment. Refrigerant leakage from appliances can occur during use and when they are disposed[136] Most F-gases have a very high global warming potential (GWP); in other words, the same amount of an F-gas will have a larger impact on global warming than the equivalent amount of CO_2, unit for unit.

The GHG effects of F-gases are not considered within current Building Regulations. However, in light of the anticipated increase in heat pump usage, it is helpful to consider the potential scale of these emissions relative to other sources. Based on the following assumptions:

- Typical refrigerant content of a domestic heat pump: 2 kg[137]
- Annual leakage rate: 3.5%[138]
- GWP of R32 refrigerant: 667

The annual refrigerant leakage from a domestic heat pump would be approximately 0.07 $kgCO_2e$ per year, resulting in GHG emissions of approximately 47 $kgCO_2e$ per dwelling per year.

7.3.3 Water supply

To estimate the scale of emissions from water supply in new domestic developments, we have referred to the BEIS GHG conversion factors for company reporting[130] which report that emissions from water supply are approximately 149 $kgCO_2e$ per million litres. Assuming that there is an average of 2.29 people per dwelling in East Hampshire[139,140] and water consumption of 110-125 litres per person per day (l/p/d)[141] the water supply for each new dwelling would result in emissions of approximately 40 $kgCO_2e$ per dwelling per year.

7.3.4 Waste and wastewater treatment

According to the LA GHG data, emissions from waste and wastewater treatment in East Hampshire in 2020 were 7.4 $ktCO_2e$, which equates to roughly 59 $kgCO_2e$ per capita per year.[142] If again we assume 2.29 people per dwelling, this would result in emissions of around 136 $kgCO_2e$ per dwelling per year.

7.4 How do these sources of emissions compare?

The graphs below provide a ***rough*** indication of the relative scale of emissions from the sources assessed, for a single dwelling operating in 2023. One-off emissions from embodied carbon of buildings and conversion of land to settlement are shown in Figure 7-18. Annual emissions are shown in Figure

[136] CCC, *'The Sixth Carbon Budget: F-gases'* (2020). Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-F-gases.pdf

[137] For more information, refer to: https://www.wsp.com/en-gb/insights/the-importance-of-refrigerants-in-heat-pump-selection

[138] Eunomia on behalf of DECC, *'Impacts of Leakage from Refrigerants in Heat Pumps'* (2014). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/303689/Eunomia_-_DECC_Refrigerants_in_Heat_Pumps_Final_Report.pdf

[139] DLUHC, *'Live tables on dwelling stock (including vacants)'* (2022). Available at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants

[140] EHDC, *'East Hampshire District Population'* (2021). Available at: https://cdn.easthants.gov.uk/public/documents/Census%20infographic%20EHDC_0.pdf

[141] Building Regulations Part G requires new dwellings to meet a water efficiency standard of 125 l/p/d as a minimum, with an optional higher standard of 110 l/p/d.

[142] Includes emissions from landfills, along with emissions from waste water treatment, sewage sludge decomposition, composting and anaerobic digestion. For more information, refer to BEIS, *'UK local and regional greenhouse gas emissions estimates for 2005-2020: Technical Report'* (2022). Available at: UK local and regional greenhouse gas emissions, 2005 to 2020: technical report (publishing.service.gov.uk)

7-19; if all other variables are held constant then these would occur every year over the lifespan of the building, which is typically 60 years. Supporting data and assumptions are provided in Appendix A.8.

Note that, for some categories, the high and low estimates indicate a range of outcomes under different scenarios and 'typical' estimates are not provided.

Figure 7-18. One-off emissions from the construction of 1 new dwelling

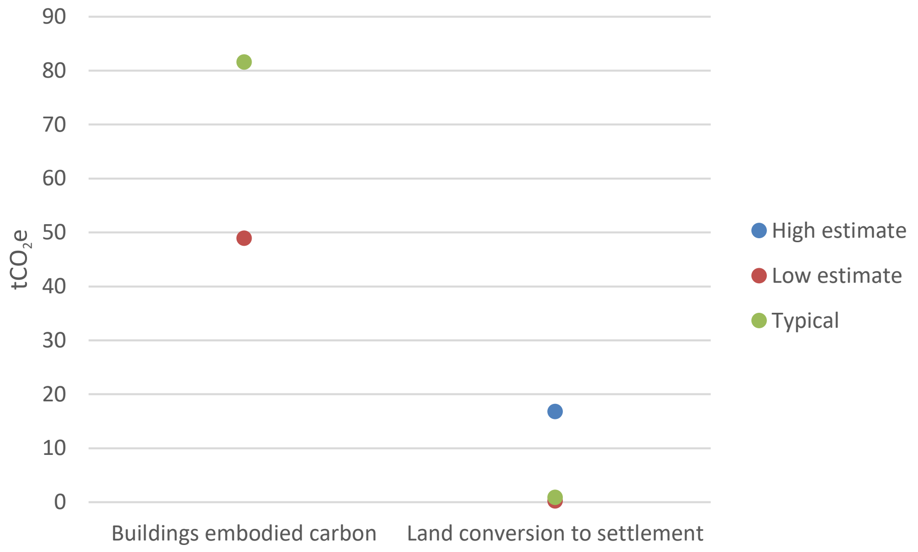
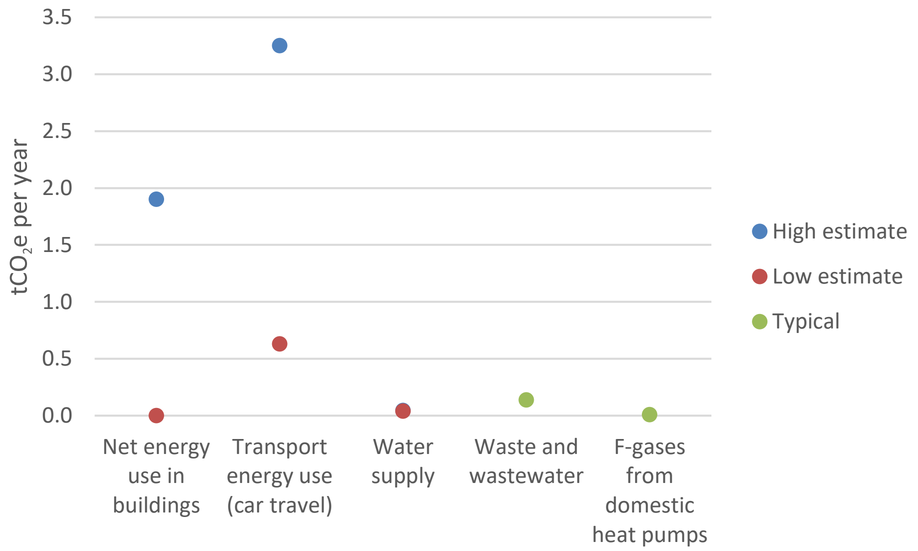


Figure 7-19. Annual emissions from 1 new dwelling operating in 2023



These results suggest that, assuming a 60-year lifespan, the main sources of emissions from this development will come from operational energy use in buildings, and the occupants' car, assuming the building is heated with gas and the car uses petrol or diesel. However, these could be more than 75% lower for a dwelling with net zero annual energy use, where residents live in a place that facilitates sustainable travel choices and/or use an EV.

The other most significant source of emissions is embodied carbon from buildings. (As discussed previously, embodied carbon from roads and other infrastructure is also likely to be significant but has not been quantified due to lack of data.) LETI guidance suggests that buildings can achieve a c. 40% reduction in embodied carbon emissions, which means that there is a significant opportunity to reduce emissions from the outset through careful design and material choices.

Emissions from water supply, waste and wastewater treatment, and refrigerant leakage (if using a heat pump) are comparatively small. Emissions from converting land to settlement are likely to be small as well, but will vary, particularly if wide areas of trees are being removed.

When interpreting these numbers, it is important to remember that sustainable development is not just about energy use and GHG emissions.

For example:

- Changes in land use have implications for biodiversity, along with water, soil and air quality.
- East Hampshire and the surrounding area is classified as being under 'serious' water stress, so water use should be reduced as much as possible.[143]
- Waste reduction is also important to help minimise indirect emissions up and down the supply chain, prevent pollution, and conserve natural resources.

These topics need to be considered in a holistic way at all stages of the development process, from site selection to detail design, construction and occupation. The sustainability appraisal process for the East Hampshire Local Plan will look at other indicators of sustainability at the plan-making stage.

7.5 Implications for the Local Plan

The table below summarises some of the key findings from the GHG assessment, and provides suggestions for how EHDC can respond, either through planning policy or more broadly.

Consideration	Suggested response
Emissions will likely be dominated by…	
Embodied carbon	Require whole life-cycle carbon to be assessed and introduce a quantitative target for reducing it as soon as possible.
Petrol/diesel use in transport	Developments must be designed to minimise reliance on travel, and also have sufficient infrastructure to support EV charging. New development should offer good, attractive connections to services and facilities by sustainable transport modes (e.g. walking and cycling networks).
Continuing use of gas boilers	Phase out use of gas in new builds as soon as possible.
Grid decarbonisation may not happen at the rate anticipated, which is a significant risk (potentially increasing cumulative operational emissions by >50%)	EHDC can respond to this by: - Requiring new development to include enough on-site renewables to meet 100% of their energy demands; and - Proactively working to achieve a step-change in deployment of large-scale renewable energy locally, thus "doing their part" to achieve grid decarbonisation nationally.

[143] Environment Agency, *'Water stressed areas – 2021 classification'* (2021). Available at: https://www.gov.uk/government/publications/water-stressed-areas-2021-classification

There are other emissions from f-gases, land use change, waste/wastewater treatment, etc. all of which need to be mitigated to achieve net zero	Steps should include: - Encouraging use of low-GWP refrigerants in heat pumps and other systems; - Take strong measures to protect existing areas of trees or grassland that act as carbon sinks; and - Setting stringent targets for water efficiency.

8 Summary of recommendations

8.1 Local Plan policies

Q5: Which of the local plan policy options for achieving net zero carbon development are most appropriate for East Hampshire?

The following policy recommendations are informed by a range of evidence that includes a policy context review, analysis of the East Hampshire building stock and new development proposals, assessment of the cost impacts of different technical standards, stakeholder feedback and an assessment of GHG emissions from seven spatial strategy options.

- **Net zero definition:** As a quantified definition, this should include emissions associated with regulated *and* unregulated energy use arising from the operation of buildings. In future this definition should be expanded to include WLC emissions from construction (see below).
- **Ultra-high energy efficiency standards**: Buildings must be constructed to meet high standards of energy efficiency. It is recommended that EHDC adopt the LETI targets for space heating demand and energy use intensity. An alternative route to compliance would be to achieve Passivhaus certification.
- **100% renewable energy**: The agreed definition of operational net zero carbon requires 100% of energy demands to be met via renewable technologies, preferably onsite unless this is not technically or practically feasible. Buildings must not use fossil fuels for heating. The amount of renewable energy provision should be *at least* enough to meet the predicted energy demands of the buildings.
- **Embodied/WLC emissions**: Developers should be required to estimate and take steps to reduce WLC emissions as far as is reasonably practicable, whilst EHDC's aim should be to gather data such that a quantitative target could be set at a later date. This is in line with UKGBC's recommendation for Local Plans to include targets for WLC emissions but reflects the fact that such assessments are not routinely carried out at present, which makes it difficult to introduce a quantitative target from the outset.
- **Sustainable transport**: Developments must be designed to facilitate walking, cycling and use of public transport. This must be reflected in the selection of sites for the Local Plan (as far as is reasonably practicable), the site masterplan, proposed mix of uses, design of the public realm, and provision of cycle parking, car clubs, etc. When evaluating on-site energy supply and infrastructure requirements, developers must account for the electricity and charging needs of EVs.
- **Offsetting**: This is understood as a last resort and should only be considered for exceptional cases, e.g., refurbishment schemes or energy-intensive non-residential developments. An offsetting scheme would need to follow the best practice principles set out in Section 4.2.2. EHDC would need to undertake further work to specify a carbon price and identify suitable projects.

