Net Zero Local Plan Evidence Base

Report for Mid Sussex District Council

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1 Executive Summary

1.1 Introduction

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.[1] Over the past ten years, global greenhouse gas (GHG) emissions have reached their highest levels in human history, and without immediate and deep emissions reductions across all sectors, we will be unable to avoid dangerous impacts of climate change. Local governments can reduce their contribution to climate change by taking steps to mitigate GHG emissions, as well as preparing their area for any impacts through adaptation measures.

The purpose of this study is to provide Mid Sussex District Council (MSDC) with a sound evidence base to set District Plan policies and understand the impact of the spatial strategy on greenhouse gas (GHG) emissions. MSDC commissioned Ricardo and LUC to:

- Review the Regulation 18 draft District Plan policies;
- Identify and compare various alternative policy options and standards that could be set in the Regulation 19 District Plan;
- Assess opportunities for significant sites to meet higher energy and GHG emissions standards;
- Advise on the potential costs and viability implications of different approaches; and
- Quantify and explain how the policies and spatial strategy may impact future emissions in Mid Sussex.

These activities will help to ensure that the District Plan and spatial strategy together make a positive contribution to the wider net zero agenda as much as possible.

1.2 What are the drivers for reducing GHG emissions?

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. 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. It would also require a 78% reduction in emissions below 1990 levels by 2035.

At a local level, MSDC has affirmed its commitment to tackling climate change. On 2nd November 2022, **MSDC adopted its Net Zero targets.**[2] There are three specific targets:

- A District-wide net zero target aligned to the national target.
- A Council-only net zero target of 2040 for emissions the Council can directly control.
- A Council-only net zero target aligned to the national target for emissions the Council can only indirectly influence

In September 2022 a **Net Zero Carbon Emissions Feasibility and Options Study** was produced by Ricardo Energy & Environment that sets out the specific steps that MSDC and other stakeholders will need to take in order to meet these goals.

The Ricardo Net Zero Carbon Emissions Feasibility and Options Study identified the actions needed to be undertaken to achieve net zero within the identified timescales. This information is being used to develop the Council Net Zero Action Plan (direct and indirect emissions) which sets out the actions and

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

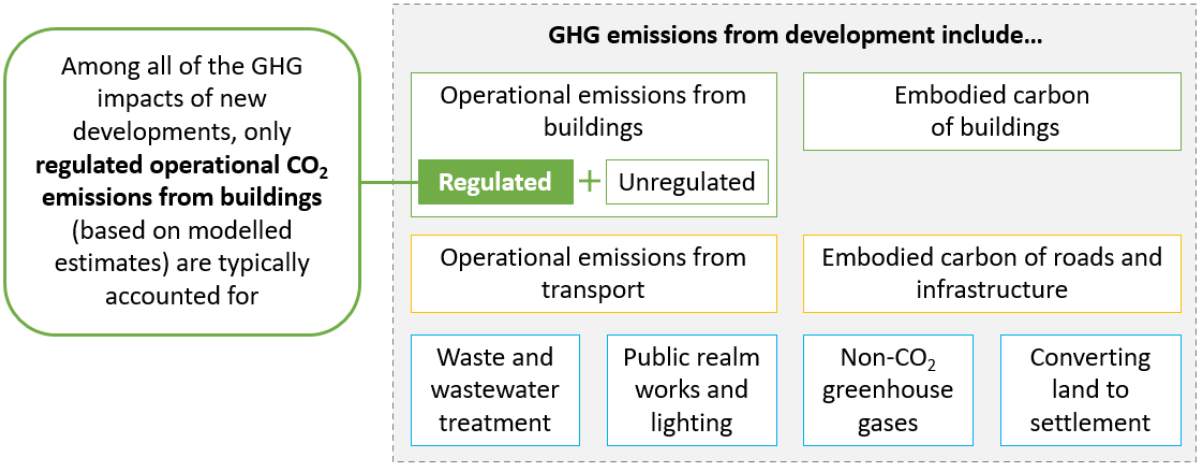
[2] For more information, refer to the MSDC website: https://www.midsussex.gov.uk/about-us/press-releases-and-publications/mid-sussex-district-council-set-net-zero-targets/

individual tasks required to achieve the adopted targets. It was considered that the actions identified by the Feasibility and Options Study to achieve the District-wide target were largely captured within the Sustainable Economy Strategy (April 2022) or intended to be secured through policies within the emerging District Plan.

Mid Sussex District Council only directly control 0.03% of the district's emissions. The vast majority exist beyond the Councils direct control and therefore depend on other mechanisms to influence behaviour change. A significant proportion (currently 30%) of the proposed actions, which are required to attain the district's net zero target, are covered by policies in the emerging District Plan. As this will carry statutory weight and be enforceable once adopted, the Council consider these policies to be essential to achieving the ambition of the Net Zero.

1.3 What are the GHG emissions impacts of new development?

The construction, operation, maintenance, and refurbishment of buildings and infrastructure all result in GHG emissions. Embodied emissions are those associated with the production of building materials, the energy used to transport them to the site, and the construction process itself. Operational emissions are those associated with the operation of the development once it is completed, which includes energy use in buildings, vehicles, water supply, public realm lighting, and so on. Over the course of a development's whole life-cycle, there are also additional emissions associated with repairs, maintenance, and decommissioning/demolition. Most of these sources are not typically accounted for as part of either the planning or Building Control process. This is illustrated in the diagram below. The diagram is not to scale.



Note: Diagram is not to scale

At present, around 80% of the annual GHG emissions associated with buildings are related to the ongoing operational emissions from the existing building stock. The remaining 20% is related to the embodied carbon impacts of new construction. However, as buildings become more energy efficient and electricity generation decarbonises, this balance will change. Operational emissions will reduce, and embodied carbon will become more significant, potentially representing 40-70% of whole life-cycle emissions in new low carbon buildings.[3]

1.4 How can the planning system contribute to lower emissions?

The Mid Sussex Net Zero Feasibility and Option Study highlighted that one of the most important ways that MSDC can influence future emissions within the District is through its role as a Local Planning Authority (LPA).

[3] LETI, *'Climate emergency design guide'* (2020). Available at: https://www.leti.uk/cedg

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.

Local Plans do so by setting out the strategic vision and priorities for development in the area, alongside more detailed policies related to sustainable design and construction. Typical examples[4] of such policies include:

- Requiring new developments to exceed the minimum energy and GHG performance standards set out in Part L of the UK Building Regulations
- Designing schemes to facilitate and encourage walking, cycling and use of public transport (e.g. by providing attractive pedestrian routes through the site, cycle storage, new bus stops, etc.)
- Inclusion of on-site renewable and low carbon energy technologies
- Evaluating the feasibility of delivering new heat networks and/or linking to existing ones
- Encouraging efficient use of water (e.g. with landscaping that requires minimal supplementary irrigation)
- Accounting for future climate change when assessing the risks of flooding or overheating

The spatial strategy can also contribute towards reducing emissions and climate change adaptation by:

- Choosing development sites that are resilient to the impacts of climate change (e.g. flooding, changes in annual temperatures and precipitation, etc.) over the development's lifetime
- Including a mix of uses and densities that will reduce reliance on private vehicles, both for the site occupants and other nearby residents/businesses
- Maximising opportunities to adopt sustainable design solutions, renewable energy technologies and heating/cooling networks via layout, orientation, massing, etc.
- Safeguarding existing carbon sinks (e.g. areas of woodland or grassland) and, more broadly, contributing towards an integrated green and blue infrastructure network

1.5 What GHG reduction requirements are LPAs allowed to set?

LPAs do not just have an opportunity to influence emissions – they are required to do so. 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.' The **Planning and Energy Act 2008** specifically enables local authorities to impose 'reasonable requirements' for:

> *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.*

Paragraph 152 of the **National Planning Policy Framework (NPPF)** states that the planning system 'should help to shape places in ways that contribute to radical reductions in greenhouse gas emissions.' Paragraph 153 of the NPPF, read in conjunction with footnote 53, requires that, 'plans should take a

[4] Note, these are intended to represent typical practice rather than best practice. More ambitious policy recommendations are described in Section 1.6 of this Executive Summary and Sections 3.2 and 5 of the main body report.

proactive approach to mitigating and adapting to climate change' in a way that is 'in line with the objectives and provisions of the Climate Change Act 2008'. These messages are reiterated in the **National Planning Practice Guidance (NPPG)**, which provides examples of how the planning process can contribute to climate change adaptation and mitigation.

To date, most LPAs that have set GHG performance requirements in their Local Plans (which is their only mechanism for doing so) have done so with reference to the **UK Building Regulations**, requiring developments to achieve a minimum (%) improvement over the minimum standards. The performance requirements in Building Regulations have become more stringent over time, and the Government has indicated that future updates will require buildings to be 'zero carbon ready'.[5]

However, that target only encompasses a sub-set of GHG emissions from new buildings. Only 'regulated' energy (building energy consumption resulting from fixed building services and fittings including heating, cooling, lighting and hot water) is covered by Building Regulations, but in order for the UK to reach net zero, it will also be necessary to address 'unregulated energy' use (e.g. energy use from cooking and other appliances).[6] Additional policies or regulatory mechanisms are therefore needed to secure truly net zero carbon development.

Despite the Planning and Energy Act 2008, in the past decade there has been some uncertainty as to whether Local Authorities are permitted to set standards that exceed Building Regulations.[7] At the time of writing (June 2023), the Government's current position, as expressed in the January 2021 Response to the Future Homes Standard Consultation and re-affirmed in June 2022 by the Department for Levelling Up, Housing and Communities (DLUHC) is that it *is* permitted.[8,9]

Unless new developments in Mid Sussex are designed to meet net zero standards, they will cause emissions in the District to increase rather than decrease. This is counterproductive to the UK's legally binding decarbonisation targets, which (according to the Climate Change Committee) are already at risk of not being achieved. It would also clearly go against the NPPF requirement that Local Plans should 'contribute to radical reductions in greenhouse gas emissions'. Setting net zero standards is in line with the powers granted to LPAs under the Planning and Energy Act 2008, and the Government has repeatedly confirmed that these powers still apply. On that basis, MSDC has the authority to adopt net zero standards in the new District Plan, and a clear obligation to do so.

[5] The term 'net zero ready' refers to buildings where 'No further energy efficiency retrofit work will be necessary to enable them to become zero-carbon as the electricity grid continues to decarbonise.'

Ministry of Housing, Communities & Local Government, *'The Future Homes Standard: Summary of responses received and Government response'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

[6] A more detailed description is provided in Section 7.

[7] A Written Ministerial Statement (WMS) issued in 2015 said that local authorities should 'not set conditions with requirements above a Code [for Sustainable Homes] Level 4 equivalent'. This was reflected in a subsequent update to the NPPG. Code Level 4 would have reduced GHG emissions by roughly 20% compared with Building Regulations in force at the time (Part L 2013). However, both of those documents have been superseded by subsequent changes to Building Regulations, as Part L 2021 requires roughly 31% lower emissions compared with Part L 2013. According to the Town and Country Planning Association (TCPA), 'Written Ministerial Statements and the NPPG are material considerations in plan preparation and planning decisions, but the level of weight placed on them will reflect (among other things) the extent to which they are up-to-date.' For more information, refer to TCPA, *'The application of net zero in local plan policy'* (2022). Available at: https://www.tcpa.org.uk/pins-assault-on-an-exemplary-net-zero-planning-policy/

[8] Ministry of Housing, Communities & Local Government, *'The Future Homes Standard: Summary of responses received and Government response'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

[9] Bath & North East Somerset Council, *'Exam 10: Policy SCR6: Note on the setting of local energy efficiency standards for new build development'* (2022). Available at: https://beta.bathnes.gov.uk/sites/default/files/EXAM%2010%20Note%20on%20Local%20Energy%20Efficiency%20Targets%20FINAL.pdf

1.6 How can the Reg 18 draft policies be strengthened?

The Regulation 18 version of the District Plan includes a broad range of policies covering a number of topic areas which seek to support delivery of sustainable development and help meet the government's targets for achieving net zero by 2050. Following review of the draft policies, recommendations have been made which strengthen the requirements and additional evidence provided to justify the approach.

The policy options set out in this report focus on best practice standards across a range of topic areas. However, to be adopted into the District Plan, they also need to be technically achievable, relevant to the local context, viable, and practical for the Council to implement.

Recommendations for strengthening the policies within the Regulation 18 (Reg 18) draft District Plan are summarised below. Section 3.2 of this report includes a summary of the technical justification, potential impacts on deliverability and viability, and sample policy wording for each policy recommendation. Information on the wider range of policy options that were considered is provided in Section 5.

Recommendation 1: All new domestic development should achieve net zero operational (regulated and unregulated) GHG emissions. All new non-domestic development should achieve net zero regulated emissions and aim to achieve net zero unregulated GHG emissions unless, in exceptional circumstances, it can be demonstrated that doing so is not technically feasible or unviable.

The Net Zero Carbon Emissions Feasibility and Options Study highlighted that new developments would *add* to existing GHG emissions, rather than contributing to the 'radical reduction' in emissions as required by the NPPF and the provisions of the Climate Change Act. An estimate of the potential impact is provided in Section 7 of this report. Given the urgency of responding to climate change, it is crucial to mitigate all avoidable sources of emissions as much as possible. On this basis, all developments should aim to achieve net zero operational emissions. The key requirements for this would be:

- **Very high levels of energy efficiency; and**
- **All energy demands to be met via renewables, with no fossil fuel combustion in buildings.**

For residential buildings, as explained in Section 5.2, there is clear evidence that net zero operational emissions is technically feasible in most cases. The more storeys a building has, is the more challenging it will be because there is less roof area compared with the total floor area, and therefore less space for on-site renewables such as solar PV. However, most residential development in Mid Sussex is expected to be low-rise (c. 1-3 storeys), so the proposed policy wording in Section 4.1.1 covers all residential new builds. By contrast, there is much greater variation in energy use and GHG emissions among non-residential buildings and less certainty as to exactly what types of commercial or industrial uses will be realised. For this reason, the current recommendation is for the net zero requirement to include emissions from all (regulated and unregulated) operational energy use in residential buildings, but focus on regulated energy use in non-residential buildings.[10]

The proposed policy wording is outcome-focused, aiming to ensure that developments achieve net zero operational GHG emissions. Embodied/whole life-cycle carbon is covered in Recommendation 7; see below. Developers will be expected to demonstrate compliance via a third-party assessment scheme, namely BREEAM for non-residential developments, and HQM for residential developments. An alternative, optional route to show compliance would be for the development to achieve Passivhaus

[10] An industry-led consortium is undertaking separate work to develop a Net Zero Carbon Buildings Standard for the UK that would cover all building types. This is expected to generate higher-quality data and evidence that would support a broader net zero requirement, i.e. one that covers unregulated and embodied/whole life-cycle emissions as well. MSDC should keep abreast of developments in this field and look to introduce stronger requirements as part of future District Plan updates. For more information, refer to https://www.nzcbuildings.co.uk

certification *and* meet 100% of energy needs on-site. More information about these schemes is provided in Section 5.2.

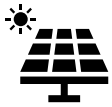
The use of third-party assessment schemes is considered most appropriate due to the fact MSDC do not currently have in-house specialist expertise to review and challenge technical energy and GHG emissions calculations. The use of a third-party assessment process and requiring certification will provide more certainty with implementation and delivery of the policy requirements, since they will be carried out by independent assessors. Furthermore, the cost will be borne by those who are securing uplift in value from the development. In the long term, it is strongly recommended that MSDC should allocate additional resources to this topic; a list of relevant skills and qualifications is provided in Section 5.2.1.6.

A review of publicly available cost information, including other Local Plan viability studies, suggests that the cost uplift of the proposed policies is c. 3%-5% for residential buildings and 5%-10% for non-residential buildings, when compared with Part L 2021. The existing viability study for Mid Sussex tested a cost uplift of 10% in both cases, (i.e. it took a much more cautious approach) and found that this would not have an undue impact on viability.

Recommendation 2: MSDC should retain the water efficiency targets in draft Policy DPH4, which require significant sites to achieve 85 l/p/d and extend this to all new residential developments. Water efficiency requirements for non-residential development should be set via BREEAM.

The Environment Agency (EA) classifies Sussex as a seriously water stressed area. Future trends such as population growth and climate change are likely to exacerbate this issue. Therefore, the water efficiency of new development is an important consideration.

A recent study by JBA Consulting on behalf of Crawley Borough Council, Chichester District Council, and Horsham District Council concluded that the 85 l/p/d target is a 'realistic achievable' target for new builds in the region.[11] As explained in Section 5.2.3, this can be achieved through various means, including water efficient fittings, rainwater harvesting and/or greywater recycling systems. The Mid Sussex Viability Study tested a cost uplift of £2,500 for all residential buildings, on the assumption that rainwater harvesting systems would be used. However, the costs would depend on the approach that is selected; a fittings-based approach is expected to have no or minimal impact on costs.

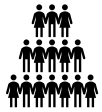


Recommendation 3: MSDC must work to facilitate a step change in renewable energy deployment, including large-scale solar and wind. MSDC should expand upon Policy DPS3 to set out criteria that relate to each type of energy technology. It may also be appropriate for more detailed issues and guidance to be included in a Supplementary Planning Document (SPD) on renewables. This should be supported by maps identifying the *most suitable locations*, either within the District Plan or an accompanying SPD based on an updated Renewable Energy Assessment.

The Net Zero Carbon Emissions Feasibility and Options Study demonstrated that electrification offers the most significant opportunity for decarbonising Mid Sussex: if heat and transport were powered with renewable electricity, annual emissions within Mid Sussex would decrease by up to 90%. The Government has announced plans for the electricity grid to be net zero by the mid-2030s – however, if this does not happen, there is a major risk that Mid Sussex (and the UK as a whole) would not achieve its GHG reduction targets. For Mid Sussex to 'do its part' in decarbonising the UK energy system, and align with the Government's Net Zero Strategy, a step change in large-scale renewable energy deployment will be required. The landscape impacts of renewable technologies will be much less severe than the landscape impacts of climate change.

[11] JBA Consulting on behalf of Crawley Borough Council, Chichester District Council, and Horsham District Council, *'Water Neutrality Study'* (2022). Available at: https://www.horsham.gov.uk/__data/assets/pdf_file/0004/120397/EYP-JBAU-XX-XX-RP-EN-0004-A1-C02-Water_Neutrality_Assessment_Part_C.pdf

The proposed policy wording in Section 4.1.2 provides additional clarity on the requirements for each type of renewable technology, thus adhering to the guidance outlined in the PPG. The proposed changes are not expected to impact on viability but instead provide greater certainty for developers, supporting deliverability, by clearly setting out the circumstances where renewable energy proposals will and will not be permitted.



Recommendation 4: MSDC should broaden its support for community renewable schemes by stating specifically that the Council would actively support community renewable energy schemes which are led by, or meet the needs of, local communities.

Community groups can face considerable challenges in the pre-planning stage and there are a number of opportunities for local authorities to provide advice and guidance at this stage, including the provision of early advice on planning requirements and lending support to consultation activities within the community. Providing clear information on local issues and the decision-making process can aid the development of community renewable energy projects.

The policy would encourage developers of renewable energy schemes to seek to work in partnership with communities living close to the development site, either through co-ownership of the scheme or shared governance arrangements. As with Recommendation 3 (see above), the proposed changes are not expected to impact on viability.

Recommendation 5: MSDC should include a reference to the movement/street hierarchy and the importance of incorporating green infrastructure along active travel routes within policy DPT1 of the emerging District Plan. In addition, specific wording within each 'significant site (large developments / urban extensions)', such as policy DPSC1 within the draft District Plan, should be added regarding the 20-mininute neighbourhood concept.

GHG emissions from transport fall outside the scope of Building Regulations and are not always evaluated as part of the planning application process. However, the GHG assessment in Section 7 shows that these will comprise a significant portion, and potentially the majority, of cumulative emissions from new developments in Mid Sussex. It is therefore very important that the location and design of the new developments contributes towards reducing private vehicle use as much as possible and facilitates sustainable modes of travel such as walking, cycling and public transport.

To prioritise sustainable travel, infrastructure must be considered at the start of any development or masterplan process. As such, incorporating the concepts of the user and street hierarchy into policy will ensure sustainable travel is taken into account from the onset of any development proposal.

Requiring large scale developments to embody the 20-minute neighbourhood concept will support more permeable and mixed-use development, with key local services provided on the new site if existing services are further than 20 min walk/cycle and/or safe, attractive walk/cycle routes being provided to existing provision. This will further encourage active travel and ensure that residents' can meet their daily needs without being dependent on using cars, avoiding the associated negative impacts on carbon emissions, air quality and congestion.

These requirements relate to the masterplanning and urban design of new streets and communities. They should be straight forward to deliver if considered from the outset of the site design process. Given the deliverability considerations summarised above, the costs of meeting these requirements are not anticipated to be significant.

Recommendation 6: MSDC should set electric vehicle (EV) charging requirements for non-residential developments and incorporate the concept of car clubs.

This policy seeks to support the transition from internal combustion vehicles to electric vehicles (EVs). EVs emit fewer greenhouse gases and air pollutants than petrol or diesel cars. Part S of the Building Regulations establish minimum requirement for provision of EV charging infrastructure

but given the critical need to expand the provision of this infrastructure to support EV uptake this policy proposed more ambitious standards.

MSDC's Reg 18 draft policy DPT4 set a requirement for EV chargers on non-residential sites with a minimum number of parking spaces; this recommendation would strengthen the proposed policy wording by expanding it to include all sites, and by encouraging the use of car clubs, which offer an alternative model to private car ownership for individuals and businesses. Car clubs reduce the need for private parking and encourage a shift towards walking, cycling and public transport instead while allowing for occasional car travel.

The cost impacts associated with this policy are primarily due to the EV charging infrastructure that is required. Information on typical costs of chargers is provided in Section 4.3.2; note that these are expected to come down over time.

Recommendation 7: All major developments should be required to undertake a whole life-cycle (WLC) carbon assessments (sometimes referred to as life-cycle carbon assessments or LCAs) and take steps to reduce embodied carbon emissions. In future, MSDC should expand this requirement to include other scales of development and set a quantitative maximum target for embodied carbon.

As buildings become more energy efficient and more energy is supplied with renewable technologies, operational emissions from buildings will reduce significantly, and embodied carbon emissions will comprise a much larger proportion of total emissions. The GHG assessment presented in Section 7 shows that, over the course of the District Plan period, the most significant source of GHG emissions from development in Mid Sussex will be due to embodied carbon. Although those emissions may not necessarily take place within the District, and therefore would not appear on the local authority GHG inventory for Mid Sussex, MSDC has an important opportunity to influence those emissions within its remit as an LPA.