8.2 Other ways for EHDC to support the transition to net zero

As explained in Section 2.1.4, there are other opportunities for EHDC to contribute to GHG mitigation through its role as an LPA, and recommendations for which are set out below.

- **Existing buildings:** As planning permission is not necessarily required for changes to existing buildings, it is suggested that the local plan plays a permissive rather than a restrictive role. This could mean:
    - Encouraging, guiding, and permitting effective retrofitting measures and ensuring that these don't appear to be discouraged by planning policy, e.g., in conservation areas
    - Support funding for retrofitting measures that would otherwise be prohibitive
- **Large-scale and community renewables:** Encouraging the uptake of renewable energy plays a vital role in decarbonising the buildings sector. The local plan can play an important role with decarbonising the electricity grid and increasing its resilience to supply fluctuations. EHDC should seek to reduce barriers to renewable energy development by:
    - Identifying and allocating suitable sites for large-scale renewables such as wind and solar farms
    - Identifying and allocating suitable sites for energy distribution and storage
    - Potentially using Local Development Orders (LDOs) to bring forward renewable energy developments

Case study: Swindon Borough Council

LDOs are a tool to simplify and accelerate the planning process by granting automatic planning permissions for certain developments in defined areas.[146] This not only provides developers with more certainty regarding their investment but can also free up time for planning officers, allowing them to focus on other planning applications.

Swindon Borough Council has created multiple low-carbon LDOs, covering:

1. Non-domestic air-source heat pumps and district heating
2. Electric and hydrogen fuelling stations on multiple sites
3. Pre-identified sites for solar farms and solar panels

The third point was found to have significantly contributed to the delivery of the council's policy to encourage solar power uptake.[148]

- **Land use:** Emissions from land use and agriculture are particularly challenging to decarbonise from a local planning perspective, although the LPA's control over these areas should not be underestimated as they are a key land management stakeholder.[14] Potential levers of influence include:
    - Choosing spatial options which do not encroach on existing carbon pools and sinks
    - Encouraging natural carbon sequestration actions such as woodland creation and wetland restoration
    - If an offsetting scheme is created, using developer contributions (see Section 4.2.5) to fund the creation of green carbon sinks[16]

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[146] Quantum Strategy & Technology Ltd. on behalf of UK100, 'Power Shift: Research into Local Authority powers relating to climate action' (2021). Available at: https://www.uk100.org/sites/default/files/publications/Power_Shift.pdf

[148] LGA and PAS, *'Local Development Orders Case study research and analysis'* (n.d.). Available at: https://www.local.gov.uk/sites/default/files/documents/2018%20Case%20Study%20Research%20on%20Local%20Development%20Orders.pdf

8.3 Conclusion

Delivering net zero carbon development is a huge challenge. By making this commitment, EHDC is in the vanguard of local authorities that are seeking to play their part in helping the UK fulfil its legal and moral obligations on climate change. Some of the policy options described in this report present technical, cost and/or practical challenges. However, the science is clear that tackling the climate emergency is one of the most urgent issues we face – and our analysis demonstrates that these measures would have a significant impact on GHG emissions from future development. This evidence can be used to help ensure that both the District Plan and spatial strategy align with EHDC's ambition.

Appendices

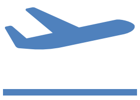
A.1 Relevant planning disputes and legal challenges

Particular examples where carbon emissions have become a matter of contention in planning policy which are relevant to the East Hampshire Development Plan include:

The Tulip, which was refused on appeal on grounds which included embodied carbon on 11 Nov 2021. The decision notice discussed embodied carbon extensively, in particular para 44 "*extensive measures that would be taken to minimise carbon emissions during construction would not outweigh the highly unsustainable concept of using vast quantities of reinforced concrete*".[151]

The roads building programme **RIS2 (Roads Investment Strategy) and National Networks NPS** (roads policy subject to Judicial Review for inappropriate consideration of carbon). The High Court has dismissed a judicial review application which accused the Secretary of State of failing to account for environmental impacts under RIS2.[152]

The A38 Derby Junctions Scheme which was recommended by inspectors for approval subject to the Secretary of State making decisions on carbon emissions under the Paris Agreement, which the inspectors viewed as outside their remit to determine. The Secretary of State decided to approve the proposal (8 Jan 2021), however, the Development Consent Order was quashed after the Secretary of State conceded a judicial review claim.[153]



Expansion Plans for Stansted Airport (Essex) were rejected by Uttlesford District Council (UDC) in 2020, but an appeal by the airport in 2021 resulted in the plan being approved by the Planning Inspectorate (PI) on the grounds that "there would be a limited degree of harm arising in respect of air quality and carbon emissions" which would be "far outweighed by the benefits of the proposal". As part of this reversal, UDC has also been ordered to cover the costs of the appeal.[155] Similar issues have been raised with other airport expansion projects; for example, Bristol Airport.[156]

These cases show how controversial decisions on development can be with regard to carbon emissions. They also highlight the need for both good guidance and support when interpreting that guidance into both policy and local (or indeed national) decisions.

[151] Planning Inspectorate, *'Appeals Casework Portal – Reference: APP/K5030/W/20/3244984'* (n.d.). Available at: https://acp.planninginspectorate.gov.uk/ViewCase.aspx?Caseid=3244984&CoID=0

[152] Burgess Salmon, *'Legal challenge to the DfT's £27bn road building plan dismissed'* (2021). Available at: https://www.burges-salmon.com/news-and-insight/legal-updates/legal-challenge-to-the-dfts-27bn-road-building-plan-dismissed

[153] Planning Inspectorate, *'A38 Derby Junctions: Examining Authority's Report'* (2020), para 9.3.1. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010022/TR010022-001426-TR010022_A38%20Derby%20Junctions_Recommendation%20Report__FINAL%20and%20appendices.pdf and see also *'A38 Derby Junctions: Secretary of State Decision' (2021). Available at:* https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/a38-derby-junctions/

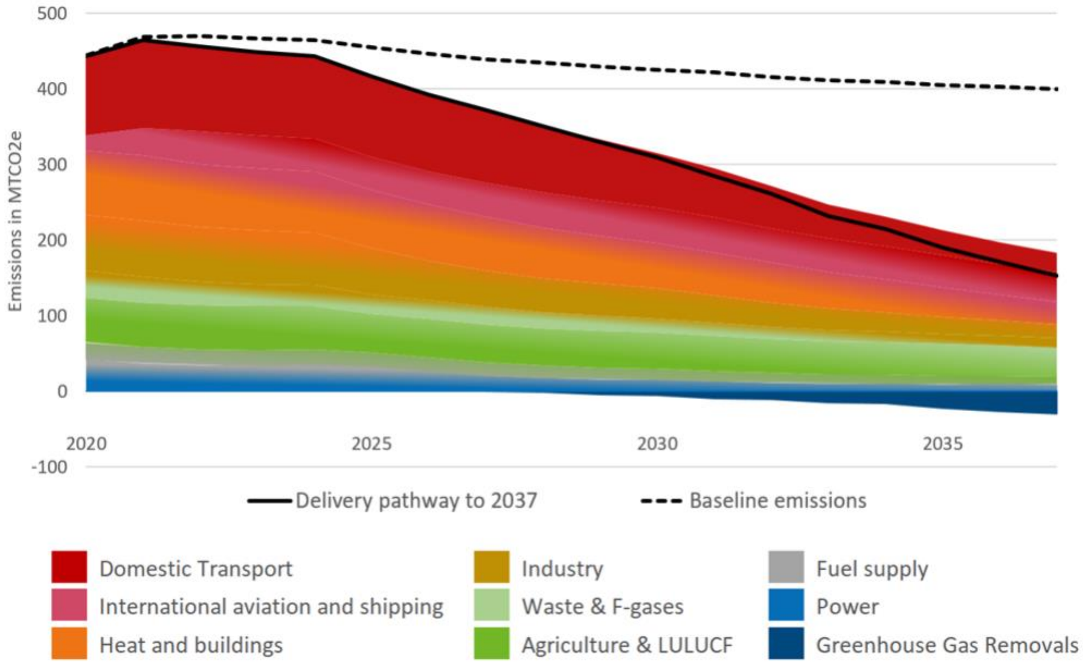
[155] Airport Watch, *'Stansted wins appeal, against refusal by Uttlesford Council, of its plans to increase capacity to 43 million passengers per year'* (2021). Available at: https://www.airportwatch.org.uk/2021/05/stansted-wins-appeal-against-refusal-by-uttlesford-council-of-its-plans-to-increase-capacity-to-43-million-passengers-per-year/

[156] BBC News, *'High Court appeal to stop Bristol Airport expansion begins'* (2021). Available at: https://www.bbc.co.uk/news/uk-england-somerset-63556101

A.2 Other Government strategies and policies relevant to building performance

A.2.1 UK Net Zero Strategy (2021)

The UK Government published its Net Zero Strategy (NZS) in October 2021. The chart below indicates how the Government expects the UK's future GHG emissions trajectory will progress, compared against a baseline prior to the introduction of the NZS.[157] It shows that, compared with a 2020 baseline, emissions would drop by approximately 30% by 2030. This compares favourably against the 'baseline emissions' reported within the NZS.



It also contains a few other new announcements that are particularly relevant to Local Authority decarbonisation planning:

- **Gas boiler ban:** A proposed ban on the sale of new gas boilers from 2035. This would mean that any homes in East Hampshire still using gas boilers by that time would be required to replace them. It remains the case that Local Authorities do not have the power to implement such a ban independently.
- **Boiler Upgrade Scheme**: Grant funding towards the purchase of heat pumps, providing up to £5,000 per home for up to 90,000 homes. The Government's hope and expectation is that this will stimulate demand and help to reduce the costs of installing heat pumps, which in future will then promote uptake.
- **Funding for MEES enforcement**: The Government will provide £4.3 million to Councils in an effort to clamp down on landlords not complying with energy efficiency regulations. Since April 2020, landlords have had to upgrade all rented properties to EPC Band E with non-compliance resulting

[157] BEIS, *'Net Zero Strategy Baseline – Partial Interim Update'* (2021). Available at: https://www.gov.uk/government/publications/energy-and-emissions-projections-net-zero-strategy-baseline-partial-interim-update-december-2021/net-zero-strategy-baseline-covering-note

in a fine of up to £5,000, but few Local Authorities enforce this. The new support can potentially start to ensure that action is ramped up over the course of this decade.

- **Hydrogen**: A decision on the role of hydrogen to heat buildings will be announced in 2026. In practical terms, this could result in more gas heating systems being installed between now and then on the assumption that hydrogen will save the day, risking further delays on short-term low-regret actions. This means that, although EHDC should not yet write off the possibility of hydrogen as a solution for low carbon heating in the district until the announcement is made, the focus should still primarily be on heating technologies that are already available.
- **Sustainable transport**: Within the NZS, uncertainty remains on how the national and local governments will work together to shift away from motorised travel. While local action will play a key role in decarbonising travel, with the NZS pledging to embed this into spatial planning processes, how and if this will be done in co-operation with local authorities remains unanswered. The NZS further states that the Government is in the process of "building [the] evidence base to understand the barriers and potential policies to increase the uptake of shared mobility", such as car sharing, which the central government plans to do in co-operation with local authorities.

The NZS also restates some earlier commitments that are relevant to this study, such as:

- **Ban on petrol and diesel cars**: The NZS reaffirms the Government's intention to phase out the sale of new combustion engine cars and vans by 2030, with hybrids to follow in 2035.
- **Active travel:** As announced in May 2020, £2 billion will be invested into walking and cycling over five years to support the ambition for half of all journeys in towns and cities to be walked or cycled by 2030.

A.2.2 Heat and Buildings Strategy

The Heat and Buildings Strategy, released in 2021, sets out a pathway to high-efficiency low-carbon buildings. The strategy emphasises that this transition must take into account individual, local and regional circumstances. The transition focuses on reducing fuel bills, improving comfort and building markets required to improve energy efficiency.