This recommendation is therefore in line with the Climate Change Committee's 2019 report on housing, which stated that, 'we need more focus on the whole-life carbon impact of new homes,' and the Environment Audit Committee which has suggested that the Government should introduce a mandatory requirement to undertake whole-life carbon assessments for buildings.

The targets can be achieved by carrying out a WLC assessment for the development using the tools prescribed by BREEAM and HQM, identifying opportunities to reduce environmental impacts and submitting the results to the independent assessors.

As noted in the Mid Sussex Viability Study, 'This is a reporting requirement rather than a requirement to build over and above national standards. This may have a modest impact on the fees associated with development, but not the cost of construction.' Consideration of WLC issues at an early stage of design development will facilitate an efficient and cost-effective solution. For example, there may be opportunities to use specific low carbon materials such as wood to displace high-carbon materials such as cement and steel and store carbon long-term in buildings.

Recommendation 8: Regarding extensions to existing residential dwellings, the existing draft wording of Policy DPS2 encourages proposals to be "as energy efficient and sustainable as possible". MSDC should strengthen this wording by requiring that any net increase in energy consumption for the building should be met via on-site renewables.

As explained in the Net Zero Carbon Emissions Feasibility and Options study, decarbonising the existing building stock is key to achieving GHG reduction targets. However, there are relatively few opportunities for MSDC to influence existing buildings, except when householders seek planning permission.

Rather than simply encouraging applicants to adopt energy efficiency measures, MSDC should introduce tighter requirements for householder developments. Otherwise, it would be missing one of the few opportunities it has to influence the existing building stock.

The requirement could be met through various means, such as (a) increasing the energy efficiency of the proposed new elements, (b) increasing the energy efficiency of other parts of the property or (c) adding on-site renewables. In that regard, the proposed policy wording offers flexibility to householders.

Compliance would be assessed based on Part L calculations which are a standard requirement, and therefore would not incur additional consultancy fees. The proportional uplift in build costs is expected to vary widely depending on the project in question, even if the difference is small in absolute terms. On a large extension, the cost uplift might be similar to that described in Section 6.3.1 and Appendix A.5, at around 3-5%. For smaller projects, it would likely be higher. On the other hand, as explained in Section 6.4, the householder would benefit from lower energy bills than they would have had if the policy was not introduced. The property could also attract higher sale or rental values.

In addition to the above policy wording, the Council could also provide further guidance on sustainable retrofitting, either by signposting to existing guidance or through the creation of a Supplementary Planning Document.

Recommendation 9: MSDC should strengthen policy requirements for new trees since trees/woodland provide higher rates of carbon sequestration than most other habitat types.

Tree planting has significant potential to boost carbon sequestration within Mid Sussex. The Committee on Climate Change has indicated that the UK needs to achieve an average of 30,000ha of new woodland planting per year up to 2050 to help sequester and store atmospheric carbon and mitigate the effects of climate change.

The NPPF (paragraph 131) states that *"Planning policies and decisions should ensure that new streets are tree-lined, that opportunities are taken to incorporate trees elsewhere in developments (such as parks and community orchards), that appropriate measures are in place to secure the long-term maintenance of newly-planted trees, and that existing trees are retained wherever possible."*

In addition, the National Model Design Code guidance notes (part 2) set out design principles for street trees and signpost the Urban Tree Manual for guidance on installation and ongoing management and maintenance.

These requirements relate to the masterplanning and urban design of new streets and communities. They should be straight forward to deliver if considered from the outset of the site design process. The costs of tree planting are modest and there is also a range of government grant funding available to support woodland creation.

Recommendation 10: MSDC should include a policy to secure post-occupancy monitoring of buildings to help to close the 'performance gap'.

Various studies have shown that buildings often do not perform as well when completed compared to what was anticipated when they were designed. The difference between anticipated and actual performance is known as the "performance gap". The Climate Change Committee[12] has highlighted this issue and identified the need for greater levels of inspection and stricter enforcement of building standards, alongside stiffer penalties for non-compliance.

The HQM and BREEAM schemes include credits covering post-occupancy evaluation, which is recognised as an effective way of getting the best possible performance out of a building and learning lessons to inform future policy and improve industry practices. Developers would be required to

[12] CCC, *'UK housing: Fit for the future?'* (2019). Available at: www.theccc.org.uk/publication/uk-housing-fit-for-the-future

undertake some post occupancy monitoring in accordance with the requirements set out in the BREEAM and HQM schemes.

According to the Post Occupancy Evaluation Guidance by RIBA[13], the cost of POE is "a very small percentage of overall building costs. Research shows as a proportion of a project's cost, undertaking POE adds an additional 0.1% – 0.25%." Thus, imposing a requirement for POE is not anticipated to have any significant impact on overall costs and viability.

1.7 How would the recommended Reg 19 policies impact GHG emissions?

An assessment of the GHG emissions arising from new development over the entire District Plan period is presented in Section 7. Key take-home points are summarised below.

- In a scenario where MSDC does not adopt any standards beyond Building Regulations, cumulative operational emissions from new buildings and residents' cars are estimated to contribute c. 139 ktCO_2e over the course of the Local Plan period. This calculation accounts for future electricity grid decarbonisation and a shift to EVs driven by consumer behaviour rather than local policies. The recommended policies for the Reg 19 version of the District Plan would provide a c. 40% reduction in GHG emissions over that period, (Further information is provided on the next page.)
- Even though proposed changes to Building Regulations would likely see gas boilers being phased out (or, at least, becoming much less common) after 2025, this is not guaranteed and there is a significant carbon penalty associated with their use. This is an argument in favour of prohibiting the use of gas boilers or other fossil fuel heating systems as soon as possible. On this basis we have recommended not only introducing a net zero policy for buildings, but also specifically introducing policy wording that prohibits fossil fuel heating.
- Similarly, although there has been a massive shift towards the use of EVs in recent years, operational emissions from vehicle use are very significant. If a net zero policy is brought forward for new buildings, cars would account for an even higher proportion of cumulative emissions. This highlights 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.
- Embodied carbon is expected to account for the vast majority of cumulative GHG emissions over the District Plan period. Embodied carbon is to a large extent determined by design choices made at an early stage of development, and therefore MSDC has a window of opportunity to influence this via the planning process. At present, embodied carbon assessments are not carried out very frequently, so there is relatively limited evidence on the level of improvement that can be achieved on a typical project. This is why the WLC recommendation (see above) only applies to major developments and does not include a quantitative component. It is strongly recommended that the Council should seek to adopt such targets in future if and when it is practical to do so, because this would have the single largest impact on the total emissions associated with new development.

Three policy scenarios were modelled:

- **Scenario 1: Minimum Standards.** This scenario assumes that the new developments are constructed to meet the minimum standards stipulated by the Building Regulations.

[13] Royal Institute of British Architects, *'Post Occupancy Evaluation'* (2020). Available at: https://www.architecture.com/knowledge-and-resources/resources-landing-page/post-occupancy-evaluation

- **Scenario 2: Reg 18 Draft Policies.** This scenario represents the current policies MSDC have drafted within the Regulation 18 version of the District Plan, notably Policies DPS2 and DPH4.
- **Scenario 3: Recommended Reg 19 Policies.** This scenario assumes that the new developments are constructed to meet the higher standards as outlined in Section 1.6 (see above).

In Scenario 1, cumulative operational emissions from new buildings and residents' cars in the period 2024-2039 are c. 139 $ktCO_2e$. For Scenario 2, cumulative operational emissions are 109 $ktCO_2e$, whereas for Scenario 3 cumulative operational emissions are c. 82 $ktCO_2e$. The Reg 18 policies modelled in Scenario 2 therefore represent a c. 20% compared with simply relying on improved standards in the Building Regulations. The recommended Reg 19 policies (Scenario 3) would provide a c. 40% saving, roughly doubling the emissions savings already being achieved by the Reg 18 draft policies. This is an estimate based on benchmarks and is not a forecast of actual emissions, but indicates the scale of improvement that can be achieved.

Figure 1. Cumulative operational GHG emissions from 2024-2039

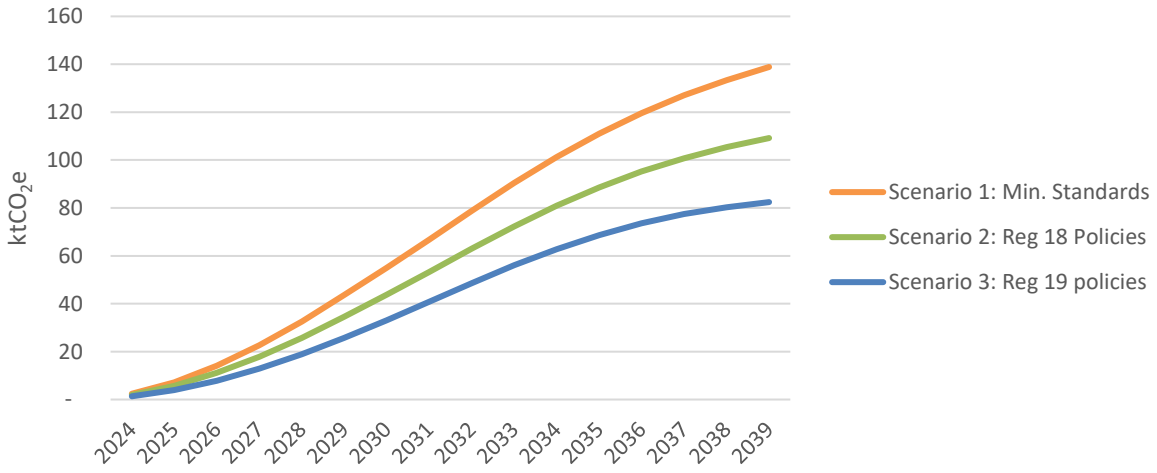


Table 1. Cumulative operational GHG emissions from 2024-2039

	Scenario 1	Scenario 2	Scenario 3
Cumulative operational emissions ($ktCO_2e$)	139	109	82
% improvement on Scenario 1	n/a	20%	40%

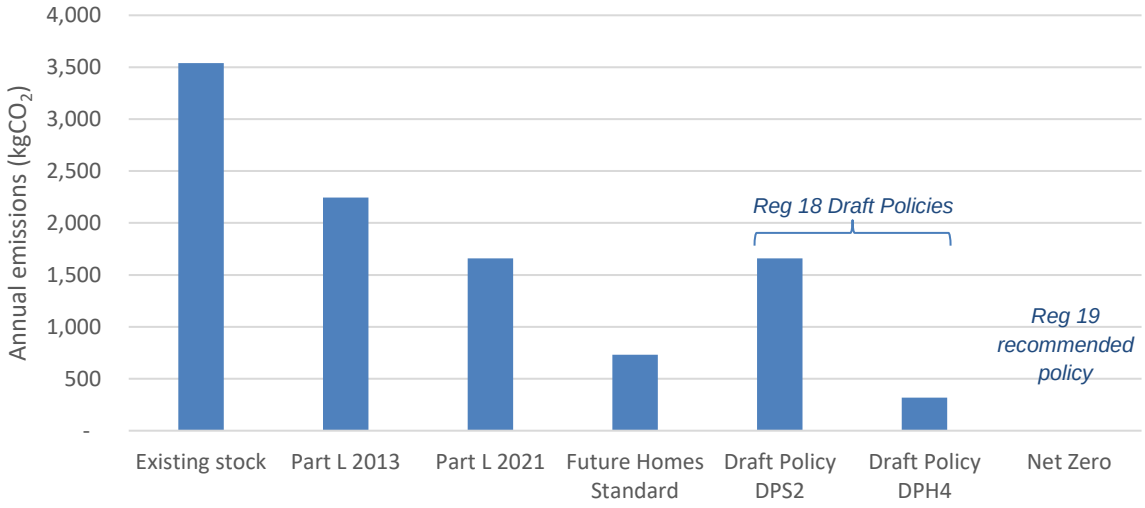
For context, annual GHG emissions in Mid Sussex in 2019 and 2020 were 651 $ktCO_2e$ and 573 $ktCO_2e$, respectively.[14] So, without seeking higher standards (Scenario 1), the operational emissions from new development over the next 15 years may equate to around 1/5th of District-wide emissions in one year. Although this may seem small, the MSDC Net Zero Feasibility Study (2022) found that, 'significant action will be needed to avoid *any* increase in emissions' given the scale of the challenge in reducing existing sources of emissions and the urgency of climate change.

The reason why the improvement (% reduction) is 40%, rather than 100%, is because the calculation includes regulated and unregulated emissions from buildings, plus emissions from residents' cars. (It is therefore broader in scope than a traditional assessment of energy use and emissions from new development.) As explained previously, the recommended policies would strongly encourage GHG

[14] BEIS, *'UK local authority and regional greenhouse gas emissions national statistics'* (2022). Available at: https://www.gov.uk/government/collections/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics Figures are published two years in arrears.

reductions across all of these categories, but the full net zero requirement only applies to domestic buildings, recognising the available technical evidence and precedent for such standards to be set. For domestic buildings, operational emissions from energy use would be reduced by 100%, as shown in the chart below.

Figure 2. Typical annual operational emissions in a dwelling constructed to different standards



Aside from lower GHG emissions, buildings constructed to the recommended standard offer a range of co-benefits for building occupants and owners, including but not limited to:

- Much lower energy bills, with running costs up to 50% lower[15]
- Higher property or rental values, with buyers and renters willing to pay more than 10% extra for low carbon homes[16] and BREEAM certified office space[17,18]

1.8 Conclusion

By adopting the policies described by this study, MSDC will be taking steps to minimise avoidable emissions as far as possible, given the Council's powers and available resources. The specific recommendations, such as adhering to the energy hierarchy, providing on-site renewables and not using fossil fuels, will provide additional benefits by lowering occupants' energy bills and contributing to a diverse, secure national energy system. Buildings that are net zero carbon from the outset will also avoid the need for significant retrofit in future – a burden that would otherwise fall on property owners, tenants, and the public purse.

[15] Currie & Brown and Etude, *'Technical Evidence Base for Policy SEC 1 – New Housing'* (2021). Available at: https://www.cornwall.gov.uk/media/fkzp45mv/eb042-20200359-climate-emergency-dpd-technical-evidence-base-rev-g.pdf

[16] Legal & General, *'Enabling the transition: The value of energy efficient homes'* (2022). Available at: https://www.legalandgeneralcapital.com/media-centre/thought-leadership/the-value-of-energy-efficient-homes/

[17] Hodkinson, *'The commercial value of BREEAM certification'* (2021). Available at: https://www.hodkinsonconsultancy.com/the-value-of-breeam/

[18] UKGBC, *'Capturing the value of sustainability: Identifying the links between sustainability and business value'* (2018). Available at: https://ukgbc.org/wp-content/uploads/2018/01/Capturing-the-Value-of-Sustainability.pdf

2 Introduction

The purpose of this study is to provide Mid Sussex District Council (MSDC) with a sound evidence base to set District Plan policies and understand the impact of the spatial strategy on greenhouse gas (GHG) emissions. MSDC commissioned Ricardo and LUC to:

- Review the current draft District Plan policies;
- Identify and compare various alternative policy options and standards that could be set in the District Plan;
- Assess opportunities for significant sites to meet higher energy and GHG emissions standards;
- Advise on the potential costs and viability implications of different approaches; and
- Quantify and explain how the policies and spatial strategy may impact future emissions in Mid Sussex.

These activities will help to ensure that the District Plan and spatial strategy together make a positive contribution to the wider net zero agenda as much as possible.

3 Background and context

3.1 Drivers for reducing GHG emissions

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.[19] Over the past ten years, global GHG emissions were at their highest levels in human history, and without immediate and deep emissions reductions across all 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.

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.

'Our recommended pathway requires a 78% reduction in UK territorial emissions between 1990 and 2035.'

– CCC, 2020

The **6th Carbon Budget**, which will run from 2033-2037, was announced by the Climate Change Committee (CCC) in late 2020.[20] 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 proposals set out in the **UK Net Zero Strategy** (2021), which sets out 'policies and proposals for decarbonising all sectors of the UK economy', go some way towards addressing this gap.

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

[20] 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

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.'[21]

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

> *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.*[22]

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.[23] 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).

At a local level, MSDC has affirmed its commitment to tackling climate change. On 2nd November 2022, **MSDC adopted its Net Zero targets**[24] There are three specific targets:

- A District-wide net zero target aligned to the national target.
- A Council-only net zero target of 2040 for emissions the Council can directly control.
- A Council-only net zero target aligned to the national target for emissions the Council can only indirectly influence

In September 2022 a **Net Zero Carbon Emissions Feasibility and Options Study** was produced by Ricardo Energy & Environment that sets out the specific steps that MSDC and other stakeholders will need to take in order to meet these goals.

The Ricardo Net Zero Carbon Emissions Feasibility and Options Study identified the actions needed to be undertaken to achieve net zero within the identified timescales. This information is being used to develop the Council Net Zero Action Plan (direct and indirect emissions) which sets out the actions and individual tasks required to achieve the adopted targets. It was considered that the actions identified by the Feasibility and Options Study to achieve the District-wide target were largely captured within the Sustainable Economy Strategy (April 2022) or intended to be secured through policies within the emerging District Plan.

Mid Sussex District Council only directly control 0.03% of the district's emissions. The vast majority exist beyond the Councils direct control and therefore depend on other mechanisms to influence behaviour change. A significant proportion of the proposed actions, which are required to attain the district's net zero target, are covered by policies in the emerging District Plan. As this will carry statutory weight and be enforceable once adopted, the Council consider these policies to be essential to achieving the ambition of the Net Zero.

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

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

[23] 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

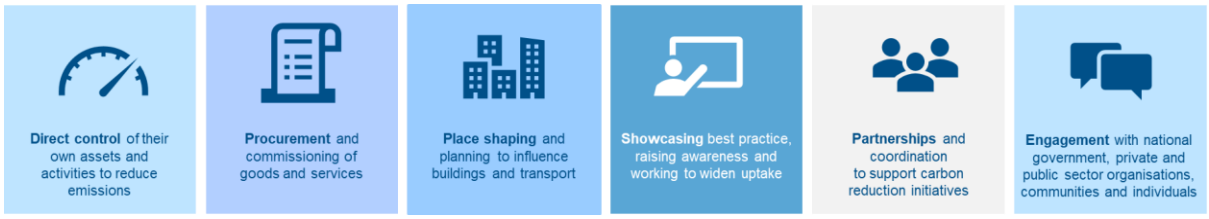
[24] For more information, refer to the MSDC website: https://www.midsussex.gov.uk/about-us/press-releases-and-publications/mid-sussex-district-council-set-net-zero-targets/

3.2 How can a local plan help achieve net zero?

Local Authorities are important players in the race to net zero. While public sector emissions are usually only responsible for a small proportion of area-wide emissions (and Emissions under MSDC's direct control only equate to around 0.03% of the Mid Sussex total), their influence can extend far beyond that, with the Climate Change Committee (CCC) estimating total influence over around 33% of emissions.[25] Other sources suggest that this figure could be even higher, for example with South Gloucestershire Council estimating influence over 40% of total emissions.[26]

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 3.

Figure 3. 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.[27]

4 Summary of policy recommendations

This chapter summarises policy recommendations across key categories for the MSDC District Plan. It provides a clear explanation and justification of each policy, indication of where the recommendation goes further than the draft (Regulation 18) District Plan, alongside an acknowledgement of deliverability and cost implications. These draw on best practice case studies from other LPAs and the latest developments in policy and standards/metrics.

We have systematically identified and assessed policy options, organising the analysis by key categories of policy as set out below:

1. Building performance standards/requirements
2. Renewable and low carbon energy (e.g. regarding wind and solar farms)
3. Sustainable travel and reducing the need to travel
4. Embodied carbon and circular economy
5. Refurbishment/change of use of existing buildings
6. Carbon sequestration

[25] 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

[26] South Gloucestershire Council, *'Climate Emergency Strategy'* (2020). Available at: https://beta.southglos.gov.uk/static/2f6a99c0e8736dfa043ddfacdd8614aa/Climate-Emergency-Strategy.pdf

[27] 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

7. 'Performance gap'

In considering these policy recommendations we have been particularly mindful of:

- The limited in-house expertise/resource the council has to evaluate technical documentation
- The changing policy/regulatory context with respect to the energy/carbon performance of buildings (explained in Section 5.2 and Appendix A.1)

The GHG emissions impacts of the proposed policies, compared with the current draft District Plan, are presented in Section 7.

4.1 Building performance standards/requirements

4.1.1 Energy/carbon performance

Recommendation 1: All new domestic development should achieve net zero operational (regulated and unregulated) GHG emissions. All new non-domestic development should achieve net zero regulated emissions and aim to achieve net zero unregulated GHG emissions unless it can be demonstrated that doing so is not technically feasible or unviable.

Regulation 18 draft policy DPS2 makes reference to the energy/carbon credits set out in BREEAM and HQM for non-residential and residential schemes respectively. So, MSDC could provide a policy guidance note to help provide clarity to developers regarding exactly what they need to do. This would for example allow them to set out the current BREEAM and HQM minimum credit requirements at the time the policy is adopted but equally allow them to revise this as and when these schemes are updated.

Given that Building Regulations and industry standards are constantly evolving, to futureproof this policy, the wording should be outcome-focused and provide some flexibility for demonstrating compliance. The policy should furthermore allow for carbon offsetting as a last resort to achieve net zero; require heating to be provided through low carbon fuels; and require major developments to demonstrate how they have sought to minimise embodied carbon emissions. Recommendations for embodied carbon are discussed in more detail in Section 4.4.

Specific wording changes proposed to policy DPS2 by development type (new content in red font):

All developments are required to submit a Sustainability Statement to demonstrate how through its design, construction, operation and use it will contribute to the reduction of ~~carbon~~ greenhouse gas emissions, increase resilience to the impacts of climate change and improve sustainability.

Unless it can be demonstrated that doing so is not technically feasible or unviable, new development must achieve zero operational GHG emissions by reducing heat and power demand and then supplying all (regulated and unregulated) operational energy demand through on-site renewables.

Residential new build: ~~HQM 3/3.5 star~~ Achieve sufficient credits in the "Energy performance" and "Towards carbon negative" categories of HQM (or equivalent) to demonstrate that the development produces net zero regulated and unregulated emissions. An alternative route to compliance is to achieve Passivhaus certification and demonstrate that 100% of operational energy use will be met via on-site renewables.

Non-residential new build: ~~BREEAM Excellent~~ Achieve maximum credits in the "Energy performance", and "Prediction of operational energy consumption" and "Beyond zero net regulated carbon" categories of BREEAM (or equivalent) to demonstrate that the development has surpassed net zero regulated emissions.