The Heat and Building Strategy highlights that to meet Net Zero, virtually all heat in buildings will need to be decarbonised. To achieve this, it will mean a mix of low-carbon heating technology including electrification of heating through heat pumps, heat networks and potentially using the natural gas network with low-carbon hydrogen.

The strategy acknowledges that reducing energy consumption through greater building efficiency is the first stepping-stone to achieving net-zero carbon. This is to be achieved through a 'fabric-first' approach; focusing on installing measure that upgrade the fabric of a building, improving wall and loft insulation, before making changes to the heating system. The Heat and Buildings Strategy refers to this as 'no- and low-regrets' action, as making fabric improvements will have benefits regardless of the heating technology changes in the future.

In order to facilitate this transition, the strategy aims to reduce the cost of fabric-first improvements as well as low-carbon heating. By creating a market that is affordable for the transition to take place to meet the target that as many homes as possible to achieve EPC C where cost-effective, reducing energy-consumption of public sector buildings by 75%, and minimum efficiency standard of EPC B for privately rented commercial buildings by 2030.

A.2.3 Energy White Paper

The Energy White Paper, released in 2020, outlines the UK's pathway to net zero. The paper describes a 'green revolution' across the UK, covering the UK electrical grid, the transport sector, protecting the natural environment, CCUS, green finance/innovation, and green buildings.

Building on the Energy White Paper, the government has released the British Energy Security Strategy in 2022. The Strategy puts an emphasis on producing low carbon solutions and delivering net zero-carbon solutions by 2050. This includes a focus on expanding new civil nuclear power, reducing reliance on foreign oil and gas, increasing ambitions for offshore wind to deliver 50GW by 2030, and developing hydrogen technologies.The British Energy Security Strategy has limited development on energy efficiency improvements for buildings from the Heat and Buildings strategy. The government are incentivising the market by offering zero-rating VAT for the next 5 years on installation of energy saving materials, launching the £450 million boiler upgrade scheme to increase the uptake of heat pumps.

A.2.4 Transport Decarbonisation Plan

The Transport Decarbonisation Plan, released in 2021, aims to decarbonise all forms of transport through a range of multi-modal commitments. The plan presents a path to net zero transport in the UK, and considers the wider benefits it can deliver. This is followed by commitments with associated actions and timings, for example for increased cycling and walking, zero emissions buses and coaches and a zero-emission fleet of cars, vans, motorcycles and scooters. The move to electric vehicles (EVs) is considered, including the current incentives to promote the uptake of EVs. Co-benefits such as air quality improvements, opportunities for jobs and growth, and reduced noise pollution are also considered in the Plan. This Plan follows the Road to Zero Strategy report (2018), which sets an aim for all new cars and vans to be effectively zero-emission by 2040, and for 100% of the central government car fleet to be ultra-low emission by 2030. This report also covers in more detail the infrastructure needs to develop electric vehicle networks.

A.2.5 Build Back Better Strategy

The Build Back Better Strategy, released in 2021, addresses growth and development through the lens of COVID-19 recovery. The Strategy considers three core pillars of growth: infrastructure, skills, and innovation. The Strategy commits to support the transition to Net Zero. Within the pillar of infrastructure, there is a commitment to "Help achieve net zero via £12 billion of funding for projects through the Ten Point Plan for a Green Industrial Revolution."

The Strategy relates to and builds upon previous documents including the Industrial Strategy (2017), which set out a cross-economy approach to boost productivity and the Clean Growth Strategy (2017), which sets out a set of policies and proposals that aim to accelerate the pace of "clean growth", i.e. deliver increased economic growth and decreased emissions.

A.2.6 Environment Act 2021

Under the Environment Act 2021, any developments requiring planning permissions will further need to consider biodiversity net gain (BNG). The concept of BNG is not new as it was already encouraged under the NPPF to help local authorities fulfil the requirements set out under Section 40 of the Natural Environment and Rural Communities Act 2006.[163] However, under the Environment Act, it is no longer optional as the Act requires developments to realise a gain in biodiversity value of 10%. BNG can be realised on-site, off-site or through credits, although credits should only be used as a last resort. The Environment Act is expected to come into effect in 2023.

[163] For more information, refer to: https://www.gov.uk/guidance/natural-environment#:~:text=What%20is%20biodiversity%20net%20gain,habitats%20in%20association%20with%20development.

A.3 Other local strategies and policies

A.3.1 Climate Change and Sustainable Construction SPD

The Climate Change and Sustainable Construction Supplementary Planning Document (SPD), adopted in 2022, aims to support development in the district (excluding the SDNP), to be accountable to the challenges of mitigating and adapting to climate change, and to address other sustainability issues covered by the adopted local plan policies (i.e., East Hampshire District Council Joint Core Strategy of 2014 and Hampshire County Council Minerals and Waste Plan of 2013). The SPD provides relatively high-level guidance, supplementing other local plans, policies and strategies.

This Supplementary Planning Document:

- Identifies design and energy-saving/efficiency measures that can result in a development minimising greenhouse gas emissions, energy use, and waste and creating places that are amenable to biodiversity and adaptable to a changing climate (including through the integration of green infrastructure).
- Provides guidance on renewable and low-carbon energy solutions, for reduced reliance on fossil fuels and finite energy sources, and for efficient use of National Grid energy for electricity and gas.
- Considers potential solutions to water shortages and water use efficiency requirements.
- Addresses the materials and methods used in construction; and
- Provides clear guidance for anyone applying for planning permission, or wishing to comment upon a planning application, as well as providing a consistent approach to assessing planning applications.

A.3.2 Sustainable Community Strategy

East Hampshire's Sustainable Community Strategy 2008 - 2026 is based on responses to a discussion document "Quality of Life in East Hampshire 2008". It sets out the policies and outcomes that all local organisations should work toward to improve the lives of local people. Three key themes were covered in the vision of the strategy:

1. Safe and strong communities
2. Economic prosperity and lifelong learning
3. Environment, infrastructure and transport

The third theme includes the vision for clean rivers and air and access to services and leisure opportunities via improved walking paths, roads and public transport.

A.3.3 Green Infrastructure Strategy

The Green Infrastructure Strategy (2019) guides future investment in East Hampshire's Green Infrastructure (GI) and provides up-to-date evidence to inform the East Hampshire Local Plan. It assesses the current state of GI in East Hampshire, identifies gaps in provisions and explores opportunities to improve the GI network. The Strategy identifies a number of GI projects to be delivered either by the Council and/or its partners, and identifies the key issues and opportunities associated with the following themes:

- Landscape, heritage and sense of place
- Biodiversity
- Woodlands and associated habitats
- Water environment
- Access, recreation and transport
- Local awareness
- Health, wellbeing and inequality

Working alongside the Suitable Alternative Natural Greenspace (SANGs) policy and the East Hampshire Open Space Study (2018), the GI Strategy will help to mitigate adverse environmental effects of development in the area, secure environmental enhancement and will be used to inform policies of the District's emerging Local Plan.

A.3.4 Local Cycling and Walking Infrastructure Plan

The East Hampshire Local Cycling and Walking Infrastructure Plan (LCWIP) was released in 2020 in response to the Government's Cycling and Walking Investment Strategy published in 2017, which sets out the ambition 'to make walking and cycling the natural choices for shorter journeys or as part of longer journeys'.

The LCWIP acts as an evidence base for the improvement of existing (and the development of future) walking and cycling networks across the district; it will also support relevant external funding bids for these infrastructure schemes. The first phase of the plan was to provide a technical report to examine the required infrastructure improvements in the existing walking and cycle network. The next phase is to outline the priority infrastructure schemes within the district where the greatest impact can be achieved, supported by the technical report. The combined documents of the LCWIP will provide an evidence base for future funding bids and a reference tool to inform other locally emerging policy specific to walking and cycling infrastructure.

A.3.5 Infrastructure Delivery Plan

The Infrastructure Delivery Plan (2015) provides an assessment of the infrastructure required to support the planned new development in East Hampshire District, contributing to the evidence base for the East Hampshire District Local Plan: Joint Core Strategy. The Plan allows the Council to meet the requirements of the NPPF, delivering the necessary infrastructure to support new development.

A.3.6 East Hampshire Corporate Strategy

The East Hampshire Corporate Strategy (2020-2024), updated in 2022, focuses on the following priorities:

- A fit for purpose council
- A safer, healthier and more active East Hampshire
- A thriving local economy with infrastructure to support its ambitions
- An environmentally aware and cleaner East Hampshire

A range of priorities and associated actions are presented in the Plan. The most recent update to the document highlights the importance of making long-term improvements to the area as part of recovery from the coronavirus pandemic, providing resources to reach net zero carbon in Council operations by 2050, requiring the highest possible environmental standards through the Planning process, and strengthening Planning Enforcement.

A.3.7 Biodiversity and Planning Guidance

EHDC's Biodiversity and Planning Guidance (2021) sets out clear guidance for the protection and enhancement of biodiversity within the East Hampshire Planning Authority Area (PAA), complementing the EHDC Local Plan. It aims to assist those involved with planning policy and development within the area: planners, developers, architects, consultants, local government members and councillors, and residents. The objectives of the document are:

- To provide a summary of the biodiversity of the East Hampshire Planning Authority Area;
- To provide clarity on how biodiversity can be protected and enhanced through the planning system;
- To set out the expectations for ecological planning submissions;
- To provide advice on the use of ecological network mapping;

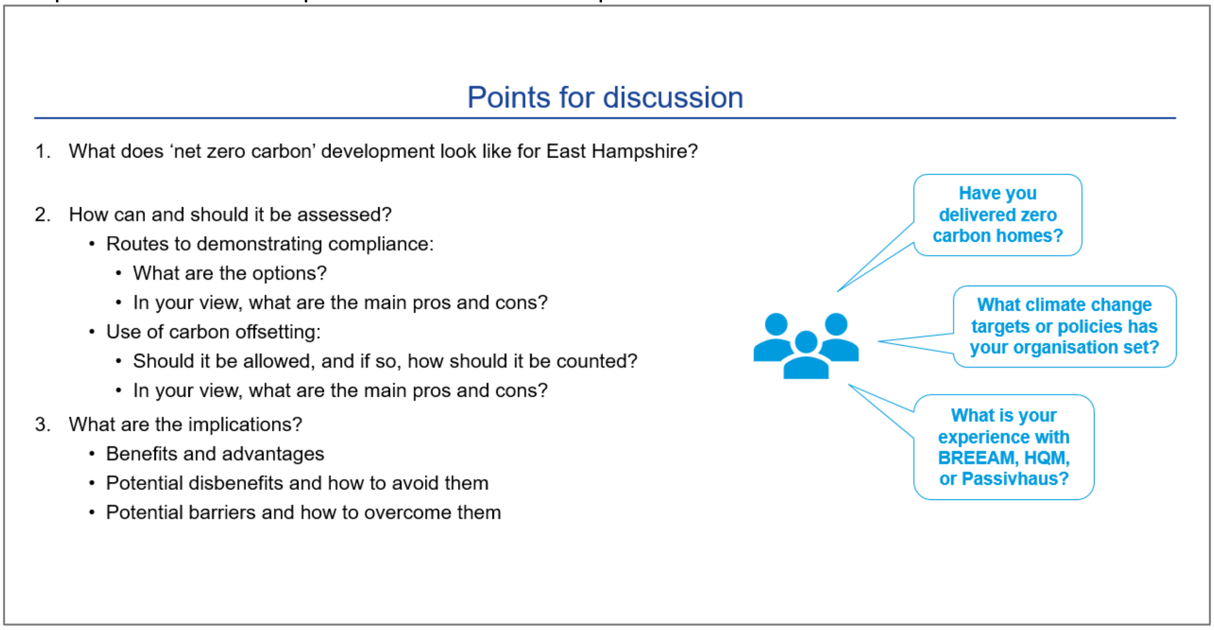
- To provide advice on achieving biodiversity net gains;
- To provide clarity on strategic measures relating to internationally designated nature conservation sites.