Add a new clause: Where it is clearly demonstrated that the net zero target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the Council, either:

1) through a cash in lieu contribution to the Council's carbon offset fund, or

2) off-site, provided that an alternative proposal is identified and delivery is certain.

…Evidence demonstrating the project has been registered with BRE during the design stage shall be submitted with any application and conditions will be imposed to secure appropriate final (post-construction stage) certification to demonstrate compliance with this policy.

Energy use

~~Demonstrate how opportunities for incorporating decentralised, renewable and low carbon energy schemes have been taken into all new development~~ All developments must include decentralised, renewable or low carbon energy provision in line with Policy DPS3: Renewable and Low Energy Carbon Schemes.

Heating should be provided through low carbon energy sources (not fossil fuels).

Justification:

MSDC needs to minimise emissions from new development to help achieve the net zero target. Only 'regulated' energy (building energy consumption resulting from fixed building services and fittings including heating, cooling, lighting and hot water) is currently covered by Building Regulations, but in order for the UK to reach net zero, it will also be necessary to address 'unregulated energy' use (e.g. energy use from cooking and other appliances). By securing the above-mentioned credits under HQM and BREEAM schemes, developments will be demonstrating that they have gone beyond net zero regulated emissions.

Although the Government has announced an intention to update Building Regulations in the future to ensure that buildings are 'zero carbon ready', the timing is uncertain (see Section 5.2.1.1 for further details). Introducing a clear net zero requirement that would be implemented as part of a local will help to safeguard against the risk of changes or delays in the national policy, which would result in higher (and avoidable) GHG emissions occurring over the District Plan period.

The proposed wording prioritises the concept of net zero as being more important than the requirement to achieve any specific credits. This is intended to further futureproof the policy, which is important given that the BRE may change the way that energy and GHG emissions are tackled within these schemes.[28]

Using HQM and BREEAM to secure this is a pragmatic approach given the lack of in-house technical expertise/capacity to interrogate energy statements. Checks of BREEAM/HQM reports to verify compliance would be relatively straightforward (and much simpler than interrogating energy/carbon calculations). Moreover, the council could have confidence in the ratings given that BREEAM or HQM assessments and ratings are completed by independent, third party BREEAM assessors in accordance with the requirements of each scheme and the cost will be borne by those benefitting from the uplift in values from the development.

Achieving Passivhaus certification and meeting 100% of operational energy use with renewables is proposed as an alternative route to compliance because it is in line with industry best practice, requiring extremely high standards of energy efficiency as well as rigorous checks on build quality. The performance levels are similar to those recommended by the CCC and other industry groups (see Section 5.2.1 and Appendix A.3).

A carbon offsetting option should be provided as a last resort so that developments that demonstrably cannot achieve net zero on-site can achieve this via offsetting residual emissions. The evidence set out in Section 5.2 suggests that achieving net zero operational emissions is technically feasible for (medium and low rise) new dwellings but may be more challenging for non-domestic developments. It is anticipated that any offsetting fund would therefore primarily be used for non-domestic developments.

[28] BRE, *'Achieving net zero with BREEAM'* (n.d.). Available at: https://bregroup.com/products/breeam/breeam-solutions/breeam-net-zero-carbon/#:~:text=Accurately%20measuring%20and%20reporting%20on,and%20lower%20whole%20life%20carbon

The wording of this clause is based on Policy SI2 of the adopted London Plan.

Post construction certification should be secured via condition to ensure that the required rating is actually delivered.

Most developments can accommodate some form of renewable technology, so this requirement has been strengthened. Policy DPS3 sets out requirements for renewable and low carbon energy technologies to avoid adverse impacts, which addresses any situations where decentralised, renewable or low carbon technologies would not be appropriate.

Heating homes using fossil fuels such as gas generates significant GHG emissions (see Section 7). The NE Cambridge AAP Regulation 19 version (Nov 2021) includes the following requirement in Policy 2: "All heating should be provided through low carbon fuels (not fossil fuels). This is in line with the Climate Change Committee's recommendations.[29]

Deliverability (what does it require the developer to do/ is it achievable?):

Viability studies for net zero carbon policies for other LPAs have developed costs based on different build specifications that are modelled to achieve net zero emissions. The most common approach involves achieving high energy efficiency (high levels of insulation and air tightness), using air source heat pumps for heating (no fossil fuels) and matching the total energy demand with an equivalent amount of on-site PV.

Carbon offsetting has been successfully delivered by LPAs across London and in other areas for a number of years. Separate guidance has been provided to the council advising on the practical steps to set up an offsetting scheme (see Appendix A.7).

Viability (any evidence on cost/viability impact):

Viability studies suggest a range of potential cost outcomes for delivering net zero carbon development (net zero carbon emissions from total energy use, i.e. 'regulated' and 'non-regulated' energy).

Published viability studies carried out on behalf of Cornwall, Greater Cambridge and Winchester Councils on average suggest that, for domestic developments, this can be achieved at a cost uplift of 3-5% compared against Part L 2021, depending on the dwelling typology in question. In the case of Mid Sussex, HQM would be used as a method of showing compliance with the net zero policy. Most of the additional capital costs would be associated with achieving the requisite number of energy credits. There are relatively small costs associated with registration and certification (a few hundred pounds), as well as consultancy fees which have been factored into the cost uplift tested in the Council's Viability Study.

The Mid Sussex Local Plan Viability Study published in 2022 tested a 10% cost uplift for residential developments to achieve all energy and GHG reduction requirements and found that this would not have an undue impact on viability for most sites.[30] We note that the other viability studies mentioned above, which drew on much more detailed cost assessments for net zero homes, suggested that the uplift would be much smaller than 10%. The latter could therefore be considered a cautious/conservative estimate, reflecting the consultancy fees associated with HQM accreditation.

For non-residential developments, evidence suggests that net zero regulated emissions could be achieved at a cost uplift of approximately 5%, while net zero regulated ***and*** unregulated emissions could be achieved at a cost uplift of approximately 10%. However, as noted in the existing viability study for Mid Sussex, the costs are likely to vary significantly depending on the scheme in question – they could be higher or lower. As with domestic buildings, MSDC's intention currently is for buildings to

[29] CCC, *'UK housing: Fit for the future?'* (2019). Available at: www.theccc.org.uk/publication/uk-housing-fit-for-the-future/

[30] HDH Planning and Development on behalf of MSDC, *'Mid Sussex Local Plan Viability Study'* (2022). Available at: https://www.midsussex.gov.uk/media/8671/dpr-viability-study-may22.pdf

demonstrate compliance with this policy via BREEAM certification. Analogous to HQM, most costs for BREEAM are expected to arise from the energy and GHG performance requirements. Published research suggests that BREEAM certification on its own would incur a 1-2% uplift in costs when compared with the previous (Part L 2013) Building Regulations. However, since those regulations were updated in 2021, the cost uplift would be smaller and is considered negligible.

Highly energy efficient, zero carbon buildings offer a range of other benefits, including much lower energy bills for occupants (up to 50% savings) and higher rental/sale prices (up to a 10% increase). This is discussed in more detail in Section 6.

4.1.2 Water efficiency

Recommendation 2: MSDC should retain the water efficiency targets in draft Policy DPH4, which require significant sites to achieve 85 l/p/d and extend this to all new residential developments. Water efficiency requirements for non-residential development should be set via BREEAM.

Specific wording changes proposed to policy DPS2 (new content in red font):

**Developments must achieve 3 credits in BREEAM category Wat 01 ~~an 'Outstanding' rating in… water categories~~ and demonstrate reasonable endeavours to achieve an 'Outstanding' rating overall.

… Residential developments must meet a maximum water consumption standard of 85 litres per person per day to minimise the impact of the development on water resources and water quality.

Justification:

Sussex is a water stressed area so the water efficiency of new development is an important consideration. South East Water's company area – into which Mid Sussex falls – has been deemed as seriously water stressed in 2013 and was confirmed to remain in this categorisation by the EA in 2021.

Residential development: For dwellings, the mandatory requirement through Building Regulations is 125 litres/person/day, but the Government has indicated that 'Where there is a clear local need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day.'[31] Regionally, there is precedent for local authorities to set even higher targets. A recent study by JBA Consulting on behalf of Crawley Borough Council, Chichester District Council, and Horsham District Council concluded that the 85 l/p/d target is a 'realistic achievable' target for new builds in the region.[32] This can be achieved either through:

- A fittings-based approach that would involve selecting water efficient taps, showers, baths, toilets, etc. which can be achieved at minimal additional cost, c. £350-430/dwelling according to the JBA Consulting study; or
- Use of rainwater harvesting and/or greywater recycling systems, which cost between £1,500-£4,000 per property.

The proposed wording above is largely replicated from draft Policy DPH4. However, we note that policy DPH4 requires the use of rainwater harvesting and greywater recycling systems, which incur higher costs. Experts in the Ricardo water team have advised that the standard can potentially be achieved with the fittings-based approach, and this is affirmed by the JBA Consulting Study. To provide greater flexibility, we have not proposed to adopt the requirement for rainwater harvesting or greywater recycling in DPS2.

[31] Ministry of Housing, Communities & Local Government, *'Housing: Optional technical standards'* (2015). Available at: https://www.gov.uk/guidance/housing-optional-technical-standards

[32] JBA Consulting on behalf of Crawley Borough Council, Chichester District Council, and Horsham District Council, *'Water Neutrality Study'* (2022). Available at: https://www.horsham.gov.uk/__data/assets/pdf_file/0004/120397/EYP-JBAU-XX-XX-RP-EN-0004-A1-C02-Water_Neutrality_Assessment_Part_C.pdf

Compliance would be demonstrated through use of the Building Regulations Part G calculator tool. For developments that are undertaking an HQM assessment this would also result in credits being awarded in the water efficiency category.

Non-residential development: There is no government guidance on setting water efficiency standards for non-residential development. As with residential development we need to consider how to drive water efficiency whilst avoiding perverse outcomes. Setting a high target that requires the installation of greywater recycling systems could lead to the installation of measures that are complex, energy-intensive and/or hard to maintain. The proposed policy wording above is in line with the recommendations of the JBA Consulting study. The BREEAM manual indicated that this credit score would require 25% of WC flushing to be met by using recycled potable water from greywater or rainwater system, which is deemed to be an appropriately stretching performance requirement.

Deliverability (what does it require the developer to do/ is it achievable?):

These water efficiency targets can be met through specifying water efficient fixtures and fittings and some rainwater harvesting, but without the need for costly and complex large scale greywater recycling systems.

Viability (any evidence on cost/viability impact):

Given the deliverability considerations summarised above, the costs of meeting these requirements are not anticipated to be significant. Water efficient fixtures and fittings will involve little increase in cost; rainwater harvesting systems are typically £1500 to £4000 for a new build property, depending on the house size and storage tank capacity.[33]

4.2 Renewable and low carbon energy

4.2.1 General requirements

Recommendation 3: MSDC must work to facilitate a step change in renewable energy deployment, including large-scale solar and wind. MSDC should expand upon Policy DPS3 to set out criteria that relate to each type of energy technology. It may also be appropriate for more detailed issues and guidance to be included in a Supplementary Planning Document (SPD) on renewables. This should be supported by maps identifying the *most suitable locations*, either within the District Plan or an accompanying SPD based on an updated Renewable Energy Assessment.

Since the 2015 Written Ministerial Statement on Wind was issued, wind energy developments are only permitted in areas identified as suitable within a Local or Neighbourhood Plan which, in practice, has resulted in a de facto ban on this technology.[34] Alongside the policy wording below, MSDC should ensure that suitable areas for wind energy developments are identified within the District Plan.

Specific wording changes proposed to policy DPS3 (new content in red font, drawing on Lancaster and BANES local plan wording):

Solar energy

The Council will support proposals for solar energy generation providing they are in conformity with this policy and other policies in the District Plan. For standalone solar panel arrays, it is expected that:

- Where necessary, the site will be screened (wherever possible with coppice, hedges or trees) and measures taken to mitigate harm to visual amenity;

[33] This is based on evidence from Central Bedfordshire: https://www.centralbedfordshire.gov.uk/migrated_images/evidence-water-efficiency_tcm3-27327.pdf This range aligns with figures cited by the UK Rainwater Harvesting Association as set out in the MSDC Viability Study published in May 2022: https://www.midsussex.gov.uk/media/8671/dpr-viability-study-may22.pdf

[34] Department for Communities and Local Government, *'House of Commons: Written Statement HCWS42'* (2015). Available at: https://www.parliament.uk/globalassets/documents/commons-vote-office/June-2015/18-June/1-DCLG-Planning.pdf

- The impact of glare and glint will be considered;
- Site security (if used) will aim to be unobtrusive;
- Applications will include quantified plans for biodiversity net gain;
- Seasonal grazing of livestock should be considered; and
- It will not adversely affect the use of the best and most versatile agricultural land.

Wind energy

The Council will support wind energy development proposals where they lie within a landscape area identified as being potentially suitable for this type of development, as shown on [document name – map of areas of wind energy potential].

Applicants would need to clearly demonstrate that adverse impacts on the landscape can be satisfactorily mitigated in these areas;

- Demonstrate that, following consultation, the planning impacts identified by the affected local community have been fully addressed by the proposal;
- There is sufficient separation from the proposed wind turbines and/or mitigation measures, to protect
- residential amenity as a result of noise, shadow flicker and visual intrusion;
- The proposals have addressed any potential adverse effects on the safety of aviation operations and navigational systems;
- Potential interference to television and/or radio reception and information and telecommunications systems will be avoided and/or mitigated;
- The proposed site access arrangements and access routes are suitable for the construction phase, including the delivery of turbine components and construction materials, the operational phase, and the decommissioning of the proposed wind farm. The use of aggregates, concrete batching and provision of grid connection infrastructure ensure adverse impacts are avoided or satisfactorily mitigated; and
- Ensure flight paths and habitat corridors of protected mobile species such as birds and bats, and functionally linked habitat associated with protected sites (SACs; SPAs; SSSIs), are not adversely affected.

Hydro energy

- The Council will support proposals for hydropower providing proposals are in conformity with this policy and other policies in the District Plan. Any applications for hydropower schemes will be expected to be accompanied by a Flood Risk Assessment, Water Framework Directive Compliance Assessment and evidence of discussions with the Environment Agency around requirements.
- Consideration must be given to the location, siting and design of the scheme, ensuring that there are no significant individual or cumulative adverse impacts on the environment and amenity. In all cases mitigation will be required to protect river flow, river continuity for fish and provide for sediment transfer.

Other renewable and low carbon technologies

The Council will support renewable or low carbon energy schemes that are compatible with this policy, other policies within the District Plan, and where impacts can be satisfactorily addressed.

In addition to the above renewable and low carbon energy sources, other renewable and low carbon technologies include: heat pumps; geothermal heat; energy and/or heat from waste; biomass; solar thermal; combined heat and power; and battery storage (see below).

Thermal Energy Distribution: Heating and Cooling Networks

The Council will support proposals for, and encourage the inclusion of, heating and cooling distribution networks, providing they are in conformity with District Plan policies.

Where feasible, new major development should connect to existing networks, or provide new/purpose built heating/cooling networks. It is expected that heat networks:

- Are designed for cost effective future connection to a proposed or planned network.
- Employ individual or communal sustainable, renewable, or low carbon heating and/or cooling.
- Make use of ambient or secondary heat sources (in conjunction with heat pumps where required).
- Demonstrate compliance with appropriate technical standards (currently'CIBSE's Heat Networks Code of Practice for the UK);
- Be registered with the Heat Trust;
- Use renewable and/or low carbon sources for their energy centre or provide an evidenced timeline and technology pathway towards system decarbonisation by 2050;
- Provide heat and/or cooling services at a fair and affordable price; and
- Where refrigerants are to be used, the global warming potential should be considered.

Energy Storage

The Council will support proposals for battery storage facilities and infrastructure providing that they are in conformity with District Plan Policies and that:

- A clear and evidenced operational lifespan for the facility is defined;
- It is clearly stated which type of batteries will be used and of what size the units are;
- A clear and funded plan for site failure including fire and material leakages is provided;
- A clear definition of what the human and environmental receptors for smoke and materials from potential fires are, and that a plan for mitigating receptor risk is provided;
- An evidenced decommissioning plan is put into place prior to site development. The plan must include;
  - The responsible party for decommissioning;
  - A disposal plan for all solid and hazardous waste including proposed receiving waste facility/facilities;
  - Information detailing how a decommissioning fund structure has been set up with a funding timeline (with the fund preferably held by a third party);
  - Evidenced cost estimates for site decommissioning;
  - A clear outline of how the decommissioning fund will be kept current and up to date; and
  - An evidenced timeline for facility decommissioning and site restoration.

The requirements of this policy shall be evidenced in a Sustainable Design Statement submitted with the planning application.

Justification:

The Net Zero Carbon Emissions Feasibility and Options Study demonstrated that electrification offers the most significant opportunity for decarbonising Mid Sussex: if heat and transport were powered with renewable electricity, annual emissions within Mid Sussex would decrease by up to 90%. The Government has announced plans for the electricity grid to be net zero by the mid-2030s – however, if this does not happen, there is a major risk that Mid Sussex (and the UK as a whole) would not achieve its GHG reduction targets. For Mid Sussex to 'do its part' in decarbonising the UK energy system, and align with the Government's Net Zero Strategy, a step change in large-scale renewable energy deployment will be required. (Further information is provided in Section 5.3.1.)

Drawing on the guidance outlined in the PPG, after expressing positive support in principle for renewable and low carbon energy development, Local Plans should list the criteria that will be taken into account in considering specific applications. This should not be a long negative list of constraints, but it should set out the range of safeguards that seek to protect the environment – including landscape

and townscape. It is important that policy does not preclude the development of specific technologies other than in the most exceptional circumstances and does not merely repeat national policy but is relevant to the process of decision-making at the local level, focusing on locally distinctive criteria related to local assets, characteristics, and sensitivities.

Furthermore, MSDC should align with the ambition set in the Net Zero Strategy: Build Back Greener which states that the UK should be powered entirely by clean energy by 2035 to achieve its overall target of net zero by 2050. The proposed policy wording above draws heavily on the Lancaster Regulation 19 Partial Review Local Plan Part 2 (not yet adopted) Policy DM53: Renewable and Low Carbon Energy Generation and BANES Local Plan Partial Update (adopted) Policy CP3. These are criteria-based policies that go further than most policies by setting out criteria separately for onshore wind, hydro, solar, other renewable and low carbon technologies, heating and cooling networks and energy storage.

Deliverability (what does it require the developer to do/ is it achievable?):

Criteria-based policies create greater certainty for developers, supporting deliverability, by clearly setting out the circumstances where renewable energy proposals will and will not be permitted.

The Council could also undertake a renewable energy assessment to update their existing study, along with an updated landscape sensitivity study, to provide further clarity for developers on which energy technologies are likely to be suitable where. However, site specific assessment and design would still be required, and all applications would still be assessed on their individual merits.

Viability (any evidence on cost/viability impact):

It is for developers of renewables and low carbon energy schemes to undertake detailed assessment of sites and project feasibility (considering local factors that can affect the development of sites that cannot be fully understood until detailed site based assessments are undertaken e.g. issues relating to the setting of heritage assets, aviation, telecommunication and landownership, cost of grid connection), informed by the policy and evidence established by MSDC, and determine if a project is feasible and viable.

4.2.2 Community renewable schemes

Recommendation 4: MSDC should broaden its support for community renewable schemes by stating specifically that the Council would actively support community renewable energy schemes which are led by, or meet the needs of, local communities.

Specific wording changes proposed to policy DPS3 (new content in red font):

The positive benefits of community energy schemes will be a material consideration in assessing renewable energy development proposals. The preference is for schemes that are led by and directly meet the needs of local communities, in line with the hierarchy and project attributes below:

Community Led Energy:

- *Project part or fully owned by a local community group or social enterprise;*
- *Local community members have a governance stake in the project or organisation e.g. with voting rights.*

Justification:

Community groups can face considerable challenges in the pre-planning stage and there are a number of opportunities for local authorities to provide advice and guidance at this stage, including the provision of early advice on planning requirements and lending support to consultation activities within the community. Engaging communities in the earliest stages of plan-making and providing clear information

on local issues and the decision-making process can aid the development of community renewable energy projects. The policy wording above is based on Policy SCR4 within the adopted Bath and North East Somerset local plan.

Deliverability (what does it require the developer to do/ is it achievable?):

The policy would encourage developers of renewable energy schemes to seek to work in partnership with communities living close to the development site, either through co-ownership of the scheme or shared governance arrangements.

Where possible community groups interested in renewable energy schemes should be directed to guidance and support. The use of interactive maps can be a key tool for community groups, neighbourhood planning groups and renewable energy developers to see where there is potential for renewable energy. One such map has been developed by LUC alongside the Shropshire Renewable Energy Study (2021). This map includes the findings of the landscape sensitivity assessment for wind and solar. Mid Sussex Council could consider developing such interactive mapping to ensure community groups understand the renewable energy potential and suitable areas for deployment.

Viability (any evidence on cost/viability impact):

It is for developers of renewable energy schemes to undertake detailed assessment of sites and project feasibility, informed by the policy and evidence established by MSDC and wider guidance, and determine if a project is feasible and viable.

4.3 Sustainable travel and reducing the need to travel

4.3.1 Movement hierarchy

Recommendation 5: MSDC should include a reference to the movement/street hierarchy and the importance of incorporating green infrastructure along active travel routes within policy DPT1 of the emerging District Plan. In addition, specific wording within each 'significant site (large developments / urban extensions)', such as policy DPSC1 within the draft District Plan, should be added regarding the 20-mininute neighbourhood concept.

Specific wording changes proposed to policy DPT1 (new content in red font):

c) Development shall integrate relevant requirements of Chapter 4 of the Mid Sussex Design Guide and be designed to prioritise sustainable and active modes of travel and define a clear street hierarchy, providing safe and convenient routes for walking and cycling through the development and linking with existing and enhanced networks beyond; before the highway layout is planned.

d) Create liveable communities which strive to embody the 20 minute neighbourhood concept and deliver attractive, healthy places that have a permeable street network within the site with clearly defined route hierarchies that are safe and designed for all users and supporting desirable opportunities for people to choose not to travel by car. Urban greening measures such as tree planting should be incorporated throughout the communities, particularly along routes prioritised for walking and cycling.

Specific wording changes proposed to the 'policy requirements section of site specific policies relating to larger scale site allocations such as DPSC1-3 (new content in red font):

A street network and mix of uses that embodies the 20-minute neighbourhood concept, ensuring that most residents' daily needs can be met within a short walk or cycle from home. New and improved walking, cycling and public transport networks should be planned at an early stage, with delivery phased appropriately to support mode shift towards active travel and public transport.