The Guidance relates to the Hampshire Biodiversity Action Plan (or BAP; last updated in 2009), which provided a means for auditing biodiversity and presenting a strategy for conserving biodiversity through measurable targets. Since 2010, the BAP system has been superseded by the UK Post-2010 Biodiversity Framework, which aims to halt biodiversity losses.

A.4 Notes from the virtual focus groups

A.4.1 Focus Group #1

The points for discussion presented to Focus Group #1 are shown below.



Broadly, attendees seemed supportive of the proposed net zero definition but reiterated the need to consider whole life-cycle (WLC) emissions from buildings, and from the development more broadly (e.g. transport).

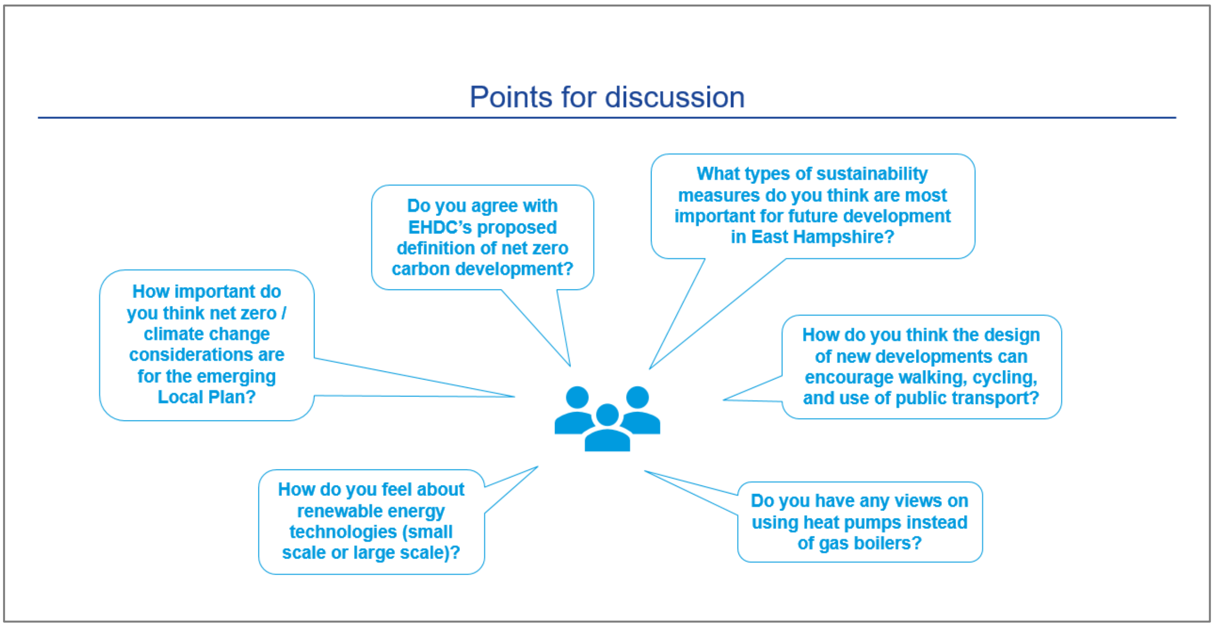
The relative pros and cons of different assessment methods were discussed. This focused on Passivhaus, BREEAM and the LETI standard. Participants described various pros and cons associated with all three of these, including the need to use different modelling software/methodologies compared with standard Building Regulations compliance calculations.

Participants highlighted their personal experience of striving for best practice, including building to 'Passivhaus equivalent' standards and potentially incorporating LETI standards into Local Plan policy in West Oxon and Winchester.

Carbon offsetting was considered potentially suitable, but participants highlighted a range of issues including (a) the need to guarantee emissions reductions onsite and (b) uncertainty about the price of carbon and the range of suitable, verified projects that would be achievable. Nature-based solutions that offer other environmental co-benefits were generally viewed positively although it was noted that these would not necessarily deliver the scale of carbon removal that is required.

8.3.1 Focus Group #2

The points for discussion presented to Focus Group #2 are shown below.



Participants were very supportive of the need for strong action on climate, biodiversity and other environmental topics.

They expressed a desire for new developments to go above and beyond minimum requirements, including through energy efficiency, renewable energy technologies and measures to promote biodiversity (e.g. green roofs and landscaping). They also highlighted the need to reduce existing sources of emissions, in particular, highlighting reliance on private vehicles.

Some of the other ideas put forward included: Use of demand-responsive or shared transport; community energy schemes; district heating (where appropriate) and BREEAM standards.

Several participants asked questions about the local planning process overall, asking how the EHDC Plan would link to that of the South Downs National Park (SDNP), what EHDC could do to promote best practice prior to the adoption of the new local plan in c. 2024, and how existing guidance should be used by planning committees.

A.5 Cost uplift compared with Part L 2021

This Appendix provides an estimate of the cost uplifts for different building types, re-baselining the results against Part L 2021. (In Table 5-1, some are compared against Part L 2013 or 2010.) ***These should be interpreted with caution because detailed cost calculations were not carried out.***

To do this, we have referred to the viability study for Cornwall Council, which reports cost uplifts in relation to both 2013 and 2021. Those results were used to derive the following conversion factors, which have been applied to Table 5-1:

Typology	Pt L 2021 is __ more expensive than Pt L 2013	Comments
Semi-detached	5.3%	
Mid-terrace	5.8%	
Detached	4.7%	
Low rise flats	1.6%	Not used
Medium rise flats	1.2%	Not used
Flats	1.4%	Average of 'Low' and 'Medium' rise
Average	**4.3%**	**Average of all typologies**

However, in some instances it was not possible to calculate equivalent figures due to a lack of information on comparable building typologies. Numbers in red indicate that they are compared against a baseline other than Part L 2021.

Source	Description	Capital costs (£/m^2)	Extra over costs (£/m^2)	£ uplift (£/unit)	% uplift	Standard assessed	Compared with…	Conversion factor used
Passivhaus Trust	Mid-terrace	1,529	110	-	7%	Passivhaus	Part L 2021	Mid-terrace
Passivhaus Trust	Mid-terrace	1,296	-101	-	-8%	Passivhaus	Part L 2021	Mid-terrace
Passivhaus Trust	Flats	1,453	110	-	8%	Passivhaus	Part L 2021	Flats
Passivhaus Trust	Terrace/Semi	1,751	345	-	20%	Passivhaus	Part L 2021	Average
Passivhaus Trust	Flats	1,807	462	-	26%	Passivhaus	Part L 2021	Flats
Passivhaus Trust	Mid-terrace	2,070	625	-	30%	Passivhaus	Part L 2021	Mid-terrace
Passivhaus Trust	Flats	1,542	189	-	14%	Passivhaus	Part L 2010	N/a
Passivhaus Trust	Mid-terrace	1,517	109	-	7%	Passivhaus	Part L 2021	Mid-terrace
Passivhaus Trust	Mid-terrace	2,035	594	-	29%	Passivhaus	Part L 2021	Mid-terrace
Passivhaus Trust	Terrace/Flats	1,966	564	-	29%	Passivhaus	Part L 2021	Average
Passivhaus Trust	Semi-detached	1,927	496	-	26%	Passivhaus	Part L 2021	Semi-detached
Passivhaus Trust	Mid-terrace	1,954	512	-	26%	Passivhaus	Part L 2021	Mid-terrace
CCC	Detached	1,430	-6	-661	0%	15 kWh/m^2/year	Part L 2021	Detached
CCC	Semi-detached	1,522	-21	-1,678	-1%	15 kWh/m^2/year	Part L 2021	Semi-detached
CCC	Low rise flats	1,389	7	451	0%	15 kWh/m^2/year	Part L 2021	Low rise flats
CCC	High rise flats	2,390	-77	-3,786	-3%	15 kWh/m^2/year	Part L 2021	Average
UKGBC	High-rise office	3,320	-	-	6%	Intermediate target	Part L 2013 (assumed)	N/a
UKGBC	High-rise office	3,370	-	-	8%	Stretch target 1	Part L 2013 (assumed)	N/a
UKGBC	High-rise office	3,660	-	-	17%	Stretch target 2	Part L 2013 (assumed)	N/a
UKGBC	High-rise residential	2,810	-	-	4%	Intermediate target	Part L 2013 (assumed)	N/a
UKGBC	High-rise residential	2,860	-	-	5%	Stretch target	Part L 2013 (assumed)	N/a
Cornwall	Semi-detached	1,553	13	1,196	1%	30 kWh/m^2/year	Part L 2021	Semi-detached

Cornwall	Mid-terrace	1,465	31	2,609	2%	30 kWh/m²/year	Part L 2021	Mid-terrace
Cornwall	Bungalow	1,634	20	2,115	1%	30 kWh/m²/year	Part L 2021	Bungalow
Cornwall	Detached	1,513	7	1,030	1%	30 kWh/m²/year	Part L 2021	Detached
Cornwall	Low rise flats	1,824	51	1,786	3%	30 kWh/m²/year	Part L 2021	Low rise flats
Cornwall	Medium rise flats	2,077	56	4,436	3%	30 kWh/m²/year	Part L 2021	Medium rise flats
Cornwall	Semi-detached	1,582	42	3,790	3%	15-20 kWh/m²/year	Part L 2021	Semi-detached
Cornwall	Mid-terrace	1,507	73	6,134	5%	15-20 kWh/m²/year	Part L 2021	Mid-terrace
Cornwall	Bungalow	1,681	66	7,058	4%	15-20 kWh/m²/year	Part L 2021	Bungalow
Cornwall	Detached	1,553	48	6,894	3%	15-20 kWh/m²/year	Part L 2021	Detached
Cornwall	Low rise flats	1,845	71	6,698	4%	15-20 kWh/m²/year	Part L 2021	Low rise flats
Cornwall	Medium rise flats	2,087	63	5,277	3%	15-20 kWh/m²/year	Part L 2021	Medium rise flats
Cornwall	Non-residential	-	-	-	4%	BREEAM 'Excellent' + offset to net zero	Part L 2021	N/a
Greater Cambridge	Semi-detached	-	-	6,101	5%	15-20 kWh/m²/year	Part L 2021	Semi-detached
Greater Cambridge	Mid-terrace	-	-	7,724	7%	15-20 kWh/m²/year	Part L 2021	Mid-terrace
Greater Cambridge	Block of flats	-	-	216,740	4%	15-20 kWh/m²/year	Part L 2021	Block of flats
Greater Cambridge	School			208,865	0%	55 kWh/m2/year	Part L 2013 (assumed)	N/a
Winchester	Semi-detached	1,535	85	7,905	6%	15 kWh/m²/year	Part L 2021	Semi-detached
Winchester	Detached	1,508	68	9,656	5%	15 kWh/m²/year	Part L 2021	Detached

To summarise, the results suggest a range of potential cost outcomes for delivering ultra-high efficiency or net zero carbon development. The ones that are likely to be most relevant to EHDC[177] are those from the Cornwall, Greater Cambridge and Winchester studies, considering the development typologies likely to come forward, the need to compare results against Part L 2021, and the fact that these studies specifically looked at metrics based on the LETI standard. An unweighted average of the results for different typologies, as reported in those three studies, suggests that meeting the LETI standard would incur a cost uplift of 3-5% compared against Part L 2021. As explained previously, this is a rough estimate and should be interpreted with some caution.

[177] Considering the development typologies likely to come forward, the need to compare results against Part L 2021, and the fact that these studies specifically looked at metrics based on the LETI standard.

A.6 Profile of the building stock in East Hampshire

To ensure that the policy recommendations in this report are relevant to East Hampshire, we have carried out an analysis of the existing building stock (including heating systems and renewable energy technologies) and the proposed scale and type of future new developments expected to be delivered over the Local Plan period. Results are described below.