Justification:

To prioritise sustainable travel, infrastructure must be considered at the start of any development or masterplan process. As such, incorporating the concepts of the user and street hierarchy into policy will

ensure sustainable travel is taken into account from the onset of any development proposal. The location of services within or outside the development must be considered and an assessment of the suitability of walking and cycling to these services should be undertaken. This firmly establishes a movement hierarchy with priority given to active travel. Following which, public transport movements should be considered and finally movement of general traffic.

Walking and cycling routes should be designed to be both convenient and attractive e.g., through greening measures such as tree planting, to encourage modal shift. Re-shaping the environment in this way can encourage people to walk and cycle as part of their daily lives.

Requiring large scale developments to embody the 20-minute neighbourhood concept will support more permeable and mixed-use development, with key local services provided on the new site if existing services are further than 20 min walk / cycle and/or safe, attractive walk/cycle routes being provided to existing provision. This will further encourage active travel and ensure that residents' can meet their daily needs without being dependent on using cars, avoiding the associated negative impacts on carbon emissions, air quality and congestion.

Deliverability (what does it require the developer to do/ is it achievable?):

These requirements relate to the masterplanning and urban design of new streets and communities. They should be straight forward to deliver if considered from the outset of the site design process.

Viability (any evidence on cost/viability impact):

Given the deliverability considerations summarised above, the costs of meeting these requirements are not anticipated to be significant.

4.3.2 Electric vehicles and car clubs

Recommendation 6: MSDC should set electric vehicle charging requirements for non-residential developments and incorporate the concept of car clubs.

Specific wording changes proposed to policy DPT4 (new content in red font):

c) All new non-residential buildings ~~with more than 10 associated parking spaces within the site boundary,~~ shall provide ~~a minimum of 2 'Fast' (7kW) or faster, Electric Vehicle Charging points~~ active electric vehicle charging infrastructure for at least 25% of their car parking provision and passive infrastructure for a further 25% of parking provision to allow for future capacity.

d) the Council will support the provision of car clubs, including the provision of accessible car club parking spaces and/or contributions towards the provision of car clubs in the vicinity of the development, where appropriate. Car club vehicles must be 'clean', i.e. powered by alternative fuels to minimise harmful impacts on the environment.

Justification:

This policy seeks to support the transition from internal combustion vehicles to electric vehicles (Evs). Evs emit fewer greenhouse gases and air pollutants than petrol or diesel cars. Part S of the Building Regulations establish minimum requirement for provision of EV charging infrastructure but given the critical need to expand the provision of this infrastructure to support EV uptake this policy proposed more ambitious standards.

Car clubs offer an alternative model to private car ownership for individuals and businesses. Car clubs reduce the need for private parking and encourage a shift towards walking, cycling and public transport instead while allowing for occasional car travel. Many car clubs now operate electric or hybrid vehicles capable of operating with zero emissions. The proposed policy wording regarding car clubs above is based on the wording of Policy T3 in Islington's draft local plan.

Deliverability (what does it require the developer to do/ is it achievable?):

Delivery of this charging infrastructure can be integrated into delivery of wider parking infrastructure. Based on the table below, the costs to developers are anticipated to be relatively low and these prices are likely to decline over time has EV infrastructure is rolled out at scale. The cost of Evs are also anticipated to continue to decline over the coming decade making them more affordable to the general public.

Viability (any evidence on cost/viability impact):

The table below sets out indicative costs for domestic and public EV charging stations, indicating the limited cost per domestic and 'standard' space. These prices are likely to decline over the coming years as the drive to support a transition to electric vehicles accelerates.[35]

Type	Description	Indicative cost (£)
Domestic	Up to 7 kW	£500 – 1,000
Public – standard	7 kW	£10,000
Public – Fast	22 kW	£13,000
Public – rapid	43 kW	£34,000

4.4 Embodied carbon

Recommendation 7: All major developments should be required to undertake a whole life-cycle (WLC) carbon assessments (sometimes referred to as life-cycle carbon assessments or LCAs) and take steps to reduce embodied carbon emissions.

In future, MSDC should expand this requirement to include other scales of development and set a quantitative maximum target for embodied carbon.

As an interim step, however, this requirement should apply to major developments as follows:

Specific wording changes proposed to policy DPS2 (new content in red font):

All major new build developments must undertake a whole life-cycle (WLC) carbon assessment using a nationally recognised assessment methodology, and seek to minimise WLC emissions. This should be demonstrated through achievement of relevant credits in HQM, BREEAM, or equivalent.

The use of sustainably sourced wood in construction, particularly from local sources, is strongly encouraged.

Justification:

Embodied carbon is the carbon emissions emitted producing a building's materials, their transport and construction/installation on site as well as their maintenance/repair and their disassembly/demolition and disposal at end of life. About 80% of the annual carbon emissions associated with buildings are related to the ongoing operational carbon emissions from the existing building stock with the remaining 20% related to the embodied impact of new construction[36]. However, as buildings become more energy

[35] Typical domestic charger costs based on market research in 2023. Public charger costs are taken from research by Cenex, Greencar and Systra on behalf of the CCC, *'Plugging the gap: An assessment of future demand for Britain's electric vehicle public charging network'* (2018). Available at: https://www.theccc.org.uk/publication/plugging-gap-assessment-future-demand-britains-electric-vehicle-public-charging-network/

[36] LETI, *'Climate emergency design guide'* (2020). Available at: https://www.leti.uk/cedg

efficient and electricity generation decarbonises, operational emissions will reduce and embodied carbon emissions will become more significant, potentially representing 40-70% of whole life carbon in new low carbon buildings.[37]

Carbon modelling for Mid Sussex has confirmed that embodied carbon in buildings is one of the most significant sources of emissions.

The Climate Change Committee's 2019 report on housing recommended that "We need more focus on the whole-life carbon impact of new homes, including embodied and sequestered carbon." It also promoted the use of wood in construction to displace high-carbon materials such as cement and steel and 'lock up' carbon over the long-term in buildings. The Environment Audit Committee has recommended that the Government should introduce a mandatory requirement to undertake whole-life carbon assessments for buildings[38]. The Government's response (Sept 2022) to this report agreed that whole-life carbon assessments are likely to have a significant role to play in delivering decarbonisation across the sector.

As stated previously, MSDC is seeking to require developments to demonstrate compliance with energy and GHG performance requirements via accreditation with HQM (for residential developments) and BREEAM (for non-residential developments). Due to the council's limited in-house expertise, relying on BREEAM and HQM assessors is an appropriate approach for reducing the environmental impacts of construction products. It also has the benefit of using accreditation schemes which are already required by other policies. Both schemes award credits for undertaking a WLC assessment, so developments that do so will be able to claim credit within those schemes.

Note: Futureproofing policy wording

The sample policy wording above focuses on the outcome rather than specific credit requirements to futureproof the policy against potential changes. Specifically, there is a risk that the number or categories of credits in BREEAM and HQM that relate to embodied carbon will change in future. The BRE has indicated that operational and embodied carbon credits, which are currently split across the energy and materials categories, will be consolidated.[39] However, for clarity, the current requirements would be as follows:

- BREEAM includes up to 7 credits for Mat 01 which can be secured if developers reduce buildings' environmental life cycle impacts through conducting a WLC assessment and integrating its outcomes in the design decision-making process. The aim of this BREEAM issue is to *"reduce the burden on the environment from construction products by recognising and encouraging measures to optimise construction product consumption efficiency and the selection of products with a low environmental impact (including embodied carbon), over the life cycle of the building."* Setting the target at minimum of 7 credits is judged to be readily deliverable.
- In HQM the relevant assessment category is 'Environmental Impact of Materials – Building Lifecycle Assessment' which has the aim *"To reduce the effect construction products have on the environment by recognising and encouraging the selection of products with a low environmental impact, including embodied carbon over the life cycle of the building".* This covers environmental topics other than embodied carbon but the latter is one of the outputs. Up to 19 credits are available for completing a building life-cycle assessment (the score depends on the level of performance that is achieved). The backstop number of credits for a 4* rating is 3 credits which we propose as the minimum credit requirement, recognising that (a)

[37] Ibid.

[38] EAC, *'Building to net zero: costing carbon in construction'* (2022). Available at: https://publications.parliament.uk/pa/cm5803/cmselect/cmenvaud/643/report.html

[39] BRE, *'Achieving net zero with BREEAM'* (n.d.). Available at: https://bregroup.com/products/breeam/breeam-solutions/breeam-net-zero-carbon/#:~:text=Accurately%20measuring%20and%20reporting%20on,and%20lower%20whole%20life%20carbon

the aim is to ensure they undertake the assessment and (b) the requirements cover topics other than embodied carbon.

As with operational energy and GHG emissions, MSDC may wish to include references to the above credits in the supporting text of the policy, and/or produce accompanying guidance, to make it easier to update the requirements in light of changes to HQM or BREEAM.

Deliverability (what does it require the developer to do/ is it achievable?):

The targets can be achieved by carrying out a whole life-cycle carbon assessment (WLC, sometimes referred to as a life-cycle carbon assessment, which is abbreviated LCA) for the development using the tools prescribed by BREEAM and HQM, identifying opportunities to reduce environmental impacts and submitting the results to the independent assessors. These methods are well established and the targets have been set at a level that should be readily deliverable. Consideration of these issues at an early stage of design development will facilitate an efficient and cost-effective solution. For example, there may be opportunities to use specific low carbon materials such as wood to displace high-carbon materials such as cement and steel and store carbon long-term in buildings.

Viability (any evidence on cost/viability impact):

The requirement only applies to major developments. Given the deliverability considerations summarised above, the costs of meeting these requirements for major developments are not anticipated to be significant. This is reflected in the existing viability study for MSDC.

4.5 Householder development

Recommendation 8: Regarding extensions to existing residential dwellings, the existing draft wording of Policy DPS2 encourages proposals to be "as energy efficient and sustainable as possible". MSDC should strengthen this wording by requiring that any net increase in energy consumption for the building should be met via on-site renewables.

Specific wording changes proposed to policy DPS2 (new content in red font):

"Proposals for householder development are encouraged to be as energy efficient and sustainable as possible, incorporating the principles of both this policy and Policy DPS1: Climate Change. If, after adopting energy efficiency measures, the proposals would still result in a net increase in energy consumption for the whole building, 100% of the increase must be met via on-site renewables. ~~Wherever possible, developments should seek to:~~

- ~~*exceed Building Regulations requirements to reduce heat and power demand;*~~
- ~~*provide heating through low carbon fuels; and*~~
- ~~*meet energy demands through on-site renewables.*~~

All measures should be set out in a proportionate Sustainability Statement."

Our other recommendations on this topic related to providing further guidance to householders and developers, rather than changes to policy wording, so are not included in this section. Please refer to Section 5.6 for details.

Justification:

As explained in the Mid Sussex Net Zero Carbon Emissions Feasibility and Options study, decarbonising the existing building stock is key to achieving GHG reduction targets. However, there are relatively few opportunities for MSDC to influence existing buildings, except when householders seek planning permission.

Intuitively, it makes sense that extension and refurbishment projects could lead to higher energy demands. Refurbishments often involve enlarging openings (e.g. adding skylights or turning windows

into French doors) while extensions provide additional spaces that include heating, lighting, and other appliances. This is supported by research published in 2011, which showed that extensions result in a c. 16% increase in energy consumption on average.[40] More recently, a 2023 study found that the energy savings from measures such as loft and cavity wall insulation decrease over time, which could be due to 'concurrent residential construction projects and renovations associated with increases in energy consumption.'[41]

Such projects are subject to Building Regulations, but these merely prescribe minimum acceptable standards; the regulated energy use and GHG emissions of the property could still increase. Rather than simply encouraging applicants to adopt energy efficiency measures, MSDC should introduce tighter requirements for householder developments. Otherwise, it would be missing one of the few opportunities it has to influence the existing building stock.

The benefits of this approach are that it would:

- Require applicants to consider the energy impacts on the whole house, not just the extension or changes that they are seeking planning permission for
- Encourage the proposals to be more energy efficient, because otherwise the applicants would need to install renewable technologies as well.
- Reduce additional energy demands, thus helping to avoid increasing occupants' energy bills.
- Potentially incentivise applicants to use electric heating systems rather than extending or installing new fossil fuel heating systems, since the additional energy needs would be met via on-site renewables.

Deliverability (what does it require the developer to do/ is it achievable?):

The requirement could be met through various means, such as (a) increasing the energy efficiency of the proposed new elements, (b) increasing the energy efficiency of other parts of the property or (c) adding on-site renewables. In that regard, the proposed policy wording offers flexibility to householders.

Compliance would be assessed based on Part L calculations which are a standard requirement, and therefore would not incur additional consultancy fees.

Viability (any evidence on cost/viability impact):

The proportional cost uplift would vary widely depending on the project in question, even if the difference is small in absolute terms. On a large extension, the cost uplift might be similar to that described in Section 6.3.1 and Appendix A.5, at around 3-5%. For smaller projects, it would likely be higher. On the other hand, as explained in Section 6.4, the householder would benefit from lower energy bills than they would have had if the policy was not introduced. The property could also attract higher sale or rental values.

4.6 Carbon sequestration

Recommendation 9: MSDC should strengthen policy requirements for new trees since trees/woodland provide higher rates of carbon sequestration than most other habitat types.

Specific wording changes proposed to policy DPN3 (new content in red font):

Add that developments should "integrate street trees and other urban greening measures (e.g. sustainable drainage measures) into new streets and open spaces, whilst ensuring tree roots have sufficient space to support healthy, long lived trees".

[40] Richard Jack, Kevin Lomas and David Allinson, *'The expanding house: extensions to domestic buildings and their impact on energy consumption'* (2011). Available at: http://www.lolo.ac.uk/wp-content/uploads/2015/10/1342526205_RJackExpandingHouse.pdf

[41] Cristina Peñasco and Laura Díaz Anadón, *'Assessing the effectiveness of energy efficiency measures in the residential sector gas consumption through dynamic treatment effects: Evidence from England and Wales'* (2023). Available at: https://doi.org/10.1016/j.eneco.2022.106435

The council could also consider adding a tree canopy policy similar to Policy G3 in Cornwall's Climate Emergency DPD: *All major developments should provide, through the retention of existing and/or the establishment of new, canopy coverage equal to at least 15% of the site area (excluding areas of the site that are priority habitat types) in accordance with a Cornwall Council approved calculator or metric.*

However, MSDC would need to undertake research to understand the existing tree canopy cover across Mid Sussex and what would be an appropriate and achievable canopy coverage target for the district.

The council could also consider undertaking further research to identify priority sites for woodland creation to boost carbon sequestration and provide wider benefits. With this evidence the council could take a proactive approach to woodland creation in the District Plan by allocating sites, or parts of larger development sites, to be protected for woodland expansion/creation (noting that woodland creation could be supported by the introduction of mandatory biodiversity net gain).

Justification:

Tree planting has significant potential to boost carbon sequestration within Mid Sussex. The Committee on Climate Change has indicated that the UK needs to achieve an average of 30,000ha of new woodland planting per year up to 2050 to help sequester and store atmospheric carbon and mitigate the effects of climate change.

The NPPF (paragraph 131) states that *"Planning policies and decisions should ensure that new streets are tree-lined, that opportunities are taken to incorporate trees elsewhere in developments (such as parks and community orchards), that appropriate measures are in place to secure the long-term maintenance of newly-planted trees, and that existing trees are retained wherever possible."*

In addition, the National Model Design Code guidance notes (part 2) set out design principles for street trees and signpost the Urban Tree Manual for guidance on installation and ongoing management and maintenance.

Deliverability (what does it require the developer to do/ is it achievable?):

These requirements relate to the masterplanning and urban design of new streets and communities. They should be straight forward to deliver if considered from the outset of the site design process.

Viability (any evidence on cost/viability impact):

The costs of tree planting are modest and there is also a range of government grant funding available to support woodland creation. A key source of cost data is the standard costs in the English Woodland Creation Offer (EWCO) Grant Manual[42]. Appendix 1 of the manual includes standards cost items that are available through EWCO. The scheme also provides £300 per hectare to maintain a woodland.

4.7 'Performance gap'

Recommendation 10: MSDC should include a policy to secure post-occupancy monitoring of buildings to help to close the 'performance gap'.

Specific wording changes proposed to policy DPS2 (new content in red font):

All major residential new build developments must achieve at least 50% of credits for post-occupancy evaluation (POE) under 'Customer Experience' under the HQM scheme.

All major non-residential new build developments must achieve a credit for post-occupancy evaluation (POE) in the category Man 05 Aftercare under the relevant BREEAM scheme.

[42] Forestry Commission, *'England Woodland Creation Offer Application Form'* (2023). Available at: https://www.gov.uk/government/publications/england-woodland-creation-offer-application-form

Developers should share their POE information with the built environment sector to ensure transparency and inform wider lesson learning.

Justification:

Various studies have shown that buildings often do not perform as well when completed compared to what was anticipated when they were designed. The difference between anticipated and actual performance is known as the "performance gap". The Climate Change Committee[43] has highlighted this issue and identified the need for greater levels of inspection and stricter enforcement of building standards, alongside stiffer penalties for non-compliance.

The HQM and BREEAM schemes include credits covering post-occupancy evaluation, which is recognised as an effective way of getting the best possible performance out of a building and learning lessons to inform future policy and improve industry practices.

We recommend that developers be encouraged to share POE information to ensure transparency and inform wider lesson learning. For example, LETI[44] recommends that operational energy data for a period of at least five years is uploaded to the CarbonBuzz online platform[45] to support wider analysis and create a culture of disclosure.

Deliverability (what does it require the developer to do/ is it achievable?):

Developers would be required to undertake some post occupancy monitoring in accordance with the requirements set out in the BREEAM and HQM schemes.

Viability (any evidence on cost/viability impact):

According to the Post Occupancy Evaluation Guidance by RIBA[46], the cost of POE is "a very small percentage of overall building costs. Research shows as a proportion of a project's cost, undertaking POE adds an additional 0.1% – 0.25%." Thus, imposing a requirement for POE is not anticipated to have any significant impact on overall costs and viability.

5 Policy options considered

5.1 Introduction

This chapter assesses the options for strengthening the GHG reduction and sequestration policies in the Regulation 18 draft District Plan, drawing on best practice case studies from other LPAs and the latest developments in policy and standards/metrics.

We have systematically identified and assessed the options, organising the analysis by key categories of policy as set out below:

1. Building performance standards/requirements
2. Renewable and low carbon energy (e.g. regarding wind and solar farms)
3. Sustainable travel and reducing the need to travel
4. Embodied carbon and circular economy
5. Refurbishment/change of use of existing buildings
6. Carbon sequestration
7. 'Performance gap'

[43] CCC, *'UK housing: Fit for the future?'* (2019). Available at: www.theccc.org.uk/publication/uk-housing-fit-for-the-future

[44] LETI, *'Climate emergency design guide'* (2020). Available at: https://www.leti.uk/cedg

[45] Available at: https://www.carbonbuzz.org/

[46] Royal Institute of British Architects, *'Post Occupancy Evaluation'* (2020). Available at: https://www.architecture.com/knowledge-and-resources/resources-landing-page/post-occupancy-evaluation

The section below summarises the key policy options for each category of climate change policy. This work built on an initial assessment of the policies in the Regulation 18 draft District Plan, to identify those that have a significant effect on the reduction and sequestration of GHG emissions. A summary of the specific policy recommendations for MSDC arising from this study have been provided in Section 3.2.

In considering these initial policy options we have been particularly mindful of:

- The limited in-house expertise/resource the council has to evaluate technical documentation
- The changing policy/regulatory context with respect to the energy/carbon performance of buildings (summarised in Appendix A.1)

5.2 Building performance standards/requirements

5.2.1 Energy and GHG emissions

5.2.1.1 Context: UK Building Regulations

This section provides a brief introduction to current and potential future GHG performance requirements in the UK, which provides important context to the discussion below.

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.[47] All new buildings, and those undergoing major refurbishment works or extensions, are required to demonstrate compliance with Part L, which sets requirements for:

- Energy efficiency of the building fabric (e.g. insulation and double or triple glazing)
- Energy use
- CO_2 emissions

Standards for energy performance in Part L have become progressively more stringent over time, with uplifts in 2006, 2010, 2013 and 2021.

However, these recent changes are an interim step on the route towards net zero carbon new buildings. The Government has announced its intention that a **Future Homes Standard (FHS)** and **Future Buildings Standard (FBS)** will be implemented from 2025 onwards. The intention is that buildings constructed to those standards will be 'zero carbon ready', i.e. capable of operating with net zero emissions in the future with no need for major refurbishment. This will likely require:

- Higher energy efficiency standards
- On-site renewable energy technologies such as solar photovoltaics (PV)
- Heating to be provided via technologies such as heat pumps, which can run on renewable electricity, instead of systems that rely on fossil fuels, such as gas boilers.

> *'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

The details of the FHS and FBS have not yet been established, and the timing of their adoption is not guaranteed. Buildings constructed to those standards would not necessarily achieve net zero emissions until and unless the national electricity grid is fully decarbonised. (The Government has stated an

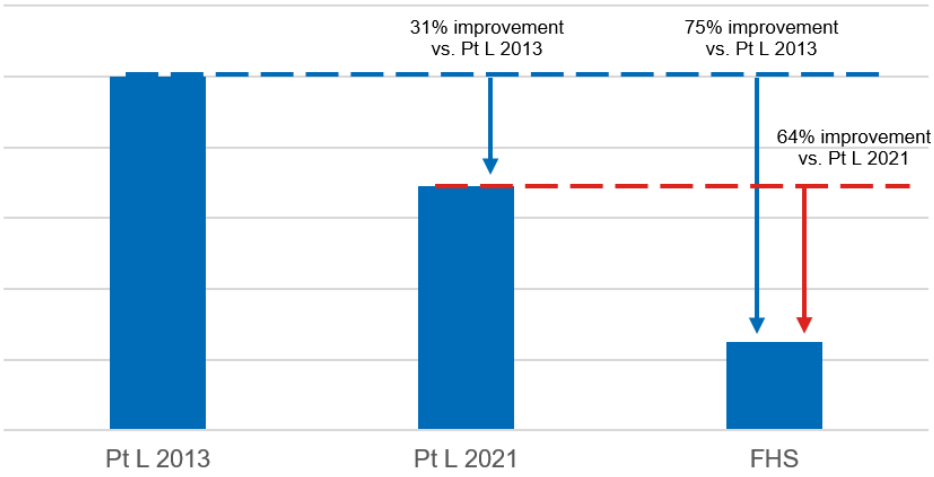
[47] HM Government, *'The Building Regulations 2010: Approved Document Part L'* (2021 edition incorporating 2023 amendments). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057372/ADL1.pdf

ambition for this to happen by 2035 although the CCC has warned that the power sector is not currently on track to achieve this.[48])

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 'regulated' emissions. Therefore, although the Government has said that new buildings from 2025 onwards will be 'zero carbon ready', it is likely that this will only apply to regulated emissions. This is discussed in more detail in Section 7.2.

In light of these considerations, there is an argument for LPAs to set energy and GHG performance standards that exceed the national requirements of Building Regulations.

Figure 4. Illustration showing the reduction in regulated CO_2 emissions from Part L 2021 and the anticipated Future Homes Standard



5.2.1.2 Going beyond Building Regulations

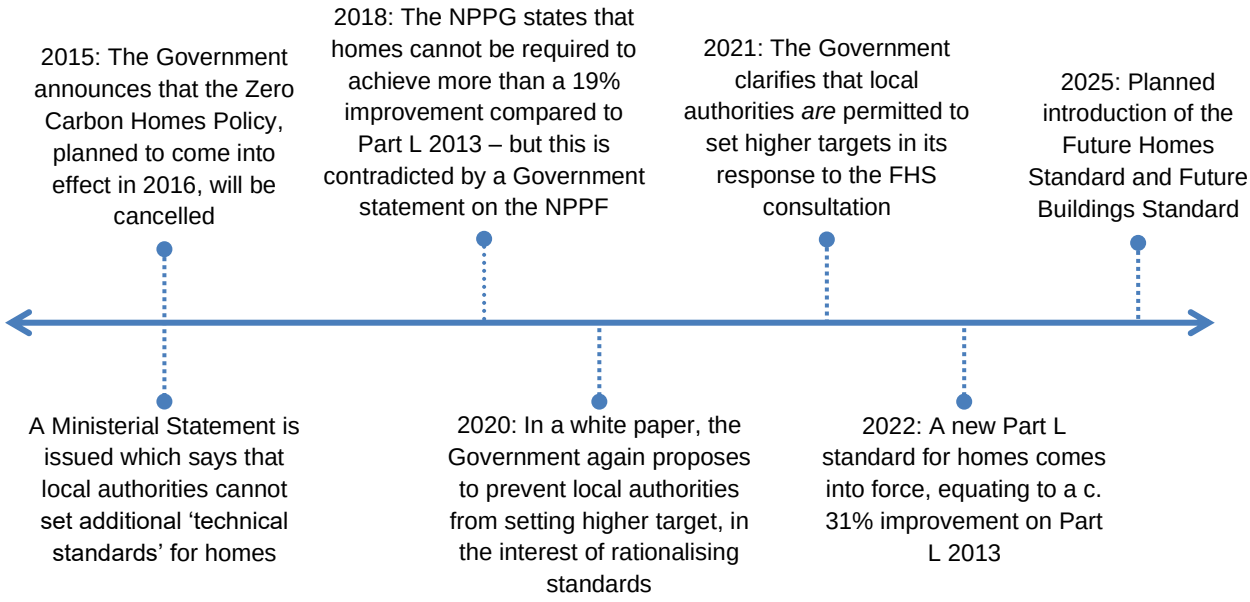
Although Building Regulations are showing the right direction of travel, at present it is not clear if or when the Government will require buildings to be net zero in operation. Any buildings that are not capable of operating with net zero emissions from Day 1 will have to be retrofitted and/or have their heating system replaced prior to 2050 in order for the UK to meet its climate targets. Given the urgent need to respond to the climate emergency, there is clear justification for local authorities to set standards that exceed Building Regulations.

In recent years there have been a series of announcements and policy U-turns that have resulted in uncertainty as to whether local authorities are allowed to set standards for energy performance or GHG emissions that exceed Building Regulations, particularly for homes.[49]

[48] CCC, *'A reliable, secure and decarbonised power system by 2035 is possible – but not at this pace of delivery'* (2023). Available at: https://www.theccc.org.uk/2023/03/09/a-reliable-secure-and-decarbonised-power-system-by-2035-is-possible-but-not-at-this-pace-of-delivery/

[49] Ministry of Housing, Communities & Local Government, *'Planning Practice Guidance: Climate change'* (2019). Available at: https://www.gov.uk/guidance/climate-change#what-are-governments-national-standards-for-a-buildings-sustainability-and-for-zero-carbon-buildings

Figure 5. Timeline of announcements on new building standards



At the time of writing (March 2023), setting standards that exceed Building Regulations *is* permitted. This was clearly stated in the Government's response to the FHS consultation[50] in 2021, and has been re-affirmed by published correspondence[51] between Bath and North East Somerset (BANES) Council and the Department of Department for Levelling Up, Housing and Communities (DLUHC) in 2022 which said, 'Plan-makers may continue to set energy efficiency standards at the local level which go beyond national Building Regulations standards if they wish.' There are also examples of recently-adopted local plans that set standards that exceed Building Regulations, including those for BANES and Cornwall County Council which were adopted in early 2023 (these will be discussed in more detail below).

The Net zero Feasibility Study (2022) produced by Ricardo on behalf of MSDC found that, 'significant action will be needed to avoid ***any*** increase in emissions' given the scale of the challenge in reducing existing sources of emissions. As explored in Section 7, new developments will lead to higher energy use and associated emissions unless they are designed to achieve operational net zero emissions from the outset. The UK is at risk of exceeding its legally binding carbon budgets[52] which means there is no leeway for any sector to create avoidable GHG emissions. This is particularly relevant to the current study because there are proven, cost-effective technological solutions available *and* doing so is within MSDC's remit as an LPA.

"Local development plans must contain policies which, taken as whole, secure radical reductions in carbon dioxide emissions in line with the Sixth Carbon Budget. Plans should achieve this by identifying a range of policies that reduce carbon dioxide emissions and encourage renewable energy generation." - RTPI and TCPA, 'The Climate Crisis: A Guide for Local Authorities on Planning for Climate Change' (October 2021)

[50] Ministry of Housing, Communities & Local Government, *'The Future Homes Standard: Summary of responses received and Government response'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

[51] Bath & North East Somerset Council, *'Policy SCR6: Note on the setting of local energy efficiency standards for new build development'* (2022). Available at: https://beta.bathnes.gov.uk/sites/default/files/EXAM%2010%20Note%20on%20Local%20Energy%20Efficiency%20Targets%20FINAL.pdf

[52] CCC, *'2022 Progress report to Parliament'* (2022). Available at: https://www.theccc.org.uk/publication/2022-progress-report-to-parliament/#key-messages

Higher performance buildings provide a wide range of social, environmental and economic benefits, including much lower energy bills for occupants and healthier, more comfortable homes. Some of the measures needed to achieve very high standards of energy efficiency may increase costs to developers; at present, concerns about viability are often cited as a reason *not* to introduce such requirements. Evidence presented in Section 66 indicates that the cost uplift may be relatively small.

Looking at the bigger picture, it would not be consistent with MSDC's climate commitments – whether legal or voluntary – to allow new development to come forward when there is a risk that those buildings will not be compatible with a net zero future. The GHG analysis in Section 7 shows that there is a carbon penalty for delaying the introduction of higher standards.

On that basis, the question is not so much whether to include a GHG reduction target, but what target should be set and how it can be implemented.

5.2.1.3 Current approach: Mid Sussex District Plan – Regulation 18 draft policy

The Regulation 18 version of the Mid Sussex District Plan[53] sets carbon targets that exceed Building Regulations with reference to specific credits in BREEAM (for non-residential development) and HQM (for residential development).

The relevant portion of policy DPS2 currently states:

> *"Unless it can be demonstrated that doing so is not technically feasible or unviable, development will be required to achieve the minimum standards below:*

Development Type	Scale of Development	Minimum Standard
Residential new build	Up to 150 dwellings	HQM 3 Star*
Residential new build	> 150 dwellings	HQM 3.5 Star*
Residential Refurbishment	Major	HQM 3 Star*
Non-residential new build[3]	All	BREEAM Excellent**
Non-residential Refurbishment	Over 500m²	BREEAM Excellent - Refurbishment and Fit-Out Technical Standards**
Sustainable Settlement allocations – Residential	1000+	Refer to DPH4

> ** Developments must achieve a minimum score of 50 credits in the energy category and 12 in the water category.*
>
> ***Developments must achieve an 'Outstanding' rating in energy and water categories and demonstrate reasonable endeavours to achieve an 'Outstanding' rating overall."*

Policy DPH4 sets additional requirements for significant sites:

> *"Meet at least 4* Rating of the BRE Home Quality Mark (HQM) with a minimum score of 55 credits in the energy category."*

[53] MSDC, *'Mid Sussex District Plan 2021-2039: Consultation Draft (Reg 18)'* (2022). Available at: https://www.midsussex.gov.uk/media/8769/district-plan-reg-18-consultation-version-for-web.pdf

We support MSDC's ambition in setting targets that exceed Building Regulations. However, while the existing credit requirements in DPS2 would improve on Part L requirements, they would *not* deliver net zero development. Key reasons include the following:

- HQM has not yet been updated to reflect current Building Regulations (Part L 2021) however a new version is due to be launched July 2023. So, for domestic developments that are required to achieve 50 credits currently, this may or may not represent an improvement over Part L 2021 and almost certainly would not offer an improvement over the proposed Future Homes Standard, expected to be introduced in 2025.
- The current requirements do not address all sources of emissions from development. Residential developments that are required to achieve 55 credits in HQM would exhibit a 100% reduction in regulated emissions and for 10% of unregulated energy consumption to be "generated by carbon neutral on-site or near-site sources", which is a good improvement but still not operational net zero. Relatedly, the requirements for non-residential development to achieve an 'Outstanding' rating in the energy category would deliver a moderate reduction in regulated emissions compared with current Building Regulations. However, this would not address unregulated energy use, which often accounts for a higher proportion of total emissions in non-residential buildings.

In light of MSDC's climate change ambitions (see Section 3), there is a need to both strengthen and futureproof the energy and GHG performance requirements of this policy. The following sections explore the main options available for doing this.

5.2.1.4 Further options for energy and GHG performance standards

The table below summarises the most common approaches setting higher performance standards, based on our team's professional experience and knowledge of UK planning policies. The pros and cons are summarised below and (aside from the option of setting no target) will be addressed in turn. For all of these options, note that the standards might be applied differently to different scales or different types of developments.

Table 2. Summary of options re: energy/carbon targets

Option	Pros	Cons
Set no target in District Plan, rely on escalating BRs requirements	Simple / no need for additional calculations.	Not consistent with MSDC's climate change ambitions. BRs requirements may not increase in 2025 as anticipated. To achieve net zero, in line with MSDC's environmental commitments and the UK's legally-binding carbon budgets, there is a need to stop any avoidable emissions.
Set targets by requiring developments to reduce emissions by a certain percent (%) compared with Building Regulations	Approach has been used in numerous adopted local plans. Straightforward for developers to evidence – submit Part L calculations which would be carried out anyway.	Risk of being superseded in the event of future regulatory changes. Not all sources of emissions are covered under Building Regulations so some would be excluded from the target.

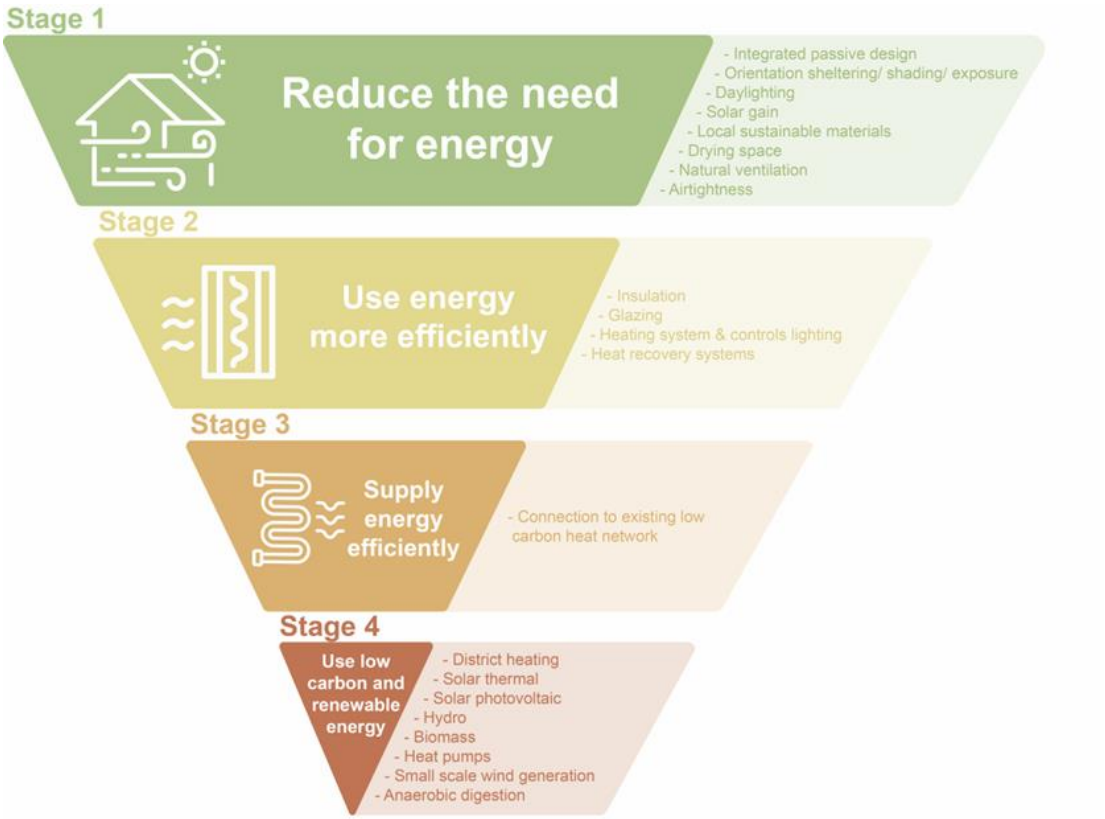
Set targets via third-party assessment schemes such as HQM and BREEAM – *this is the current approach in the Reg 18 draft*	Approach has been used in numerous adopted local plans. Can have confidence in ratings as completed by independent, third-party assessor.	Risk of being superseded in the event of future changes to the scheme and/or Building Regulations. These schemes are not intended to demonstrate net zero performance so they are an imperfect method of achieving net zero, but useful as an interim step
Set targets by specifying absolute performance targets or other metrics, such as energy use intensity (EUI)	Reflects emerging best practice and is in line with CCC recommendations. Approach has been used in a small number of recently-adopted local plans.	Most ambitious approach is also likely the most challenging for developers to achieve. Lack of in-house expertise to review energy calculations/ verify calculations are robust. Approach has been adopted in some places but challenged in others.

5.2.1.4.1 Require developments to reduce emissions by a certain percent (%) compared with Building Regulations

A significant proportion of local plans are silent on the issue of energy and GHG performance standards, and simply defer to Building Regulations. (This is likely due to a variety of factors, including different levels of local ambition and uncertainty surrounding the 2015 WMS.) However, in the past decade, where higher standards have been set, the most common approach has been to mandate a certain level of energy or GHG reduction (% improvement) in relation to Building Regulations. Examples of such policies are provided below:

- London Plan policy SI2 requires all major development to achieve a net 100% reduction in regulated emissions through a combination of on-site measures and carbon offsetting: “A minimum on-site reduction of at least 35 per cent [carbon reduction] 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.” Proposals must demonstrate how the target will be met within the framework of the energy hierarchy of be lean (use less energy), be clean (exploit local energy resources), be green (maximise on-site renewables). Where “it is clearly demonstrated the zero-carbon target cannot be fully achieved on-site”, any shortfall must be met through carbon offsetting (see Appendix A.7).

Figure 6. Energy Hierarchy



- The Sutton Local Plan (2018, policy 31) has similar targets and includes a requirement that "all minor residential developments should achieve at least a 35% reduction in regulated CO_2 emissions on site".

Although this is a well-established approach, there are some important disadvantages. For example, there is a risk that such a policy will be superseded by subsequent updates to Building Regulations. Any % reductions below 75-80% would likely be less ambitious than the minimum basic requirements of the Future Homes Standard, expected to be adopted in 2025.

Given this context, newer Local Plan policies may refer to these national changes in their policies to future proof them. For example, Solihull's Local Plan (currently at examination/ not yet found sound) includes the following policy wording (Policy P9):

All new dwellings to achieve 30% reduction in energy demand/carbon reduction improvement over and above the requirements of Building Regulations Part L (2013) at the time of commencement up to March 2025.

From April 2025, for all new dwellings to be net zero carbon.

It is not generally necessary to repeat national policy in local plan policies, but Solihull's approach is interesting in that it appears to be locking in a requirement for dwelling to be net zero carbon from April 2025, whether or not the Building Regulations (BRs) are actually updated to require the same. This is one way of reducing the risk that the national policy is not actually implemented or is delayed.

The other key disadvantage of this approach is that Building Regulations do not cover all sources of energy use and emissions from development (this will be discussed in more detail in Section 7), only those from 'regulated' energy uses. To be compatible with MSDC's climate change ambitions, and for the UK to have the best chance of meeting its legally binding carbon budgets, Local Plan policies must aim to mitigate all avoidable sources of emissions, wherever this is practical within the remit of the LPA.

5.2.1.4.2 Set targets via third-party assessment schemes such as HQM and BREEAM

To assess if a carbon reduction or net zero target has been achieved, LPAs often set out requirements for the submission of an energy statement which sets out the relevant calculations and assumptions. MSDC have advised that, due to their limited capacity to assess detailed energy or sustainability statements in-house, it may be preferable to set policy with reference to 'off the shelf' third party accreditation schemes. This would mean that MSDC could simply seek proof of certification/performance rather than reviewing detailed energy modelling (as would be needed if MSDC sought to implement the LETI standard, described in Appendix A.3). The council could have confidence in the ratings given they are completed by independent assessors and would ensure the cost is borne by those benefitting from the uplift in values from the development.[54]

The options that have been explored in this study are BREEAM, Home Quality Mark and Passivhaus, as these are the most widely recognised in the UK.

BREEAM is an industry recognised sustainability assessment and rating methodology from the Building Research Establishment (BRE). Assessment and rating certification is delivered through accredited third-party assessors. BREEAM assessments consider a wide range of sustainability factors and are completed throughout the lifecycle of the development. The assessments include an analysis of energy use, health and wellbeing, innovation, land use, materials, management, pollution, transport, waste and water.

The Regulation 18 version of the Mid Sussex District Plan includes a policy specifying BREEAM requirements for different types of non-residential development (e.g. BREEAM Excellent for all non-residential new builds and non-residential refurbishments over 500sqm). There are many examples of Local Plans that require BREEAM certification, so this is a well-established approach.

HQM is a relatively new scheme for new build homes (also from the BRE). Like BREEAM, it considers a range of sustainability topics, but also awards credits for homes based on the design and construction quality, running costs, and measures to promote occupant health and wellbeing. HQM incudes criteria relating to energy performance (see chapters 5.1 and 5.2 of the HQM manual).[55]

Regulation 18 draft policy DPS2 sets out requirements for minimum HQM star ratings for residential new build and refurbishment schemes. We are not aware of many other local plans specifying a HQM requirement, although Tunbridge Wells Submission Local Plan (2021) and Islington's local plan (currently at examination) provide two examples. Policy S3 of Islington's local plan states that: *"Major and minor new-build residential developments must achieve a four-star rating (as a minimum) under the BRE Home Quality Mark scheme."*

A key point to understand is that both schemes address topic areas other than energy and GHG performance. The benefit of this is that they prompt developers to consider wider sustainability issues; the potential downside is that, unlike some performance standards that are solely targeted at reducing energy use and GHG emissions, simply gaining accreditation with these schemes will not guarantee that development in Mid Sussex is compatible with the net zero target – unless specific credit requirements are introduced. Under that approach, it *is* possible to use those schemes to secure radical reductions in operational emissions, reduce the performance gap, and drive better performance in regard to embodied carbon, which would still go significantly beyond current Building Regulations.

[54] BRE Global, the certification body and operators of BREEAM and HQM, is accredited by the United Kingdom Accreditation Service (UKAS) against these standards to ensure independence, competence, and impartiality.

[55] Rather unhelpfully, HQM still assess energy performance relative to 2013 Building Regulations (not the revised 2021 regulations) but BRE have said this will be updated as part of the next HQM scheme update (date tbc).

Some other points to consider:

- Viability: Use of these schemes would incur some additional costs to developers, which need to be taken into account. The viability evidence presented in Section 6 indicates that the scale of uplift in build costs associated with use of these schemes depends on the energy/GHG performance requirements (i.e. number of credits) rather than the overall rating. Setting an overall net zero requirement is expected to increase build costs for domestic developments by c. 3-5%, and for non-domestic developments by c. 5-10%. Demonstrating compliance with this policy via HQM or BREEAM would result in some additional cost to developers which, according to anecdotal research can range from c. £4,000 for a design team that is new to HQM down to c. £1,000 per unit.[56]
- Futureproofing: The schemes are updated semi-regularly. This is necessary to keep up with changes in Building Regulations, otherwise credits could be awarded to buildings that perform at or below the minimum national standard. However, the timing of updates is uncertain; at the time of writing (March 2023) BREEAM has been updated to reflect Part L 2021 but HQM is not due to be updated until July 2023. The Regulation 18 draft of policy DPS2 includes specific ratings and credit requirements, which introduces a risk of the policy being superseded within the next few years. Policy wording therefore needs to be outcome-oriented and/or caveated to reduce the emphasis on achieving overall ratings or credits within either of these schemes. The Solihull example (see above) offers an alternative approach, which is to use a phased policy.
- Promoting a shift to renewable energy and heating: BREEAM and HQM, like the Building Regulations themselves, are designed to offer flexibility in terms of how a developer achieves the target energy and GHG performance. So, while achieving the star ratings set out in the Regulation 18 draft policy would require some combination of energy efficiency measures and on-site renewables, there are few specific requirements. For example, they would not necessarily prohibit the use of gas boilers, or mandate the use of PV, to achieve a certain number of credits. The GHG assessment in Section 7 and the Mid Sussex Net Zero Study both show that there is an urgent need to (a) phase out the use of fossil fuels and (b) maximise renewable energy generation. So, in addition to setting requirements in HQM and BREEAM, it is recommended that MSDC adopt additional policy wording to address these specific points.

Another widely recognised third-party assessment scheme is Passivhaus. The Passivhaus Standard, developed in Germany, focuses on maximising the thermal efficiency of the building fabric using high levels of insulation and air tightness and mechanical ventilation with heat recovery, certified through an exacting and independent quality assurance process.