A.6.1 General characteristics

There are approximately 50,000-51,000 dwellings in East Hampshire, which is home to around 120,000 people.[178] The district is predominantly rural. Around one third of households are distributed across large areas with a low population density, while around two thirds of households live in urban areas (i.e. towns).

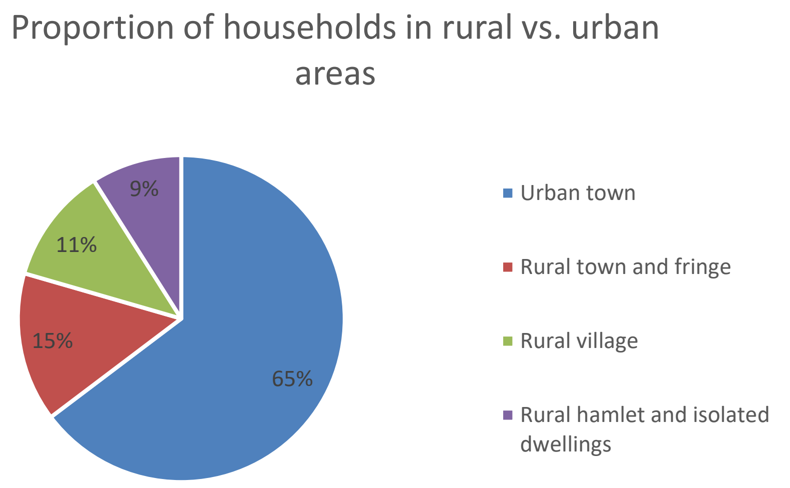


Figure 8-1. A breakdown of dwellings in East Hampshire according to rural or urban location.

Around 42% of homes are detached, 25% are semi-detached, 18% are terraced, and 14% are flats, maisonettes or apartments. These proportions vary by age band. Compared with the stock average, buildings constructed since 1999 are much less likely to be detached and much more likely to be flats.

[178] Census 2011, accounting for new buildings constructed since then.

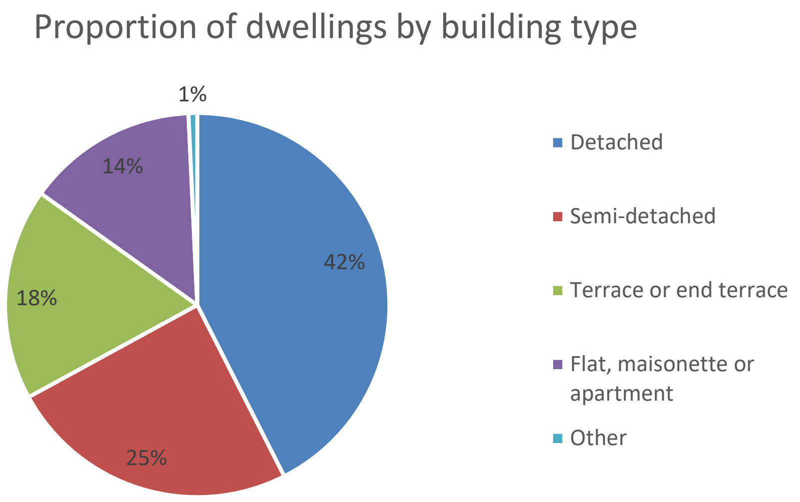


Figure 8-2. A breakdown of dwellings in East Hampshire according to building type.

The chart below presents an estimate of the number of dwellings in East Hampshire by age and type.[179]

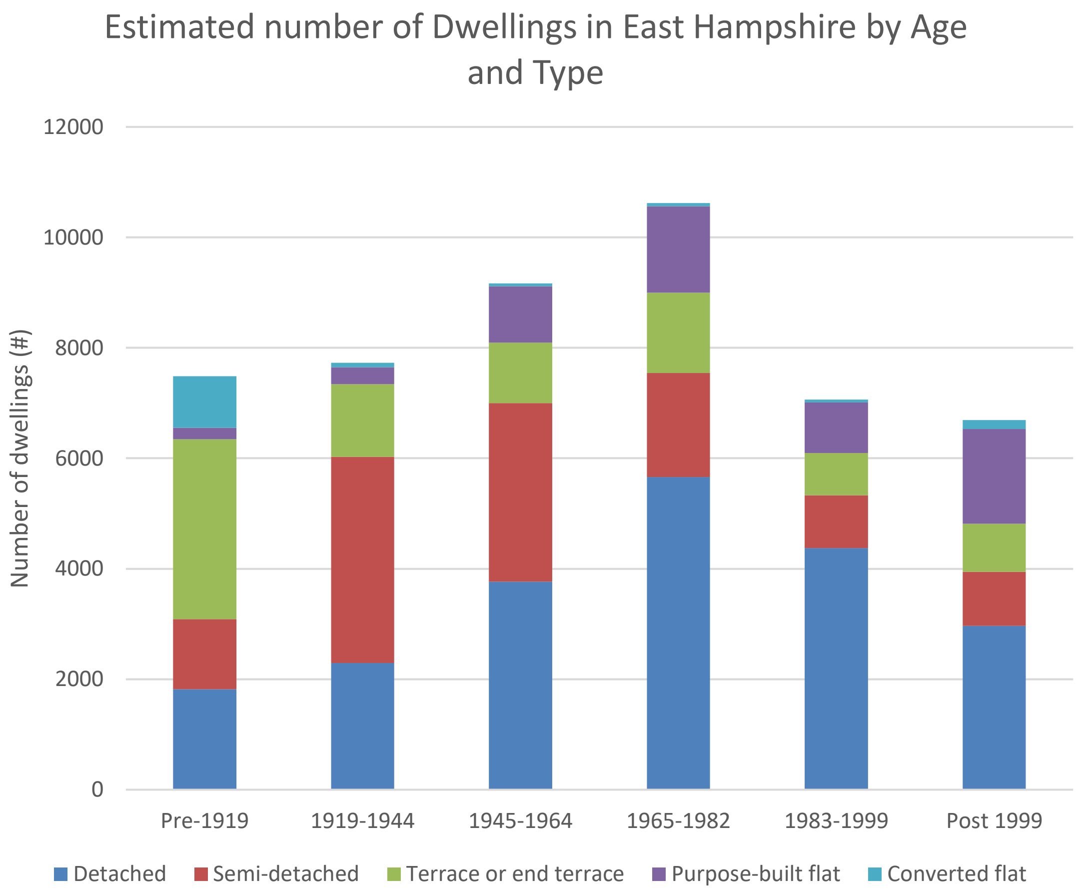


Figure 8-3. A breakdown of dwellings in East Hampshire according to building age and building type.

179 Based on building types in East Hampshire as per the Census 2011, with a split of age bands applied based on the National Energy Efficiency Database. Note that the NEED figures are for all of Great Britain, so this is only a rough estimate.

A.6.2 Fuel consumption

According to fuel consumption statistics from 2020, gas and electricity consumption in domestic buildings was higher in East Hampshire than in most other local authorities within Hampshire. This is likely due to a wide combination of factors, including but not limited to: local climate and weather patterns; typical property ages, sizes, and types; household income and tenure; and occupant habits.

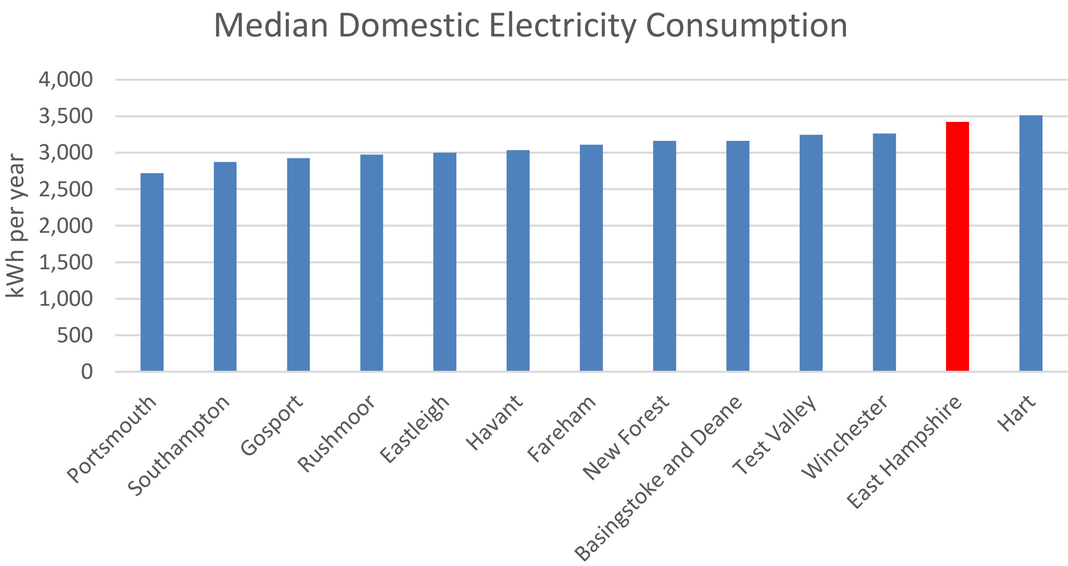


Figure 8-4. Median domestic electricity consumption for Local Authorities (LAs) in Hampshire, including East Hampshire (highlighted in red).

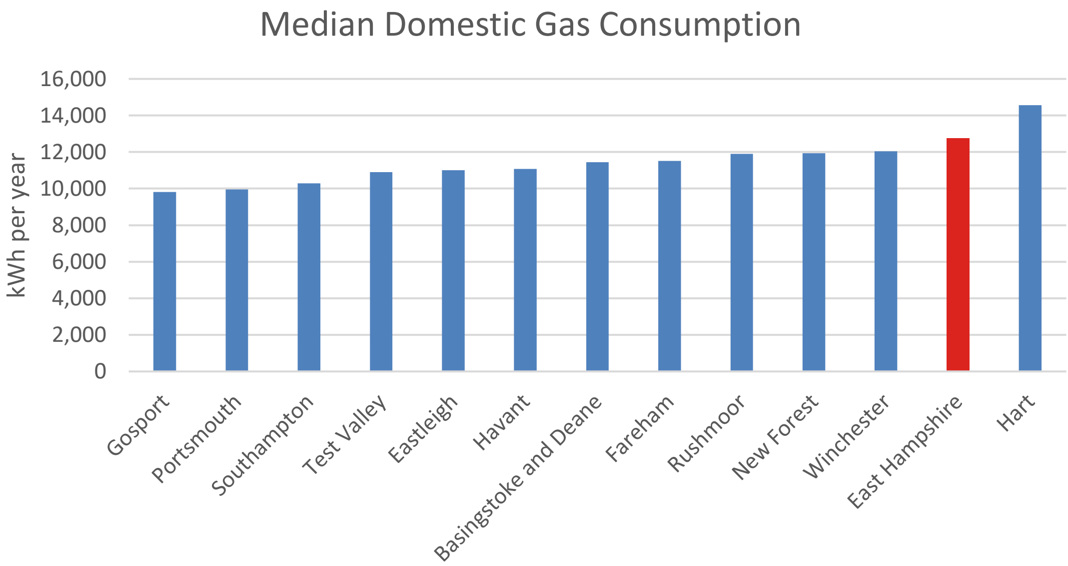


Figure 8-5. Median domestic gas consumption for Local Authorities (LAs) in Hampshire, including East Hampshire (highlighted in red).