Given that third party accreditation schemes can be used to secure enhanced energy/carbon performance (as per Regulation 18 draft policy DPS2 and noting that this also allows verification costs to be passed directly to the developer), **it is recommended that MSDC sets carbon reduction targets with reference to the energy and carbon credits set out in BREEAM and HQM for non-residential and residential schemes respectively**. Specific recommendations on wording and credit requirements for HQM and BREEAM are presented in Section 4.1.

Passivhaus represents best practice levels of energy and GHG performance. The levels of energy efficiency are very high, in line with those proposed by the CCC.[57] The Passivhaus standard drives much higher levels of insultation than current building regulations. Furthermore, Ricardo modelling suggests that even once the FHS is adopted, space heating demand may still be 3 times higher than buildings constructed to Passivhaus standards.

[56] Based on discussions between HDH Planning & Development and various consultancies, in correspondence shared with MSDC.

[57] CCC, *'UK housing: Fit for the future?'* (2019). Available at: www.theccc.org.uk/publication/uk-housing-fit-for-the-future

To achieve the standard the Passivhaus Planning Tool (PHPP) must be used. PHPP is known to provide very robust and reliable outputs. However, PHPP would be needed in addition to calculations for building regulations and potentially also for BREEAM/HQM, adding work for applicants. This could be particularly challenging for minor developments.

Achieving the standard creates added construction costs and requires skilled labour – a recent analysis by AECOM[58] suggested that the uplift could be ~1-2% but case study evidence from the past decade shows a much wider, and higher, range of costs (see Section 6). Finding appropriately qualified construction workers to build to the exacting Passivhaus standard could also be a constraint.

The Passivhaus standard has not been widely used in planning policies in England to date. However, there are some examples. One of the strongest is Bristol City Council's policy CCS2 in the Local Plan Review (2019, not yet adopted) which actively encourages use of this standard by reducing wider policy requirements on Passivhaus schemes:

Where buildings are proposed to be certified Passivhaus standard, the % CO_2 reduction targets above relating to energy efficiency measures, on-site renewables and Allowable Solutions will not need to be met. In these cases, a full Energy Strategy will not be required and it will be sufficient to submit the technical information required to demonstrate that the Passivhaus standard can be achieved and for the Sustainability Statement to demonstrate that the residual heat/cooling demand for the development has been met sustainably as set out below.

Other councils such as Cambridge City and Havant simply indicate their support for schemes that use the Passivhaus standard.

Given the robustness of the Passivhaus standard, we recommend that MSDC should explicitly support the use of the Passivhaus standard as an alternative route to compliance regarding energy and GHG emissions. Schemes that achieve a Passivhaus certification would not need to undergo a BREEAM or HQM assessment. The current draft of the plan states in the supporting text to policy DPS2 that *"Equivalent standards for buildings by nationally recognised certification bodies may also be accepted, such as Passivhaus or AECB standards*". We recommend the option for using Passivhaus is included in the standards table in the policy itself (for residential new build) and that, as an incentive, applications committing to achieve this standard should not need to meet wider policy requirements relating to energy measures (as per the Bristol example above).

5.2.1.4.3 Set targets by specifying absolute performance targets or other metrics

In recent years, some local authorities have chosen to take a different approach and set absolute performance targets or other metrics, rather than targets based on Building Regulations or third-party assessment schemes. This approach accords with the Climate Change Committee's recommendations for new dwelling standards.[59]

There are a variety of targets and metrics, including standards set by the UK GBC, RIBA and LETI, that could be specified based on emerging industry best practice. These are described in more detail in Appendix A.3, but they share some common principles, such as:

- Very high standards of energy efficiency, such that demand for space heating and all other energy requirements (measured in kWh/m^2 per year) are extremely low
- Reducing all other energy demands and ensuring that 100% of energy use can be met through on-site renewables, not allowing any fossil fuel combustion on-site

[58] 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/

[59] CCC, *'UK housing: Fit for the future?'* (2019). Available at: www.theccc.org.uk/publication/uk-housing-fit-for-the-future

- Reducing the performance gap and prioritising as-built performance, rather than modelled design-stage estimates, as the most important measure of whether the building can be considered net zero in operation

There are some examples of recently-adopted or draft Local Plan policies that take this approach.

Bath & North East Somerset Local Plan Partial Update (LPPU) – adopted 2023

The LPPU contains net zero policies for residential and non-residential new builds:[60]

Policy SCR6 Sustainable Construction Policy for New Build Residential Development

New build residential development will aim to achieve zero operational emissions by reducing heat and power demand then supplying all energy demand through onsite renewables. Through the submission of an appropriate energy assessment, having regard to the Sustainable Construction Checklist SPD, proposed new residential development will demonstrate the following;

- *Space heating demand less than 30kWh/m^2/annum;*
- *Total energy use less than 40kWh/m^2/annum; and*
- *On site renewable energy generation to match the total energy use, with a preference for roof mounted solar PV*
- *Connection to a low- or zero-carbon District heating network where available*

Major residential development

In the case of major developments where the use of onsite renewables to match total energy consumption is demonstrated to be not technically feasible (for example with apartments) or economically viable, renewable energy generation should be maximised and the residual on site renewable energy generation (calculated as the equivalent carbon emissions) must be offset by a financial contribution paid into the Council's carbon offset fund where the legal tests set out in the Community Infrastructure Regulations are met.

Policy SCR7 Sustainable Construction Policy for New Build Non-Residential Buildings

New build non-residential major development will maximise carbon reduction through sustainable construction measures. Through the submission of an appropriate energy assessment having regard to the Sustainable Construction Checklist SPD all planning applications will provide evidence that the standards below are met.

Major development is to achieve a 100% regulated operational carbon emissions reduction from Building Regulations Part L 2013 (or future equivalent legislation), following the hierarchy set out below.

- *Minimise energy use through the use of energy efficient fabric and services*
- *Residual energy use should be met through connection to a low- or zero-carbon heat network if available.*
- *Maximise opportunities for renewable energy to mitigate all regulated operational emissions.*
- *Residual carbon emission that cannot be mitigated on site should be offset through a financial contribution to the council's carbon offset fund.*

Cornwall Council Climate Emergency DPD – adopted 2023

Cornwall's Climate Emergency DPD includes a policy requiring residential proposals to achieve net zero carbon emissions and sets specific targets for space heating demand and total energy

[60] BANES, *'Local Plan Partial Update'* (2023). Available at: https://beta.bathnes.gov.uk/sites/default/files/2023-01/Adopted%20LPPU%20Jan%202023.pdf

consumption, allowing offsite contributions where this cannot be achieved on-site. Major non-residential schemes are required to achieve BREEAM Excellent "or an equivalent better methodology".[61]

Policy SEC1 – Sustainable Energy and Construction

1) *The Energy Hierarchy - All proposals should embed the Energy Hierarchy within the design of buildings by prioritising fabric first, orientation and landscaping in order to minimise energy demand for heating, lighting and cooling. All proposals should consider opportunities to provide solar PV and energy storage.*
2) *(a) New Development – Major Non-Residential: Development proposals for major (a floor space of over 1,000m^2) non-residential development should demonstrate how they achieve BREEAM 'Excellent' or an equivalent or better methodology.*
2) *(b) New Development – Residential: Residential development proposals will be required to achieve Net Zero Carbon and submit an 'Energy Statement' that demonstrates how the proposal will achieve:*
    - *Space heating demand less than 30kWh/m^2/annum;*
    - *Total energy consumption less than 40kWh/m^2/annum; and*
    - *On-site renewable generation to match the total energy consumption, with a preference for roof-mounted solar PV.*

Where the use of onsite renewables to match total energy consumption is demonstrated to be not technically feasible (for example with apartments) or economically viable renewable energy generation should be maximised as much as possible; and/or connection m a d e to an existing or proposed low carbon district energy network; or where this is not possible the residual energy (the amount by which total energy demand exceeds the renewable energy generation) is to be offset by a contribution to Cornwall Council's Offset Fund.

Where economic viability or technical constraints prevent policy compliance, proposals should first and foremost strive to meet the space heating and total energy consumption thresholds. Proposals must then benefit as much as possible from renewable energy generation and/or connection to an existing or proposed low carbon district energy network. As a last resort, any residual energy is to be offset by a contribution to Cornwall Council's Offset Fund, as far as economic viability allows.

Other examples

There are similar policies in draft plans for authorities such as North East Cambridge, Winchester, Leeds, and Lancaster, which are at different stages of consultation.[62,63,64,65] Note that some of these draft policies have been challenged by planning inspectors, as in the case of Lancaster City Council. However, the more recent adoption of the BANES and Cornwall policies sets an encouraging precedent. It is the view of the Town and Country Planning Association (TCPA) that, 'As a matter of law and policy […] a local planning authority is entirely justified, and, in the TCPA's view required, to set out a net zero objective in planning policy.'[66]

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[61] Cornwall Council, *'Climate Emergency Development Plan Document'* (2023). Available at: https://www.cornwall.gov.uk/media/uxqjk4jn/climate-emergency-dpd.pdf

[62] Greater Cambridge Council, *'Proposed Submission North East Cambridge Area Action Plan – Regulation 19* (2021). Available at: https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-11/NECAAPNorthEastCambridgeAreaActionPlanReg192020v22021.pdf

[63] Winchester City Council, *'Winchester District Local Plan – Regulation 18 Consultation Plan'* (2022). Available at: https://democracy.winchester.gov.uk/documents/s22961/CAB3357%20-%20APDX%201%20Local_Plan-12pt-.pdf

[64] Leeds City Council, *'Local Plan Update'* (2022). Available at: https://www.leeds.gov.uk/planning/planning-policy/local-plan-update

[65] Lancaster City Council, *'Climate Emergency Review of the Development Management DPD Submission Local Plan'* (2022). Available at: https://www.lancaster.gov.uk/planning/planning-policy/local-plan-examination

[66] TCPA, *'The application of net zero in local plan policy'* (2022). Available at: https://tcpa.org.uk/wp-content/uploads/2022/07/20220714-climate-statement-W-Ox.docx

Conclusion on setting absolute performance targets

MSDC could introduce similar targets, as this would be fully in line with its climate change commitments and reflect the recommendations of the Net Zero study. However, these standards do not form part of an off the shelf assessment scheme and so would require developers to undertake bespoke calculations to prove compliance. This, in turn, would require in-house expertise to scrutinise energy statements.

For these reasons, **following discussions with MSDC we suggest that industry standards or other metrics that are *not* linked to a third-party certification process would not be practical to adopt at this stage. However, it is recommended that the Council consider options for bringing in more technical expertise to assess such applications in future.** This is because, going forward, net zero requirements are likely to become an increasing focus of development proposals, and (regardless of if or when these are adopted into the Building Regulations), officers will need to be able to evaluate the merits of individual schemes.

5.2.1.5 Tackling residual emissions

There may be cases where achieving the carbon target on-site can be proven to be not technically feasible or unviable. In those instances, carbon offsetting might need to be allowed, as a last resort where it is demonstrated a development cannot achieve net zero on-site. **We recommend that MSDC therefore give further consideration to setting up a carbon offsetting scheme.**

The advantage of this would be that carbon offsetting could generate funds to invest in energy efficiency improvements to existing homes, reducing emissions and fuel poverty. The major disadvantage is that carbon offsets do not always deliver actual carbon reductions and are widely perceived as a get-out clause. If carbon offsetting was pursued, a further challenge would be the lack of in-house expertise and resources within MSDC to identify relevant carbon reduction projects and run the scheme.

There is evidence that low or medium rise domestic developments can achieve net zero regulated emissions without offsetting but that it may be more challenging for non-domestic or higher density developments.[67,68] Recognising the types of development that are likely to come forward in Mid Sussex, it is anticipated that any offsetting fund would primarily be used for non-domestic developments.

More information on carbon offsetting is provided in Appendix A.7.

5.2.1.6 Resource requirements to assess compliance

A person without any specialist knowledge could easily check whether the requisite HQM and BREEAM credits have been achieved. An understanding of sustainable building design would, however, be needed to interrogate and push back against any proposals that do *not* meet the required standard. (This issue will apply not just for energy and GHG performance, but for any environmental policies that MSDC sets that go beyond minimum statutory requirements.)

Whether MSDC chooses to adopt a policy that requires the use of bespoke net zero metrics or third-party assessment schemes, ideally applications would be evaluated by individuals who are competent to assess them. This is a specialist field of knowledge that would require dedicated officer resource in future. Depending on the policies adopted, the type of qualifications that are necessary might include:

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[67] 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).

[68] 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.

- 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
- Officers 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

In terms of resource requirements on MSDC's part, the key difference between using a third-party assessment scheme is that the officers would not need to have specialist knowledge to interpret energy calculations when assessing overall compliance and the cost is borne by those benefitting from the uplift in values from the development. As with any other District Plan policy, however, officers would need to have enough subject knowledge to be able to push back against developers who claim that a certain policy cannot be met.

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.[69] However, it will need to become a priority going forward as greater attention is paid to the GHG impacts of new development.

5.2.2 Other energy/carbon requirements

This policy sub-category relates to options around imposing further requirements in addition to the above, covering heat network connections and demand-side response.

5.2.2.1 Requirements for heat network connection

Heat networks[70] are still considered to be an effective and low carbon means of supplying heat where there is a high and consistent heat demand and a readily available source of zero carbon or surplus/waste heat. The higher the heat demand density, the more cost effective the network. Given that most of the proposed developments in Mid Sussex are lower density residential developments – which will have low heat demands due to meeting higher energy efficiency standards —heat networks are not likely to be a cost effective solution for many of the new development sites.

The exceptions would be if there are high-density developments, particularly in or near existing heat loads or urban areas, or developments that are in proximity to sources of waste heat such as industrial facilities or wastewater treatment plants (WWTPs).

LPAs with areas meeting these criteria sometimes set requirements for development to connect to decentralised heat networks. A good example of this is Policy EN4 of Leeds Core Strategy (2019) which states:

[69] 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

[70] Heat networks (also known as district heating) supply heat from a central source to consumers, via a network of underground pipes carrying hot water.

Where technically viable, appropriate for the development, and in areas with sufficient

existing or potential heat density, developments of 1,000 sqm or more or 10 dwellings or more (including conversions where feasible) should propose heating systems according to the following hierarchy:

(i) Connection to existing District heating networks,

(ii) Construction of a site wide District heating network served by a new low carbon heat

source,

(iii) Collaboration with neighbouring development sites or existing heat loads/sources to

develop a viable shared District heating network,

(iv) In areas where District heating is currently not viable, but there is potential for future District heating networks, all development proposals will need to demonstrate how sites have been designed to allow for connection to a future District heating network.

The London Plan takes a similar approach in Policy SI3, which includes seeking energy masterplans for large scale developments and setting requirements for heating systems for developments in Heat Network Priority Areas to ensure they can connect.

MSDC could consider commissioning heat mapping/energy masterplans for key settlements, taking into account significant site allocations and significant industrial uses. This could build on the high-level mapping completed in the West Sussex Sustainable Energy Strategy (2009) and the high-level assessment of strategic sites presented in Appendix A.4. However, given the relatively limited opportunities and the declining heat demand from new buildings as energy standards are tightened, there may be limited benefits to be gained (and substantial investment in technical expertise would be required to design and delivery a new heat network) so we do not see this as a priority commission.

5.2.2.2 Requirements for fossil fuel free heating

Heating homes using fossil fuels such as gas generates significant carbon emissions (see modelling in Section 7). The NE Cambridge AAP Regulation 19 version (Nov 2021) includes the following requirement in Policy 2:

- *"All heating should be provided through low carbon fuels (not fossil fuels).*
- *No new developments should be connected to the gas grid."*

This is in line with the Climate Change Committee's recommendations from 2019[71] which stated that:

- *By 2025 at the latest, no new homes should connect to the gas grid*. Instead they should have low-carbon heating systems such as heat pumps and low-carbon heat networks.
- *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. This can save £1,500 - £5,500 per home compared to later having to retrofit low-carbon heat from scratch.

We recommend that Mid Sussex consider adopting a similar approach, imposing a requirement for all new heating in all building types to be provided through low carbon fuels (i.e. not oil or gas) ahead of the planned national ban on gas boilers in new homes from 2025[72].

The technical evidence presented in Section 7 clearly demonstrates the need to phase out the use of fossil fuels. However, particularly in light of the currently very high electricity prices, it is important to ensure that the transition towards low carbon heat does not lead to high heating costs. The most effective way to address this while also achieving GHG reductions is to mandate very high standards

[71] CCC, *'UK housing: Fit for the future?'* (2019). Available at: www.theccc.org.uk/publication/uk-housing-fit-for-the-future

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

of energy efficiency. As discussed in Section 6, occupants can enjoy significantly lower energy bills if these standards of performance are adopted.

5.2.2.3 Requirements relating to demand-side response

Demand-side response refers to the ability to reduce or increase energy consumption for a period of time in response to an external driver (e.g. in response to an energy price rise, on-site renewable energy generation or limited availability of grid electricity when renewal energy generation is low). This can have multiple benefits, such as maximising the benefits of on-site renewables, contributing to local electricity grid resilience and allowing more renewables to supply the national grid (renewable power generation is intermittent and does not necessarily match with peak demands on the grid).

LETI anticipates that in the future new buildings will be expected to incorporate demand-side response measures to support a more stable grid. However, such measures are rarely designed into new buildings at present and there are no targets to define what good looks like. Measures could include reducing peak heating, cooling and hot water loads; and more active measures such as home energy management systems that can turn down heating or cooling for short periods to reduce demand; or systems that encourage people to turn down energy use through use of incentives; or battery systems that can store electricity when demand on the grid is low and supply it when grid supply is constrained.

Given the lack of industry standards for demand-response at this time and the limited technical energy expertise in the council we do not recommend that MSDC sets requirements for demand-side response at this stage.

5.2.3 Water efficiency

MSDC's Reg 18 policy has set *"a maximum water consumption standard of 85 litres per person per day […]"* to alleviate pressure on natural resources. While the main driver is the Habitats Regulations rather than GHG emissions,[73] this also has the co-benefit of reducing indirect emissions that are associated with water supply. This exceeds current guidelines of both the minimum whole building standard of 125 litres per person per day (l/p/d) as well as the tighter, optional standard of 110 l/p/d as set out in Part G of the Building Regulations. **We support the adoption of tighter water efficiency standards within Mid Sussex and recommend that this wording is retained.** South East Water's company area – into which Mid Sussex falls – has been deemed as seriously water stressed in 2013 and was confirmed to remain in this categorisation by the EA in 2021.

A recent study by JBA Consulting on behalf of Crawley Borough Council, Chichester District Council, and Horsham District Council concludes that the 85 l/p/d target is both practicable and crucial to achieve water neutrality.[74] 85 l/p/d was described as a 'realistic achievable' target.

What is Water Neutrality?

"Water neutrality is defined as development that takes place which does not increase the rate of water abstraction for drinking water supplies above existing levels."[75]

There are two broad approaches to achieving this standard:

- A fittings-based approach that would involve selecting water efficient taps, showers, baths, toilets, etc. This can be achieved at minimal additional cost, c. £350-430/dwelling according to

[73] Natural England, *'Advice Note regarding Water Neutrality within the Sussex North Water Supply Zone'* (2022). Available at: https://www.westsussex.gov.uk/media/17127/ne_advicenote_waterneutrality.pdf

[74] JBA Consulting on behalf of Crawley Borough Council, Chichester District Council, and Horsham District Council, *'Water Neutrality Study'* (2022). Available at: https://www.horsham.gov.uk/__data/assets/pdf_file/0004/120397/EYP-JBAU-XX-XX-RP-EN-0004-A1-C02-Water_Neutrality_Assessment_Part_C.pdf

[75] For more information, refer to the Horsham District Council website: https://www.horsham.gov.uk/planning/water-neutrality-in-horsham-district

the same JBA Consulting study. Note that, if occupants replace these fittings with less efficient alternatives, this would result in higher water consumption.

- Use of rainwater harvesting or greywater recycling systems. Rainwater harvesting systems cost £1,500-£4,000 per property whereas greywater recycling systems cost closer to £4,000 per dwelling. Experts in the Ricardo water team have advised that the standard could be achieved with the fittings-based approach or rainwater harvesting so the latter is an upper estimate.

5.3 Renewable and low carbon energy policy

5.3.1 Context: Renewable energy resources within Mid Sussex

In the past 15 years, to the authors' knowledge there have been two previous energy studies carried out for Mid Sussex and the surrounding area. The most recent one was a 2014 study which evaluated the potential for renewable energy projects in Mid Sussex.[76] The authors of that study acknowledged the technical constraints (e.g. airport/radar) and landscape constraints (e.g. the Area of Outstanding Natural Beauty) and stated that, 'Whilst such constraints do not necessarily preclude renewable energy development, the range of issues simply increases the risks for potential developers.' In line with the then-current Government guidance on undertaking area-wide renewable energy assessments, that study mapped existing constraints, but did not explore whether MSDC or other authorities could loosen those constraints.[77] A similar approach was taken in the 2009 West Sussex Renewable Energy Study.[78] These studies may have given the impression that there is limited scope for large-scale renewables in Mid Sussex, even though both studies identified that there is significant physical resource.

However, the scientific understanding of climate change, as well as the policy context at a local, national and global scale, is very different now compared to when that report was issued: The UK ratified the Paris Agreement, the Climate Change Act was adjusted to require a 100% reduction in GHG emissions rather than an 80% reduction, and the Government announced its ambition for the electricity grid to be net zero by 2035.

To have a realistic chance of meeting those targets, LPAs need to adopt a presumption in favour of renewable energy projects, provided they are not subject to technical, environmental or safety concerns – even if they have a visual impact. After all, the landscape impacts of renewable technologies will be much less severe than the landscape impacts of climate change. We therefore recommend that MSDC works with other relevant bodies to re-evaluate the current policy restrictions in a way that acknowledges the ongoing climate catastrophe, to the extent possible within their legal remit.

5.3.2 Criteria based policy options

The key options for this policy type relate to whether criteria-based policy approaches to renewable and low carbon energy go far enough and if further work should be done to create policies that identify 'suitable areas' for the various types of renewable and low carbon energy, most notably wind.

The NPPF states that local authorities should design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily. The PPG provides helpful guidance for local authorities on how to develop robust criteria-based policies in relation to renewable and low carbon energy projects. Key points include:

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[76] Amec, *'Mid Sussex District Council Sustainable Energy Study'* (2014). Available at: https://www.midsussex.gov.uk/media/2591/mid-sussex-sustainable-energy-study-report.pdf

[77] Department of Energy and Climate Change, *'Renewable and Low-carbon Energy Capacity Methodology'* (2010). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/226175/renewable_and_low_carbon_energy_capacity_methodology_jan2010.pdf

[78] CSE, Impetus Consulting and Land Use Consultants, *'West Sussex Sustainable Energy Study'* (2009). Available at: https://www.midsussex.gov.uk/media/2600/west-sussex-renewable-energy-study.pdf

- The criteria should be expressed positively (i.e. that proposals will be accepted where the impact is or can be made acceptable).
- Should consider the criteria in the National Policy Statements as these set out the impacts particular technologies can give rise to and how these should be addressed.
- Cumulative impacts require particular attention, especially the increasing impact that wind turbines and large-scale solar farms can have on landscape [including designated landscapes such as national parks and AONBs] and local amenity as the number of turbines and solar arrays in an area increases.
- Local topography is an important factor in assessing whether wind turbines and large-scale solar farms could have a damaging effect on landscape. Recognise that the impact can be as great in predominantly flat landscapes as in hilly areas.
- Care should be taken to ensure heritage assets are conserved in a manner appropriate to their significance, including the impact of proposals on views important to their setting.
- Protecting local and residential amenity is an important consideration which should be given proper weight in planning decisions.

Drawing on the guidance outlined in the PPG, after expressing positive support in principle for renewable and low carbon energy development, Local Plans should list the criteria that will be taken into account in considering specific applications. This should not be a long negative list of constraints, but it should set out the range of safeguards that seek to protect the environment – including landscape and townscape. Other key considerations may include residential amenity, aviation, heritage, tranquillity, etc. For example, the Lancaster Regulation 19 Partial Review Local Plan Part 2 (not yet adopted) Policy DM53: Renewable and Low Carbon Energy Generation[79] (set out in Appendix A.2) is a criteria-based policy that goes further than most policies as it sets out criteria separately for onshore wind, hydro, solar, other renewable and low carbon technologies, heating and cooling networks and energy storage.

Policy DPS3: Renewable and Low Carbon Energy Schemes of the Draft Mid Sussex Local Plan sets out overarching criteria for renewable and low carbon energy proposals (including in relation to landscape, visual, ecological and residential impacts). It contains useful policy wording; however **we recommend this could go further by setting out criteria that relate to each type of energy technology, drawing on the Lancaster example cited above**.

It is important that policy does not preclude the development of specific technologies other than in the most exceptional circumstances and does not merely repeat national policy but is relevant to the process of decision-making at the local level, focusing on locally distinctive criteria related to local assets, characteristics, and sensitivities.

It may also be appropriate for more detailed issues and guidance to be included in a Supplementary Planning Document (SPD) on renewables. **We recommend that any criteria-based policy designed to manage the development of renewable and low carbon technologies should also be supported by guidance on *the most suitable locations*, either within the District Plan or an accompanying SPD.** Criteria based policies create greater certainty for developers and allow the Council to clearly set out the circumstances where renewable energy proposals will and will not be permitted, but they may be perceived as overly restrictive.

5.3.3 Identification of 'Suitable Areas for Wind Energy' Policy Options

In line with the NPPF, when considering applications for wind energy development, local planning authorities should only grant planning permission if the development site is in an area identified as

[79] For more information, refer to the Lancaster City Council website: https://www.lancaster.gov.uk/planning/planning-policy/local-plan-review

suitable for wind energy development in a Local or Neighbourhood Plan (albeit this area of policy may change in future given recent government announcements about enabling onshore wind).

As highlighted in the Mid Sussex Net Zero Carbon Emissions Feasibility and Options Study (2022), there is potentially enough wind resource within Mid Sussex to provide more than 25% of electricity demands for the District. However, the deployable amount is severely constrained by (a) the presence of the SDNP and HWAONB and (b) the fact that there are no areas specifically identified within the District Plan.[80] This is based on analysis set out in the 2009 West Sussex Renewable Energy Study.

When identifying suitable areas for wind, the PPG does not dictate how suitable areas for renewable energy should be identified, but in considering locations, LPAs will need to ensure they take into account the requirements of the technology and, critically, the potential impacts on the local environment, including from cumulative impacts and views of affected local communities. It also makes reference to the former Department of Energy and Climate Change's (now part of the Department for Energy Security and Net Zero) methodology on assessing the capacity for renewable energy development. The guidance notes the value of landscape character assessments in identifying which technologies are appropriate in different locations, including the appropriate scale of development.

One of the key factors determining the acceptability or otherwise of wind turbines is their potential impacts on the local landscape (noting the South Downs National Park and High Weald AONB are key considerations for Mid Sussex) – this is due to their height and the movement they introduce into the landscape (i.e. rotating blades). Different landscapes present different opportunities for renewable energy, and landscape sensitivity studies can assist both planners and developers in identifying what scale of development may be appropriate in which areas. This approach is endorsed by the PPG which states that *"landscape character areas could form the basis for considering which technologies at which scale may be appropriate in different types of location".*

It is important to note that if areas of suitability are identified in the District Plan or Neighbourhood Plans they would be broad designations rather than allocations and would not therefore provide a definitive statement of the suitability of particular locations for wind energy. Site specific assessment and design would still be required, and all applications would still be assessed on their individual merits. It is also not possible at a strategic level, to consider cumulative effects. Residential amenity, the setting of heritage assets, telecommunications, ecology, air traffic safety and other issues would also need to be carefully considered at a site level.

All applications would also have to meet the second test set out in the NPPF, i.e. that it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and the proposal has their backing (though note this requirement may be subject to change given recent government announcements about enabling onshore wind). It is therefore recommended that such policies are also supported by development management criteria against which individual planning applications will be judged (see section on criteria-based policies above). As outlined in the TCPA/RTPI Climate Change Planning Guidance (2021) whether a proposal has the backing of the affected local community is a planning judgement for the local planning authority, and the courts have ruled that 'addressed' does not mean 'resolved' or 'eliminated'. It is also important to note that plans can allocate areas as suitable for wind turbines and do not have to follow the more onerous route of allocating actual sites, as is sometimes mistakenly assumed.

Examples of where identification of 'suitable areas for wind energy' has been included in local plans include Bath and North East Somerset, Eden, Hull and Exmoor National Park – note that these are not necessarily examples of best practice but serve to illustrate different approaches taken. The Redcar and Cleveland Local Plan (adopted in May 2018) includes Renewable and Low Carbon Energy Policy SD 6 which identifies areas with potential for wind and solar technologies in the Proposal Map

[80] Allocating suitable areas within a Local or Neighbourhood Plan has been a requirement since the 2015 Written Ministerial Statement on Wind. The policy position could change in future and the Government is consulting on some changes to the way that onshore wind development is managed. For more information, refer to: https://www.gov.uk/government/consultations/developing-local-partnerships-for-onshore-wind-in-england

accompanying the Local Plan. These areas were identified by undertaking a technical assessment of wind and solar potential overlaid with the findings of a landscape sensitivity assessment.

As nearly 50% of the district of Mid Sussex lies within the High Weald AONB and over 10% is within the South Downs National Park landscape assessments will be critical to understand the 'deployable' potential of renewable energy schemes within the district. **It is very important to understand that these are *not* technical constraints and large-scale renewables could be much more widely adopted in this area.** Given that onshore wind (along with ground-mounted PV) is one of the cheapest forms of electricity generation, if the UK is to meet its climate change targets in a cost-effective way, while also ensuring a secure and diverse energy supply, there is a strong argument in favour of taking a much more permissive approach to wind energy developments. Therefore, whilst recognising that MSDC has to work within existing Government policy, and acknowledging that there are other stakeholders involved, as a minimum starting point the Council should proactively identify suitable areas for wind development.

Currently, Policy DP40 refers to the need for areas to be defined in Neighbourhood Plans as stated in the 2014 Sustainable Energy Study[81]. The study identifies the various considerations and constraints for wind power schemes, noting that there is limited scope for large scale wind farm development given the combination of environmental designations, communication and radar issues and proximity to existing communities. However, we could not find any maps actually identifying suitable areas for wind energy development in Mid Sussex. Furthermore, the size of turbines used within wind farms has changed dramatically since the 2009 West Sussex Renewable Energy Study[82] was published. While there are no standard categories to use for wind turbine sizes the Study assumed that the largest hub height considered would be 80m, however, most studies now consider 200m as the largest hub height. Therefore, updated information on the suitable size of wind turbines within Mid Sussex would be necessary to fully understand the technical and deployable potential for wind energy.

Therefore, **we recommend that MSDC undertake work to identify areas where proposals are more likely to be supported. This should be based on an updated landscape sensitivity assessment and constraints mapping, but as explained in Section 5.3.1, broadly speaking MSDC should adopt a presumption in favour of such schemes and work with other stakeholders to remove policy barriers where possible. These areas should then be cross-referenced in the District Plan and MSDC should proactively encourage renewable energy developments in areas that are identified as suitable**.

Identifying suitable areas for renewable and low carbon energy projects in the District Plan will enable planners to have informed discussions with developers and communities, meets national policy and can act as a useful tool for neighbourhood planning.

5.3.4 Community Led Renewable and Low Carbon Schemes Policy Options

As noted within the Mid Sussex Sustainable Energy Study 2014, there is an opportunity for community-led renewable/low carbon led schemes, such a smaller scale community owned wind farm, solar farm or biomass scheme. The NPPF states that local authorities should support community-led initiatives for renewable and low carbon energy, including developments being taken forward through neighbourhood planning. Community-led renewable energy projects are increasingly being seen as an attractive option for local communities wishing to contribute to local/national climate change targets and as a way to generate local revenue to directly benefit the community. For example, the Westmill Wind Farm Co-

[81] Amec, *'Mid Sussex District Council Sustainable Energy Study'* (2014). Available at: https://www.midsussex.gov.uk/media/2591/mid-sussex-sustainable-energy-study-report.pdf

[82] CSE, Impetus Consulting and Land Use Consultants, *'West Sussex Sustainable Energy Study'* (2009). Available at: https://www.midsussex.gov.uk/media/2600/west-sussex-renewable-energy-study.pdf

operative[83] in Swindon was the first 100% community owned wind farm to be built in the south of England.

Community groups can face considerable challenges in the pre-planning stage and there are a number of opportunities for local authorities to provide advice and guidance at this stage, including the provision of early advice on planning requirements and lending support to consultation activities within the community. Engaging communities in the earliest stages of plan-making and providing clear information on local issues and the decision-making process can aid the development of community renewable energy projects.

Examples of plans that include policies to support community renewable energy schemes include the adopted Bath and North East Somerset Local Plan.[84]

The Council's draft policy DPS3 could broaden its support for community renewable schemes by stating that the Council would actively support community renewable energy schemes which are led by or meet the needs of local communities (and subject to meeting wider requirements in relation to landscape, ecology, amenity, etc). Such developments would normally be conceived and/or promoted by the community within which the renewable development will be undertaken, delivering economic, social and/or environmental benefits to the community. Neighbourhood plans provide a particular opportunity to define detailed site allocation policies for renewable and low carbon technologies.

Furthermore, the use of interactive maps can be a key tool used by community groups, neighbourhood planning groups and renewable energy developers to see where there is potential for renewable energy. One such map has been developed by LUC alongside the Shropshire Renewable Energy Study (2021).[85] It includes the findings of the landscape sensitivity assessment for wind and solar. Mid Sussex Council could consider developing such interactive mapping to ensure community groups understand the renewable energy potential and suitable areas for deployment.

5.4 Sustainable travel and reducing the need to travel

The NPPF states that planning policies should: '*provide for attractive and well-designed walking and cycling networks with supporting facilities such as secure cycle parking'.* Furthermore, the National Design Guide[86] notes that the patterns of movement of people are integral to well-designed places. A well-designed movement network should limit the impacts of car use (including carbon emissions) by prioritising and encouraging walking, cycling and public transport.

The Local Plan plays a key role in promoting the creation of sustainable transport and active travel links throughout the local plan area and within new developments as well as encouraging the use of those transport methods. Many local plan policies simply set out the principle of promoting the use of sustainable transport and active travel. For example, Policy DM33 Safe, Sustainable and Active Travel of the Brighton and Hove City Plan Part 2 (found sound in summer 2022) sets out that it '*will promote and provide for the use of sustainable transport and active travel by prioritising walking, cycling and public transport in the city.'* However, this policy then goes further, setting out how new developments should accommodate for each transport method: pedestrians, cyclists, public transport users and safe and inclusive travel.

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[83] For more information, refer to the Westmill Wind Farm Co-operative website: https://www.westmill.coop/

[84] Bath & North East Somerset Council, *'Core Strategy'* (2014) and *'Placemaking Plan'* (2017). Available at: https://beta.bathnes.gov.uk/policy-and-documents-library/core-strategy-and-placemaking-plan

[85] Shropshire Climate Action Partnership, *'Energy opportunities and constraints mapping'* (n.d.). Available at: https://shropshire.maps.arcgis.com/apps/webappviewer/index.html?id=e3b884cadead4965a0462242a1bc62c0

[86] Ministry of Housing, Communities & Local Government, *'National Design Guide: Planning practice guidance for beautiful, enduring and successful places'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962113/National_design_guide.pdf

For example, for pedestrians (including wheelchair users and buggies/prams) it states: *In order to encourage walking, new development should:*

a) provide for safe, comfortable and convenient access to/from proposed development for all pedestrians, irrespective of their level of personal mobility and cognition; and

b) where appropriate contribute towards improvements to the wider pedestrian environment, providing for a safe and attractive public realm, including signage, seating, shade/shelter and planting, including consideration of assigning some parts of streets and spaces for shared use by pedestrians and small numbers of vehicles; and

c) maintain, improve and/or provide pedestrian/wheelchair accessible routes that are easy, convenient and safe to use, giving consideration to pedestrian desire lines within and outside site boundaries

Although the Mid Sussex Draft District Plan prioritises sustainable and active travel, we recommend a similar approach could be taken to give further direction to developers.

5.4.1 Inclusion of the 20-minute neighbourhood concept

The emerging Local Plan will need to review whether a new development would achieve the strategic objective of creating places that encourage a healthy and enjoyable lifestyle by the provision of high quality cultural and sporting facilities, informal leisure space and the opportunity to walk, cycle or ride to common destinations. This will require measures to minimise the distance required by individuals to travel, and encourage access on foot or bicycle, or access to well-connected public transportation links. It should consider access to local services as well as journeys to work (mode and distance).

We previously noted that draft policy DPT1 referred to creating communities that *"embody the 20 minute neighbourhood concept and deliver attractive, healthy places that have a permeable street network within the site with clearly defined route hierarchies that are safe and designed for all users and supporting desirable opportunities for people to choose not to travel by car."* We agree that the concept of '20-minute neighbourhoods' – creating places in which most people's daily needs can be met within a short walk or cycle - is a useful tool for informing the design of schemes and the assessment of planning applications. Based on an earlier version of the District Plan we suggested that more use of this concept could be made throughout. The updated version of the draft District Plan includes reference to the principles of a 20-minute neighbourhood through the draft plan including within Policy DPS1 and the supporting text of Policy DPS6. We welcome and support these amendments.

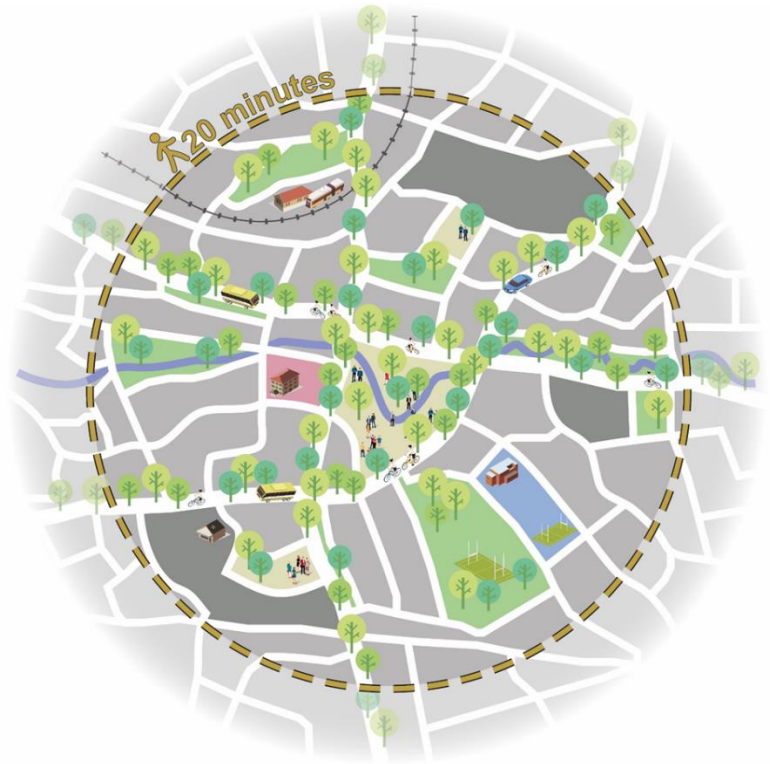
With regard to new large greenfield developments, adopting the 20-min neighbourhood concept as a strategic objective could encourage more mixed-use development applications – with key local services[87] being provided on the new site if existing services are further than 20 min walk / cycle and/or safe, attractive walk/cycle routes being provided to existing provision. This should include easy access to playspace and open space. There will be different design solutions to achieve a 20-min neighbourhood depending on the specific context. Lessons can be learnt from elsewhere. For example, the Trumpington Meadows development in Cambridge of 1200 homes includes a 60 ha country park on the periphery whilst the new homes are built around public transport access and cycle paths with a compact urban form, creating a walkable neighbourhood that encourages public transport use and active travel to reduce car dependency. However, the scheme has struggled to establish local shops, cafes and businesses; a lesson learned was the need to get retail in early.

We note that policies for significant sites such as Policy DPH5 within the draft District Plan state that the site should provide for a village centre and sustainable travel links to surrounding areas. However, **we recommend that site specific policies within the emerging District Plan for 'significant sites**

[87] There is no single list of services and facilities should be considered, indeed this may need to be tailored to different communities. However Sustrans and Our Place have created lists of what they think should be included – see respectively: https://www.ourplace.scot/about-place/themes/20-minute-neighbourhoods-home/20-minute-neighbourhoods and https://www.sustrans.org.uk/our-blog/get-active/2020/in-your-community/what-is-a-20-minute-neighbourhood

(large developments / urban extensions) explicitly incorporate the 20-min neighbourhood concept as they would be able to facilitate delivery of this concept from the design stage and ensure that key services can be accessed easily within 20 minutes' walk from all homes.

Figure 7. 20-minute neighbourhood including the provision of green spaces, public transport, homes, and key local services



5.4.2 Movement Hierarchy

To prioritise sustainable travel, infrastructure must be considered at the start of any development or masterplan process. As such, incorporating the concepts of the user and street hierarchies into policy will ensure sustainable travel is taken into account from the onset of any development proposal. Mid Sussex Design Guide SPD (2020) provides design principles for new development across Mid Sussex. Two principles within the guide set out the need to establish a clear movement network that connects with the surrounding area and to deliver a clear and connected structure of streets and spaces which set out a clear street hierarchy and network of open spaces. We would recommend that such principles are put into policy within the emerging District Plan.

The location of services within or outside the development must be considered and an assessment of the suitability of walking and cycling to these services should be undertaken. This firmly establishes a movement hierarchy. Following which, public transport movements should be considered and finally movement of general traffic. This approach should be set out within policy to ensure developers understand that walking and cycling should be prioritised. For example, Policy 21: Street hierarchy of the Proposed Submission North East Cambridge Area Action Plan (not yet adopted) sets out how the area will be designed around active travel as the first choice, but with a functional street network for vehicular access including for public transport, emergency vehicles, servicing local businesses, and for people with mobility issues as well as community transport and taxis. MSDC could utilise a similar policy approach, specifically within draft policy DPT1 or DPT2. Further to this, there is also potential to integrate green infrastructure within sustainable transport spaces as shown in the figure below.

Walking and cycling routes should be designed to be both convenient and attractive e.g., through greening measures such as tree planting, to encourage modal shift. Re-shaping the environment in this way can encourage people to walk and cycle as part of their daily lives. Additionally, cycling

infrastructure must be considered when creating cycling routes for commuting and leisure activities, therefore we welcome Policy DPT3: Active Travel within the emerging District Plan which sets out that development is required to provide appropriate levels of cycle parking facilities, well designed and laid out to be under cover, secure, conveniently located and easily accessible.

Figure 8. Examples of incorporating green bus stops and cycle parking into development

5.4.3 Electric Vehicles

There should also be provision for electric vehicle charging infrastructure to support the transition from internal combustion vehicles to electric. Requirements for EV charging have been introduced into Part S of the Building Regulations. (Alongside the wider shift towards electric heating, electrification of transport will place pressure on grid infrastructure in future which reaffirms the need to reduce energy demands, undertake infrastructure upgrades, and provide as much renewable electricity on-site as possible.)

The emerging District Plan for Mid Sussex contains Policy DPT4: Parking and Electric Vehicle Charing Infrastructure which sets out requirements for electric vehicle charging through Part S of the Building Regulations[88]. Policy could also require that all applications for major non-residential development must include at least 25% of any onsite car parking provision to be served by active electric vehicle charging infrastructure and a further 25% of car parking to be served by passive infrastructure to allow for future capacity.

In terms of viability, Table 3 below sets out indicative costs for domestic and public EV charging stations, indicating the limited cost per domestic and 'standard' space. These prices may decline over the coming years as the drive to support a transition to electric vehicles accelerates.