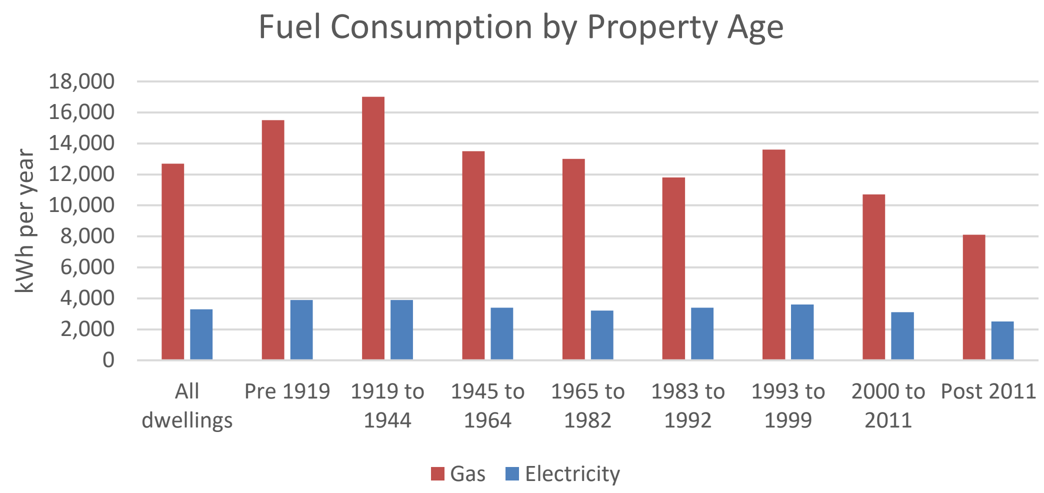


Figure 8-6. Fuel consumption by property age for dwellings in East Hampshire.

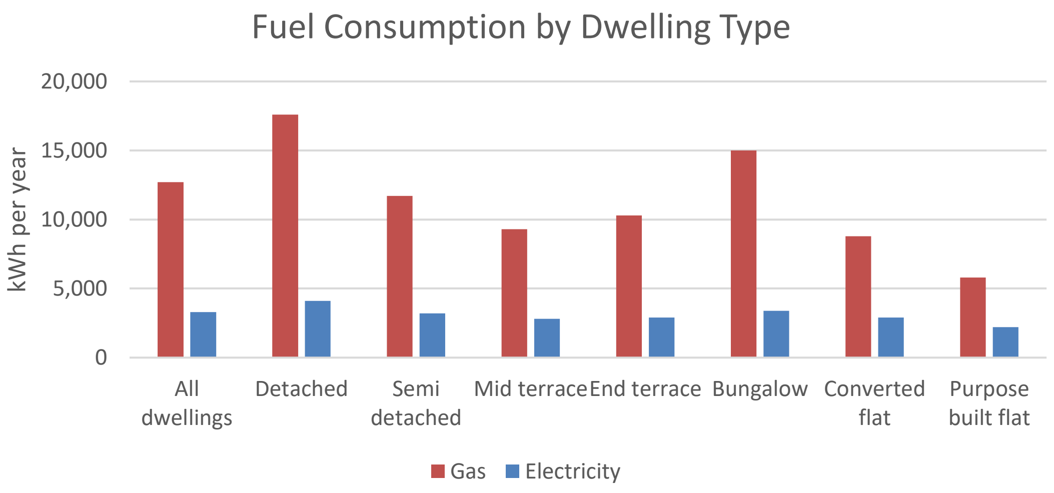


Figure 8-7. Fuel consumption by dwelling type for buildings in East Hampshire.

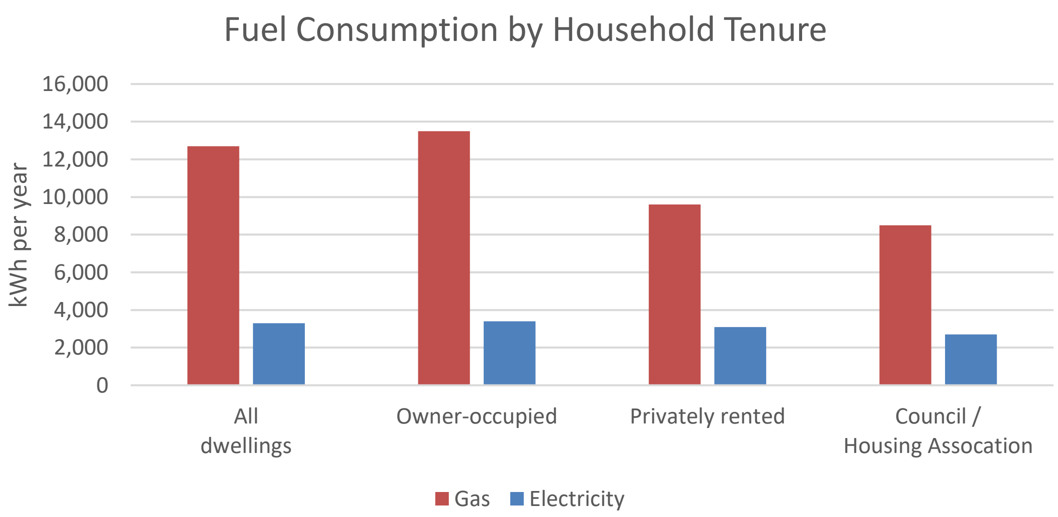


Figure 8-8. Fuel consumption by household tenure for dwellings in East Hampshire.

Although there are multiple factors at play, one notable trend can be seen in Figure 8-9 below, which shows median gas consumption by property age. This can be thought of as a rough proxy for space heating demand. Although it is not linear, there is a clear downward trend over time, particularly since the 1990s, which is likely to be associated with the increasing energy efficiency standards for buildings that have been introduced since then. The chart shows that homes built in East Hampshire since 2011 consume, on average, around half as much gas as those built prior to World War II.

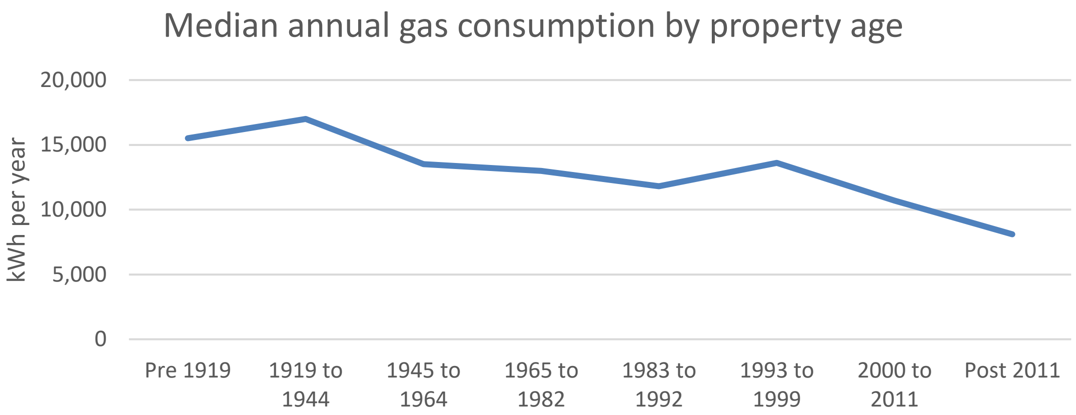


Figure 8-9. Median annual gas consumption in East Hampshire, disaggregated by property age.

A.6.3 Energy efficiency

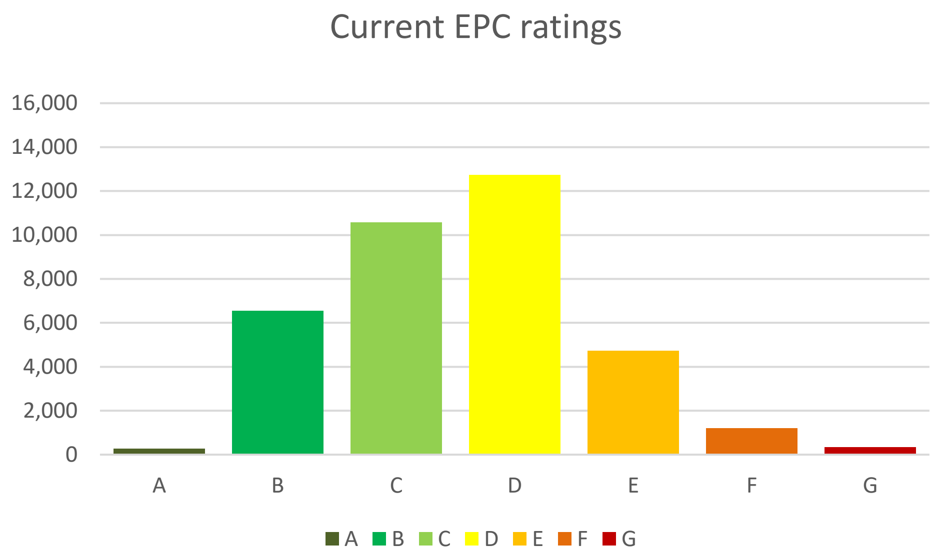


Figure 8-10. A breakdown of EPC ratings for domestic buildings in the East Hampshire District. Data source: Department for Communities and Local Government.

In East Hampshire District, there are approximately 500 properties on the Carbon Saving Obligation (CSO) Scheme[180] which is a UK government scheme designed to assist low-income households in paying for hard-to-treat cavity wall insulation and solid walls.[181]

[180] Kiln on behalf of Affordable Warmth Solutions, *'Non-gas map'* (n.d.). Available at: https://www.nongasmap.org.uk/

[181] For more information, refer to: https://ukenergysupport.co.uk/carbon-saving-obligation/

A.6.4 Heating systems

Like most of the rest of the UK, the majority of homes in East Hampshire (c. 76%) are heated using gas boilers. Most of the remainder are heated using electricity, oil, or two or more types of central heating. Across East Hampshire as a whole, around 18% of properties are off the gas grid entirely, but this figure varies; it is lower in towns and higher in rural areas.[182]

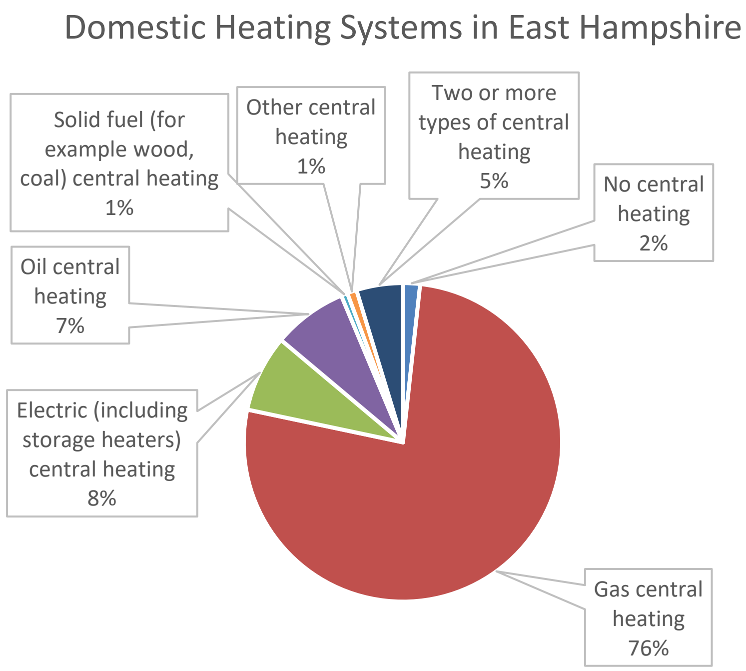


Figure 8-11. The different types of heating systems present in East Hampshire, and their prevalence.

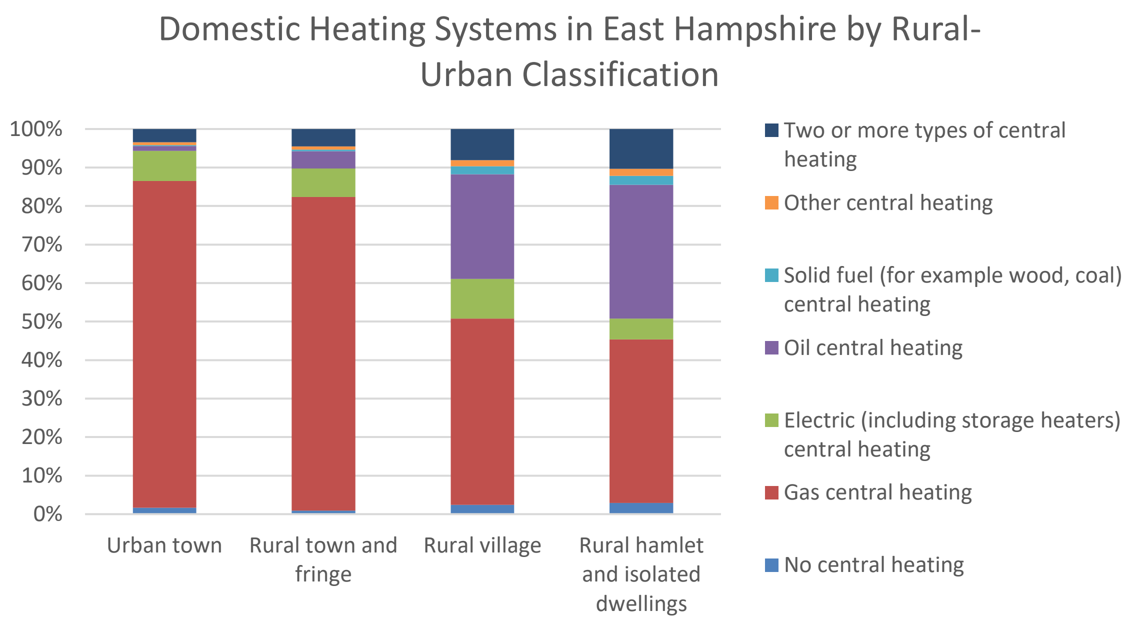


Figure 8-12. The different types of heating systems present in East Hampshire and their prevalence across different rural-urban classifications.

[182] Based on the ratio of domestic electricity meters to domestic gas meters as per the BEIS Sub-national Fuel Consumption Statistics, which can be used as a rough proxy.

Available data[183] suggests that there are a comparatively small number of renewable and low carbon heating systems in use in East Hampshire. As of December 2021, there were 304 accredited installations in East Hampshire registered under the domestic Renewable Heat Incentive scheme. This is the fourth highest number of installations in Hampshire (out of 11 authorities), behind Basingstoke and Deane (430), Winchester (366) and Test Valley (340). The lowest number of accredited installations in Hampshire are found in Rushmoor (16) and Gosport (14).

As shown in the chart below, more than half of the installations in East Hampshire were air source heat pumps (ASHPs), but there are also records of ground source heat pumps (GSHPs), biomass boilers, and solar thermal systems.

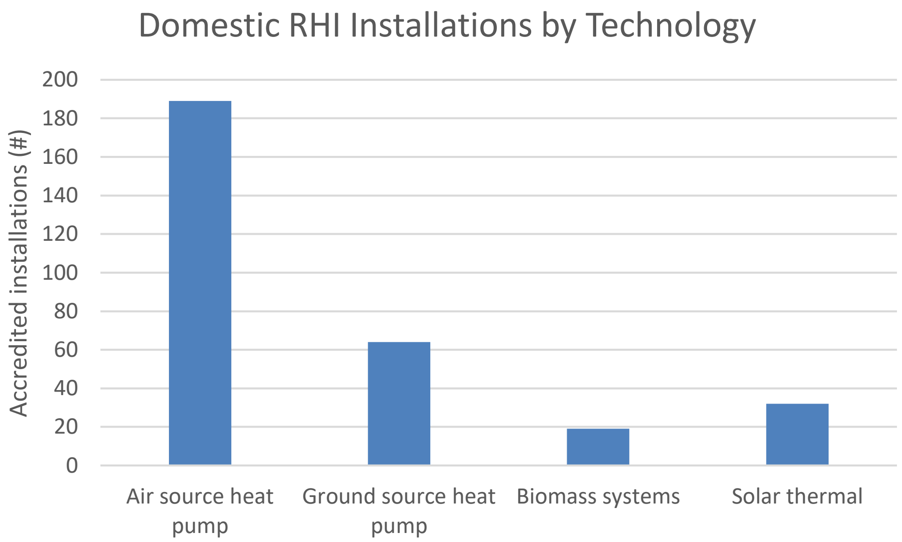


Figure 8-13. Domestic Renewable Heat Incentive (RHI) accredited installations in East Hampshire (as of December 2021) disaggregated by technology. Source: RHI

A.6.5 Building-integrated renewable electricity technologies

According to the BEIS Regional Renewable Statistics (RRS), there are roughly 2,970 solar photovoltaic (PV) installations in East Hampshire, producing nearly 50 MWh of renewable electricity per year.[184] The majority of this electricity comes from a small number of large-scale solar farms in the district.[185] However, in terms of the number of installations, the vast majority are domestic roof-mounted PV arrays.[186] There are also two records of onshore wind installations; based on the very small installed capacity, these are assumed to be micro-scale turbines.

Table 8-1. A summary of renewable energy installations in East Hampshire. Source: RRS

	Photovoltaics	Onshore Wind
Number of installations (#)	2,970	2
Installed capacity (MWp)	48	0.01

[183] BEIS, *'RHI Monthly Deployment Data'* (2021). Available at: https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-december-2021-annual-edition

[184] BEIS, *'Regional Renewable Statistics'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/861834/CFR-Dec2019_LA_Count.pdf

[185] According to the Renewable Energy Planning Database (Q4 2021) there are five operational large-scale PV farms totalling c. 37.4 MWp of capacity. On that basis, we estimate that there is c. 10-11 MW capacity of roof-mounted PV installations with an average size of roughly 3.5 kWp.

[186] As of the end of 2020 there were 2,970 PV installations listed in the RRS (including domestic and non-domestic installations). Government statistics from March 2019 indicated that there were more than 2,500 domestic installations in East Hampshire.

Generation (MWh)	48,634	33
MWh/MWp	1,015	2,717

A.6.6 Implications for GHG emissions and the net zero target

Some general observations are set out below:

- Existing domestic buildings in East Hampshire have higher than average fuel consumption compared with the rest of the County, even though the average EPC rating (a proxy for energy efficiency) is the same. This is linked to a variety of factors, such as building age, size, type, tenure, household income, and so on.
- Although RHI data does not list every heat pump in operation, it suggests that (as in the rest of the country) current rates of heat pump deployment are low, while most households use gas central heating. This means that a large number of heating system replacements will be needed before 2050 in order to reach net zero emissions.
- Because the District is predominantly rural, there are likely to be fewer opportunities for district heat networks (DHNs) in existing buildings. DHNs rely on high and consistent heat loads to be cost-effective, so this is likely to be true for new buildings as well, assuming that the new development densities are similarly low.
- The rural nature of the district likely to mean that roads and other infrastructure works may have a bigger impact on overall GHG emissions of new development.
- On the other hand, greenfield developments have fewer existing constraints (e.g. overshading) so there may be more opportunity to incorporate passive design measures and onsite renewable power generation.
- Rural areas are less likely to have gas connection at present – so it will be important to make sure that 100% of new builds in these areas use electric (heat pumps) instead of any new gas connections or other fossil fuel heating systems.

A.7 Potential impacts of EHDC's tree planting initiative

EHDC's target in context

EHDC has committed to planting 120,000 trees as part of their response to the climate emergency, which the Council declared in 2019. This will be carried out in cooperation with the Woodland Trust, landowners, parish and town councils, schools, and communities.[107] This target would require 75 hectares (ha) of land to be made available, or 0.15% of East Hampshire's total area. To put the target further into context, an analysis by the CCC suggests that UK woodland cover needs to be increased from 13% to 19%, requiring an additional 1.5 million ha of woodland to be established by 2050.[188] According to the Woodland Trust, this would amount to around 1.5 billion trees[189] – or 22 trees per person in the UK. To apply this to East Hampshire, this would mean an increase of the current target by a factor of 22 which would require c. 3-4% of East Hampshire's total land area.[190]

A stocktake of current emissions in East Hampshire shows an estimated total of ~648 $ktCO_2e$ including existing GHG sequestration from land use, land use change and forestry (LULUCF) and excluding scope 3 emissions.[122,192] As expected for a UK local authority, the largest share of emissions stems from transport and the domestic sector. Agricultural emissions stand out as particularly high, accounting for around 11% of the total (see Figure 8-14). Using the WCC calculation spreadsheet, EDHC's tree planting target (120,000 trees) was translated into carbon sequestration potential. Assuming a growth period of 100 years, the average annual sequestration amounted to 0.36 $ktCO_2e$, or 0.05% of annual emissions in 2019. This is illustrated in Figure 8-14Figure 4-2 below.

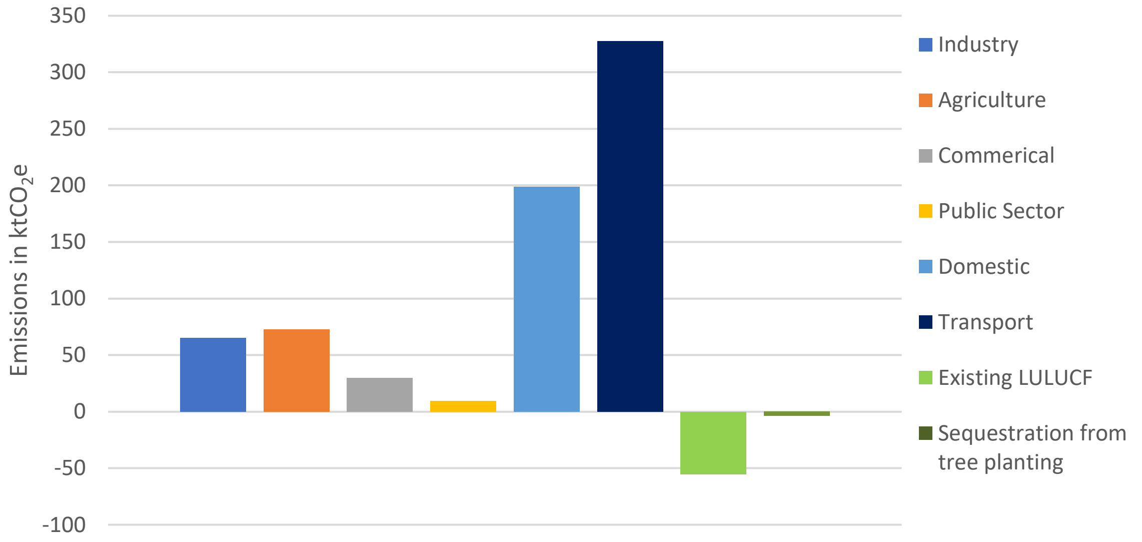


Figure 8-14. GHG emissions in East Hampshire, 2019. Sources: BEIS, NAEI, WCC

Even if the tree planting were to be increased by a factor of 22, it would only sequester 1-2% of East Hampshire's annual emissions. It should further be noted that initially (over the first ~5 years), emissions are expected to occur from soil carbon loss.

[188] CCC, *'Land use: Reducing emissions and preparing for climate change'* (2018). Available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Land-use-Reducing-emissions-and-preparing-for-climate-change-CCC-2018-1.pdf

[189] Woodland Trust, *'UK needs 50 million new trees a year'* (2019). Available at: https://www.woodlandtrust.org.uk/press-centre/2019/05/uk-needs-50-million-new-trees/

[190] Note that this is a rough calculation of how the UK-wide target would be applied to east Hampshire as the 1.5 billion trees would not be planted equally across more and less densely populated areas (e.g., London vs Lincolnshire) but was included to provide an indication of the scale of effort needed.

[192] BEIS, *'National Atmospheric Emissions Inventory Map'* (2021). Available at: https://naei.beis.gov.uk/emissionsapp/

Calculation methodology

To estimate the GHG sequestration potential from the 120,000 tree planting target, the carbon calculation spreadsheet created by the WCC was used to make several estimates.[193] It was assumed that the 120,000 trees consist of a mix of native broadleaves (species mix provided by WCC).[194] Further, to calculate CO_2e sequestration per ha, average spacing figures of 2.5m for broadleaves were assumed.[195,196] Overall, this resulted in a required area of 75 hectares (ha), or around 0.15% of East Hampshire's total land area.

To illustrate the difference in CO_2e sequestration, four scenarios were calculated using the base assumptions about tree species, spacing and land used as well as varying factors such as the previous land use (arable, pasture, or seminatural), soil type (mineral or organo-mineral), and soil disturbance (ranging from negligible to very high disturbance). Scenario 1 illustrates the standard selection as provided by the WCC, scenarios 2-4 were included to showcase the effects of land type and site preparation on initial (first ~5 years) and overall emissions (over 100 years). As the dominant soil type in East Hampshire is mineral soil[197], no scenarios with organo-mineral soil were calculated. Both arable- and pastureland are present in the region[198] and were therefore used for the scenarios. Note that these are only rough estimates to provide an indication of the scale of GHG sequestration.

Table 8-2. Carbon sequestration estimates under four different scenarios. Source: WCC

		Scenario			
		1	2	3	4
Base assumptions	Tree type	Pedunculate oak (20%), Sycamore (20%), Burch (20%), Alder (10%), Rowan (10%), Aspen (8%), Hazel (7), Goat Willow (5%)			
	Land used (ha)	75 hectares			
	Spacing	2.5 m			
Scenario assumptions	Previous land use	arable	arable	pasture	pasture
	Soil type	mineral	mineral	mineral	mineral
	Soil disturbance	low	high	low	high
Results (in $ktCO_2e$)	5 years	0.1	-0.6	0.0	-0.7
	10 years	0.7	0.1	0.2	-0.5
	15 years	2.8	2.2	0.9	0.2
	20 years	6.7	6.1	3.0	2.3
	25 years	10.6	9.9	7.5	6.8
	Annual Average over 100 years	3.6	3.5	3.6	3.5

[193] WCC, *'Standard & Guidance: Project Carbon Sequestration'* (n.d.). Available at: https://www.woodlandcarboncode.org.uk/standard-and-guidance/3-carbon-sequestration/3-3-project-carbon-sequestration

[194] WCC, *'How to create a carbon estimate from the Carbon Lookup Tables'* (n.d.). Available at: https://www.woodlandcarboncode.org.uk/images/PDFs/WCC_CarbonCalculation_Guidance_V2.4_March2021.pdf

[195] Ibid.

[196] WCC, *'Creating Woodland – How to Plant Trees'* (n.d.). Available at: https://www.creatingtomorrowsforests.co.uk/blog/creating-woodland-how-to-plant-trees

[197] Cranfield University Soil and Agrifood Institute, *'Soilscapes map'* (n.d.). Available at: http://www.landis.org.uk/soilscapes/

[198] Copernicus Land Monitoring Service, *'CLC 2018 Map'* (2018). Available at: https://land.copernicus.eu/pan-european/corine-land-cover/clc2018

As shown in Table 8-2, GHG savings do not occur from year one – in fact, over the first 5 years, emissions are expected to occur from soil carbon loss which cannot be compensated for by the tree saplings in scenarios 2 and 4 (high soil disturbance). The degree of this varies depending on the land type, soil type and level of soil disturbance with scenarios 1 and 3 showing no emissions but no or negligible sequestration figures (low soil disturbance). However, even over 100 years, the average CO_2e sequestration is only around 0.4 ktCO_2e, or 0.05% of annual emissions in 2019. This figure could be increased through more tree planting; however, even if the target was to be increased by a factor of 22 to match the UK-wide tree planting need set out by the CCC, this would require c. 3-4% of East Hampshire's total area while only sequestering the equivalent of around 1-2% of annual emissions as of 2019.

A.8 Esri land cover definitions

Land Cover Classification	Definition
Water	Areas where water was predominantly present throughout the year; may not cover areas with sporadic or ephemeral water; contains little to no sparse vegetation, no rock outcrop nor built up features like docks.
Trees	Any significant clustering of tall (~15-m or higher) dense vegetation, typically with a closed or dense canopy/.
Flooded Vegetation	Areas of any type of vegetation with obvious intermixing of water throughout a majority of the year; seasonally flooded area that is a mix of grass/shrub/trees/bare ground.
Crops	Human planted/plotted cereals, grasses, and crops not at tree height.
Built Area	Human made structures; major road and rail networks; large homogenous impervious surfaces including parking structures, office buildings and residential housing.
Bare Ground	Areas of rock or soil with very sparse to no vegetation for the entire year; large areas of sand and deserts with no to little vegetation.
Rangeland/Grassland	Open areas covered in homogenous grasses with little to no taller vegetation; wild cereals and grasses with no obvious human plotting (i.e., not a plotted field); examples: natural meadows and fields with sparse to no tree cover, open savanna with few to no trees, parks/golf courses/lawns, pastures. Mix of small clusters of plants or single plants dispersed on a landscape that shows exposed soil or rock; scrub-filled clearings within dense forests that are clearly not taller than trees.

A.9 Assumptions used to compare emissions from 1 new dwelling

	High estimate	Low estimate	Typical	Units	Type	Comment
Buildings embodied carbon	81.60	48.96		tCO_2e	One-off/ intermittent	Assuming typical practice is around 850 $kgCO_2e/m^2$ and average floor area of 96 m^2; low estimate assumes 40% lower embodied carbon in line with LETI recommendations
Land conversion to settlement	16.80	0.25	0.9	tCO_2e	One-off	Assuming LULUCF emissions of 5-336 tCO_2e/ha and a development density of 20 dwellings per hectare[199]
Buildings (net) energy use	1.90	0.00		tCO_2e	Annual	High estimate is typical consumption for a gas-heated home; low estimate assumes net zero operational energy due to on-site PV
Transport energy use	3.25	0.63		tCO_2e	Annual	High estimate reflects petrol/diesel car in rural location; low estimate reflects EV in urban location AND 15% reduction in vehicle kilometres due to design of development

[199] A study by EHDC found development densities to be consistently very low across the District. EHDC, *'Neighbourhood Character Study'* (2018). Available at: https://cdn.easthants.gov.uk/public/documents/5EastHantsNCSReportSection5Chapter5to7FINALDec2018.pdf#:~:text=The%20net%20residential%20densities%20of,(dpha)%20to%20around%2023dpha.

Water supply and treatment	0.04	0.04		tCO_2e	Annual	Assuming 2.29 people per dwelling on average; high estimate is typical Part G requirement (125 l/p/d) and low estimate reflects optional Part G standard (110 l/p/d)
Waste			0.14	tCO_2e	Annual	Per capita emissions from waste management in New Hampshire as per LA GHG data and assuming 2.29 people per dwelling on average
F-gases from domestic heat pumps			0.01	tCO_2e	Annual/ intermittent	Based on 2kg refrigerant content, 3.5% annual leakage rate and leading to 0.07 kg leakage per year and refrigerant GWP of 667. High estimate assumes that the system leaks; low estimate assumes no leakage.

A.10 GHG emissions in a 'Business as Usual' scenario

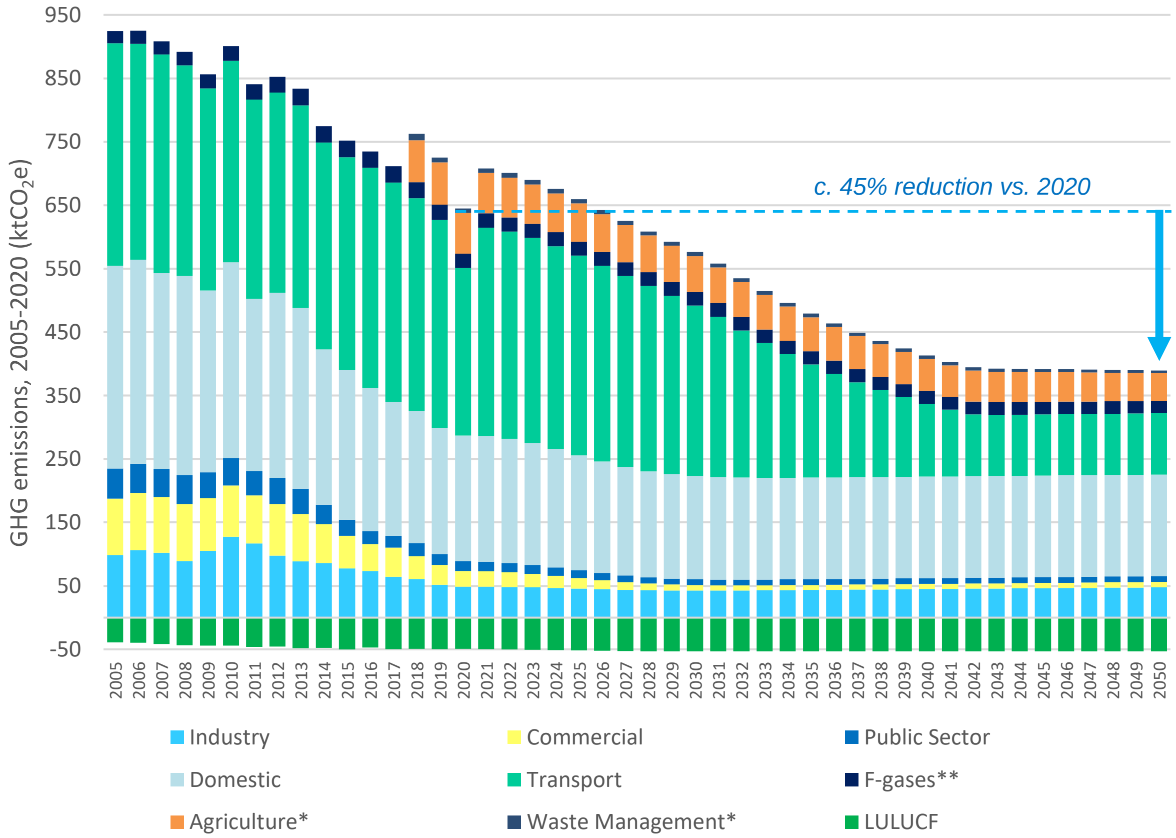
A 'Business as Usual' (BAU) scenario has been modelled to estimate the potential change in GHG emissions that may occur if no further local action is taken. The BAU scenario uses historic and baseline emissions as per the UK national and local authority GHG inventories. These are then projected forward using average annual growth rates for each sector and fuel type, as reported in the BEIS Energy and Emissions Projections (EEP). This provides a *rough* estimate of the impact of:

- Economic growth
- Population changes
- Technological and industrial efficiency improvements
- Government policies relating to energy use and carbon emissions (where these are supported by legislation and funding, and where there is sufficient data to undertake an assessment)

New development is *not* included as a separate variable in this scenario; the potential effects are assessed in more detail in Section 7.

The calculations further assume that there will be a major increase in EV uptake taking place in the coming decade, and that the national electricity grid will undergo a significant reduction in carbon intensity due to increasing use of renewables. Recognising that transport emissions in 2020 were unusually low due to the impacts of the Covid-19 pandemic and associated restrictions, we have assumed that these will return to 2019 levels from 2021 onwards and have projected emissions from transport on that basis.

Figure 8-15. GHG emissions in a BAU scenario



** BEIS does not report emissions from these sectors at a local authority level pre-2018.*

*** Estimate derived from the UK GHG Inventory, prorated by population.*

In this scenario, GHG emissions in East Hampshire would decrease by roughly 45% between now and 2050. The most significant reductions are due to the shift to EVs, and decarbonisation of grid electricity. From 2040 onwards, if there are no policies brought in to require the phase-out of fossil fuels, these reductions would be expected to slow, as the electricity grid would have decarbonised but demand for other fuels would continue to increase.

This estimate should be interpreted with caution, as there is a high level of uncertainty in trying to calculate emissions over this time period. In particular, note that the assumed rate and scale of electricity grid decarbonisation is considered to be highly optimistic, given the recent rates of renewable energy installations and policy landscape. Regardless, the calculation shows that the Government's current set of planned and adopted policies are not sufficient to deliver net zero emissions, and that further action – at both a national and local level – is urgently required.

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