Table 3: Potential EV charging station costs

Type	Description	Indicative cost (£)
Domestic	Up to 7 kW	£500 – 1,000
Public – standard	7 kW	£10,000
Public – Fast	22 kW	£13,000
Public – rapid	43 kW	£34,000

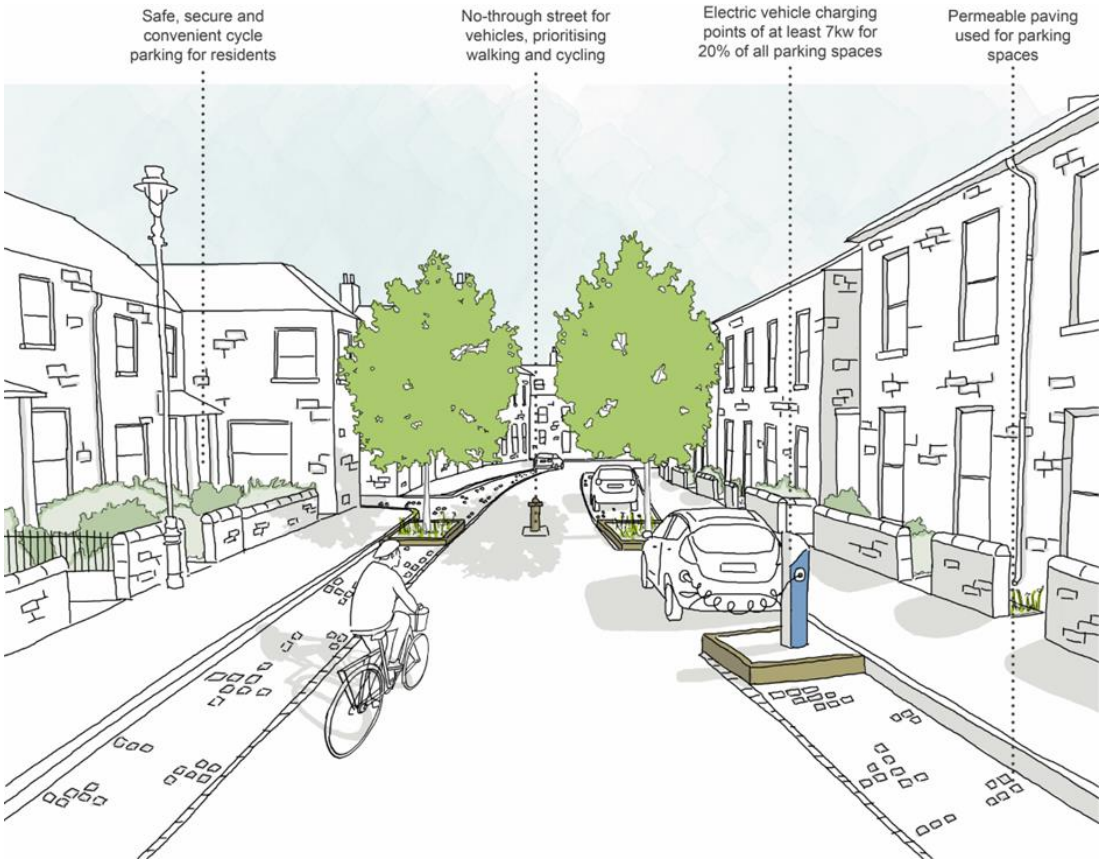
[88] HM Government, *'Building Regulations - Approved Document S: Infrastructure for the charging of electric vehicles'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1057375/AD_S.pdf

EV charging stations can be seamlessly integrated into the public realm as illustrated in the figure below.

The council might also consider directly supporting the development of car clubs that use EVs. For example, Islington's draft local plan includes wording in Policy T3: Car-free development which states:

The Council will support the provision of car clubs, including the provision of accessible car club parking spaces and/or contributions towards the provision of car clubs in the vicinity of the development, where appropriate. Car club vehicles must be 'clean', i.e. it must be powered by alternative fuels to minimise harmful impacts on the environment.

Figure 9. Example of a street which incorporates good design features, including EV charging points



5.5 Embodied carbon and circular economy

As discussed in more detail in Section 7, the majority of emissions from future developments in Mid Sussex are likely to relate to the embodied carbon of buildings and infrastructure. (Embodied carbon refers to the carbon emissions that occur during the process of producing a building's materials, their transport and construction/installation on site as well as their maintenance/repair and their disassembly/demolition and disposal at end of life.) Indeed, zu Ermgassen et al (2022)[89] estimate that embodied emissions from new housing construction (based on the government's targeted housing delivery rate) could consume 8% and 27% of the national carbon budgets for 2038-2042 and for 2043-2050 respectively.

Alongside taking steps to reduce embodied carbon, to minimise resource demands and pollution, the materials used to make buildings need to be reused at the end of a building's life i.e., kept in the circular economy.

[89] Sophus O.S.E. zu Ermgassen, Michal P. Drewniok, Joseph W. Bull, Christine M. Corlet Walker, Mattia Mancini, Josh Ryan-Collins, and André Cabrera Serrenho, *'A home for all within planetary boundaries: Pathways for meeting England's housing needs without transgressing national climate and biodiversity goals'* (2022). Available at: https://doi.org/10.1016/j.ecolecon.2022.107562

The Climate Change Committee's 2019 report on housing[90] recommended that "We need more focus on the whole-life carbon impact of new homes, including embodied and sequestered carbon." It also promoted the use of wood in construction to displace high-carbon materials such as cement and steel and 'lock up' carbon over the long-term in buildings. Local timber production for buildings could support the local economy, although impacts on the woodland stock and the benefits it provides (not least for carbon sequestration) would need to be considered and addressed e.g. through forestry management plans that ensure new trees of the right type are planted to place those felled.

More recently, the Environment Audit Committee has recommended that the Government should introduce a mandatory requirement to undertake whole-life carbon assessments for buildings[91]. The Government's recent response (Sept 2022) to this report agrees with the Committee that whole-life carbon assessments are likely to have a significant role to play in delivering decarbonisation across the sector. It also states that Government intends to consult in 2023 on their proposed approach to mainstream the measurement and reduction of embodied carbon in the built environment.

We note that the draft plan includes policy DPS2 which states: *"Prioritise retention and retrofit of existing buildings or structure to capture the embodied energy associated with the building's original construction, unless it can be demonstrated to be unviable to do so".* This is a good starting point, but the policy could go further.

For example, Camden Council's adopted Local Plan Policy CC1 includes a requirement that *"all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building".* This strengthens the requirement by putting the onus on the developer to prove that retention and refurbishment was not possible.

The supporting text to the policy indicates that *"all proposals for substantial demolition and reconstruction should be fully justified in terms of the optimisation of resources and energy use, in comparison with the existing building. Where the demolition of a building cannot be avoided, we will expect developments to divert 85% of waste from landfill and comply with the Institute for Civil Engineer's Demolition Protocol and either reuse materials on-site or salvage appropriate materials to enable their reuse off-site. We will also require developments to consider the specification of materials and construction processes with low embodied carbon content."* Note that new build projects have a zero VAT rate but VAT is charged at a rate of 20% on retrofit projects currently which means added costs for retrofit projects (although the government has recently introduced a zero VAT rate for installation of certain Energy Saving Materials[92]). The overall impact on viability for brownfield sites will be project-specific, but in some cases the overall costs may be lower for refurbishment projects due to the avoided costs of demolition, waste disposal, and creating new foundations and structural elements.

For greenfield sites, or in cases where retrofit is not possible, it is still important to address embodied carbon since it has a major impact on total emissions, as shown in Section 7. The key options are:

- Whether to set a quantitative target (and if so, what it should be) or simply require developers to show that they have taken steps to reduce embodied carbon
- How embodied carbon will be assessed by the developers (and what the implications are for MSDC officers assessing proposals)
- Whether to differentiate between developments of different types and scales

On these points, our recommendations are based on a review of similar policies in adopted local plans.

[90] CCC, *'UK housing: Fit for the future?'* (2019). Available at: www.theccc.org.uk/publication/uk-housing-fit-for-the-future

[91] EAC, *'Building to net zero: costing carbon in construction'* (2022). Available at: https://publications.parliament.uk/pa/cm5803/cmselect/cmenvaud/643/report.html

[92] HM Revenue & Customs, *'Policy Paper: Changes to the VAT treatment of the installation of Energy Saving Materials in in Great Britain'* (2022). Available at: https://www.gov.uk/government/publications/changes-to-the-vat-treatment-of-the-installation-of-energy-saving-materials-in-in-great-britain

One example adopted policy on embodied carbon is that included in the London Plan and supplementary guidance. Policy SI2 includes the requirement that:

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.

The supporting text highlights the increasing importance of embodied carbon emissions as operational carbon targets become more stringent and thus flags the importance of a "whole life-cycle approach" to capture unregulated emissions (see earlier section) and embodied emissions. Further guidance on how to complete a whole life carbon assessment is provided in dedicated supplementary guidance[93]. A reporting template is also provided along with suggested wording for a planning condition to secure the assessment in line with this guidance.

It should be noted that the GLA London Plan policy only covers "referable" proposals which generally refers to major developments (150+ dwellings), development over 30m in height and development on Green Belt or Open Metropolitan land. In other words, it does not apply to smaller schemes. Furthermore, the policy does not include a quantitative target for embodied carbon.

More recently, in the Local Plan Partial Update (2023) which has now been approved, BANES introduced the following Policy SCR8:

Large scale new-build developments (a minimum of 50 dwellings or a minimum of 5000m^2 of commercial floor space) are required to submit an Embodied Carbon Assessment having regard to the Sustainable Construction Checklist SPD that demonstrates a score of less than 900kgCO_2e/m^2 can be achieved within the development for the substructure, superstructure and finishes.

Similar to the GLA policy, the BANES policy is aimed at larger developments. It is the only example of a quantitative embodied carbon target in an adopted local plan that was found in this policy review. As such, it is an example of best practice. **MSDC should consider adopting a similar approach, perhaps initially only applying it to large scale site allocations where the benefits would be most marked and the added cost and technical input required could be best managed. That approach would be consistent with the precedent set by BANES and Cornwall Councils.**

In the longer term, MSDC should seek to adopt numerical embodied carbon targets for all types and scales of development. However, there is limited precedent for this approach at present, and MSDC has limited in-house capacity to assess such proposals. Therefore, **as an interim step, given that MSDC will require developers to seek BREEAM and HQM accreditation, an alternative option would be to specify requirements in BREEAM and HQM relating to materials use.** Based on the current scheme requirements, for BREEAM we suggest the minimum should be 7 credits in the Mat 01 category. For HQM we suggest the minimum should be 3 credits in the Environmental Impact of Materials – Building Lifecycle Assessment category. Further information is provided below.

BREEAM includes up to 7 credits for Mat 01 which can be secured if developers reduce buildings' environmental life cycle impacts through conducting Life Cycle Assessment and integrating its outcomes in the design decision-making process. The aim of this BREEAM issue is to *"reduce the burden on the environment from construction products by recognising and encouraging measures to optimise construction product consumption efficiency and the selection of products with a low environmental impact (including embodied carbon), over the life cycle of the building."*

Similarly, HQM Environmental Impacts of Materials category has the aim *"To reduce the effect construction products have on the environment by recognising and encouraging the selection of products with a low environmental impact, including embodied carbon over the life cycle of the building".* Up to 19 credits are available for completing a building life-cycle assessment (the score depends on

[93] GLA, *'Whole Life-cycle Carbon Assessment Guidance'* (2022). Available at: https://www.london.gov.uk/sites/default/files/lpg_-_wlca_guidance.pdf

the level of performance that is achieved). This covers environmental topics other than embodied carbon but the latter is one of the outputs.

With this approach, MSDC should note that there is a risk that the number or categories of credits in BREEAM and HQM that relate to embodied carbon will change in future. The BRE has indicated that operational and embodied carbon credits, which are currently split across the energy and materials categories, will be consolidated.[94] Any policy wording that references specific credits would therefore need to be suitably caveated to futureproof the policy against future changes.

Finally, a much simpler approach (again, only recommended as an interim measure) would be to include a checklist of measures that commonly contribute towards lower embodied carbon emissions.

The District Plan could also explicitly encourage use of wood in construction, as per the Climate Change Committee's recommendation cited above.

5.6 Householder development

5.6.1 General requirements

Please see the section on building standards above (Section 5.2) which covers how BREEAM can be applied to refurbishments; and the section immediately above (Section 5.5) on embodied carbon which cites policy that encourages refurbishment over demolition and rebuild.

As explained in the Mid Sussex Net Zero Feasibility and Options study, reducing carbon emissions from existing homes represents one of the biggest challenges facing the UK in our transition to a net zero economy by 2050. The retrofitting process entails improving a building to make it more energy efficient. However, there are relatively few opportunities for MSDC to influence existing buildings – except when proposals come through the planning system.

Policy DPS2: Sustainable Design and Construction of the Reg 18 draft District Plan states that development should '*prioritise retention and retrofit of existing buildings or structures to capture the embodied energy associated with the building's original construction, unless it can be demonstrated to be unviable to do so.*'

The Council could provide further guidance on sustainable retrofitting, either by signposting to existing guidance[95] or through the creation of a Supplementary Planning Document. For

[94] BRE, *'Achieving net zero with BREEAM'* (n.d.). Available at: https://bregroup.com/products/breeam/breeam-solutions/breeam-net-zero-carbon/#:~:text=Accurately%20measuring%20and%20reporting%20on,and%20lower%20whole%20life%20carbon

[95] There is a wide range of guidance available. A small selection is provided below, but there are many other examples.

- A sustainable design toolkit intended for Local Authority use is available under a Creative Commons license; MSDC could choose to signpost to it directly or adapt it to suit local needs: https://www.cotswold.gov.uk/media/05cougdd/net-zero-carbon-toolkit.pdf
- Hertfordshire is an example of a Local Authority that has commissioned a website and toolkit dedicated to sustainable design, which includes templates for sustainability statements to accompany planning applications: https://www.hertfordshire.gov.uk/microsites/building-futures/a-sustainable-design-toolkit/sustainable-design-toolkit.aspx
- The Energy Saving Trust offers a range of guidance on energy efficiency, renewables and heating: https://energysavingtrust.org.uk/energy-at-home/
- LETI has produced guidance on how to retrofit homes in line with net zero standards: https://www.leti.uk/retrofit
- The Government has produced guidance aimed at improving the public sector estate: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1035417/Net_Zero_Estate_Playbook__1_.pdf
- Information aimed at local authority housing: https://localpartnerships.org.uk/wp-content/uploads/2021/07/Local-Partnerships-LA-Domestic-Retrofit-Handbook-July2021.pdf
- The UKGBC has produced guidance aimed at encouraging retrofits in commercial buildings: https://ukgbc.org/resources/delivering-net-zero-key-considerations-for-commercial-retrofits/
- A range of toolkits aimed at improving environmental performance of commercial buildings is provided via the Better Buildings Partnership: https://www.betterbuildingspartnership.co.uk/sites/default/files/media/attachment/bbp-low-carbon-retrofit-toolkit.pdf
- For older properties and heritage assets, guidance is available from Historic England and the Sustainable Traditional Buildings Alliance:
    - https://historicengland.org.uk/images-books/publications/energy-efficiency-and-traditional-homes-advice-note-14/heag295-energy-efficiency-traditional-homes/

example, the Royal Borough of Kensington and Chelsea have prepared a Greening SPD[96] which includes a chapter on retrofitting existing buildings to help developers and residents increase energy efficiency within existing buildings. Similarly, Epping Forest have recently published sustainability guidance for householders on refurbishments and extensions.[97] Such guidance could also refer to the Passivhaus EnerPHit standard[98] which is a version of the Passivhaus standard (see earlier) adapted for whole house retrofits. This is a very demanding standard, so it might not be widely adopted, but should nonetheless be highlighted as a best practice approach.

Part L of the Building Regulations covers 'consequential improvements' which refer to energy efficiency improvements that are consequential to changes to a building. Regulation 28 of the Building Regulations and Section 12 require that, for an existing building with a total useful floor area of over 1000sqm, additional works may be needed to improve the overall energy efficiency of the building ("to the extent they are technically, functionally and economically feasible") if proposed work consists of an extension or specified works to building services. The aim is to ensure that the entire building complies with the current requirements of Part L.[99]

Consequential improvements could include:

- Upgrading heating, cooling or air handling systems.
- Upgrading lighting systems.
- Installing energy metering.
- Upgrading thermal elements.
- Replacing windows.
- On-site energy generation.
- Applying measures proposed in a recommendations report accompanying an Energy Performance Certificate.

This requirement provides a useful driver to wider improvements to the energy efficiency of existing buildings when specific works are proposed, but it only applies to buildings over 1000sqm floor area. **Mid Sussex could consider including the various consequential improvements highlighted above within policy or guidance to encourage developers and residents to make consequential improvements as part of works to smaller buildings as well**. That guidance should reference the Passivhaus EnerPHit standard as an example of best practice and an alternative means of showing compliance with any consequential improvements policy.

5.6.2 Householder development

Although householder development projects can provide significant advantages – allowing families to expand their properties rather than having to move, for instance – in many cases, they result in higher overall energy use. Refurbishments often involve enlarging openings (e.g. adding skylights or turning windows into French doors) while extensions provide additional spaces that include heating, lighting, and other appliances. Research published in 2011 showed that extensions result in a c. 16% increase

- https://historicengland.org.uk/images-books/publications/planning-responsible-retrofit-of-traditional-buildings/responsible-retrofit-trad-bldgs/
- https://stbauk.org/guidance-wheel/

[96] Royal Borough of Kensington and Chelsea, *'Greening SPD'* (2021). Available at: https://www.rbkc.gov.uk/planning-and-building-control/planning-policy/greening-spd

[97] Epping Forest District Council, *'EFDC Sustainability Guidance & Checklist: Refurbishments & Extensions'* (2022). Available at: https://www.eppingforestdc.gov.uk/wp-content/uploads/2022/03/EFDC-Sustainability-Guidance_Vol3_refurb.pdf

[98] Passivhaus Trust, *'Passivhaus Retrofit'* (n.d.). Available at: https://www.passivhaustrust.org.uk/competitions_and_campaigns/passivhaus-retrofit/

[99] See Section 12 of HM Government, *'The Building Regulations 2010: Approved Document Part L2B'* (2021). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1133081/Approved_Document_L__Conservation_of_fuel_and_power__Volume_2_Buildings_other_than_dwellings__2021_edition_incorporating_2023_amendments.pdf

in energy consumption on average.[100] More recently, a 2023 study found that the energy savings from measures such as loft and cavity wall insulation decrease over time, which could be due to 'concurrent residential construction projects and renovations associated with increases in energy consumption.'[101]

Any increase in the use of fossil fuels and/or grid electricity will exacerbate the challenge of decarbonising the heat and electricity supply, respectively. **So, in addition to providing guidance, MSDC should introduce more ambitious requirements aimed at mitigating energy use and GHG emissions in existing buildings.** Otherwise, it would be a missed opportunity.

The Reg 18 draft Policy DPS2 sets out requirements for householder developments as follows:

'Proposals for householder development are encouraged to be as energy efficient and sustainable as possible, incorporating the principles of both this policy and Policy DPS1: Climate Change. Wherever possible, developments should seek to:

- *exceed Building Regulations requirements to reduce heat and power demand;*
- *provide heating through low carbon fuels; and*
- *meet energy demands through on-site renewables.*

All measures should be set out in a proportionate Sustainability Statement.'

Policy DPS2 policy should be strengthened by introducing a requirement that the proposal should not increase the use of fossil fuels or grid electricity. Example wording would be as follows:

'If, after adopting energy efficiency measures, the proposals would still result in a net increase in energy consumption for the whole property, 100% of the increase must be met via on-site renewables.'

The benefits of this approach are that it would:

- Require applicants to consider the energy impacts on the whole house, not just the extension or changes that they are seeking planning permission for
- Encourage the proposals to be more energy efficient, because otherwise the applicants would need to install renewable technologies as well.
- Reduce additional energy demands, thus helping to avoid increasing occupants' energy bills.
- Potentially incentivise applicants to use electric heating systems rather than extending or installing new fossil fuel heating systems, since the additional energy needs would be met via on-site renewables.

The requirement could be met through various means, such as (a) increasing the energy efficiency of the proposed new elements, (b) increasing the energy efficiency of other parts of the property or (c) adding on-site renewables. In that regard, the sample policy wording above offers flexibility to householders.

To avoid incurring additional consultancy costs, this policy could be restricted to regulated emissions only, and be assessed via Part L calculations, which are a standard part of Building Regulations compliance.

In terms of the overall impact on viability, the proportional cost uplift would vary widely depending on the project in question, even if the difference is small in absolute terms. On a large extension, the cost uplift might be similar to that described in Section 6.3.1 and Appendix A.5, at around 3-5%. For smaller projects, it would likely be higher. On the other hand, as explained in Section 6.4, the householder would benefit from lower energy bills than they would have had if the policy was not introduced. The

[100] Richard Jack, Kevin Lomas and David Allinson, *'The expanding house: extensions to domestic buildings and their impact on energy consumption'* (2011). Available at: http://www.lolo.ac.uk/wp-content/uploads/2015/10/1342526205_RJackExpandingHouse.pdf

[101] Cristina Peñasco and Laura Díaz Anadón, *'Assessing the effectiveness of energy efficiency measures in the residential sector gas consumption through dynamic treatment effects: Evidence from England and Wales'* (2023). Available at: https://doi.org/10.1016/j.eneco.2022.106435

property could also attract higher sale or rental values. Nonetheless, MSDC should consider the potential impacts on vulnerable groups to ensure that there are no unintended consequences.

The above policy would be much more ambitious and impactful than just providing guidance on retrofitting. However, ultimately, it is likely to be the availability of appropriate financial incentives (e.g. grants and loans) rather than planning requirements that will be most important for driving energy upgrades to existing buildings. A 'zero carbon' policy for new homes linked to a carbon offset fund could help to generate funding for such upgrades, but as noted in the earlier section this might be challenging to implement given the lack of in-house energy/carbon expertise and resources (e.g. to identify and work up appropriate carbon reduction projects to fund).

5.7 Significant impact on carbon sequestration (e.g. woodland creation)

Tree planting has significant potential to boost carbon sequestration within Mid Sussex. The Committee on Climate Change has indicated that the UK needs to achieve an average of 30,000ha of new woodland planting per year up to 2050 to help sequester and store[102] atmospheric carbon and mitigate the effects of climate change. However, despite stating 'the purpose of planning is help achieve sustainable development' the NPPF makes very limited reference to trees and woodland, with most attention to preventing the loss of existing trees rather than on the role of the planning system in supporting national woodland expansion targets. However, it should be noted that it is preferable to prevent the loss of existing trees rather than to remove trees for development and then replant new ones.

The table below sets out a short list of potential types of trees and other habitats that can help sequester carbon, however at varying rates. We have included a variety of habitats as the retention, enhancement, and creation of grasslands and the expansion of priority habitats may be preferable to woodland in certain areas of Mid Sussex.

Habitat	Habitat Type	Carbon Sequestration ($tCO_2e/ha/yr$)
Broadleaved woodland	Woodland	5.7
Reedbed	Aquatic	3.29
Scrub	Grass	3.7
Native and non-native Hedgerow	Hedgerow	2
Other neutral and semi-improved grassland	Grass	0.4

The National Model Design Code guidance notes (part 2) do state that: "It is the government's intention that all new streets include trees". They also set out design principles for street trees and signpost the Urban Tree Manual for guidance on installation, management and maintenance (getting this right is key to ensuring the health and longevity of street trees). The District Plan could consider doing likewise.

Policy DPN4 in the draft District Plan seeks to protect and enhance trees, woodland and hedges and sets out requirements for replacement planting where felling of trees cannot be avoided. Importantly it goes beyond protection of existing trees by requiring that development *"takes opportunities to plant new*

[102] Carbon sequestration is the process of taking carbon dioxide from the atmosphere and storing it while carbon storage is the act of retaining carbon in a solid form which keeps it out of the atmosphere.

trees, woodland and hedgerows within the new development to enhance on-site green infrastructure and increase resilience to the effects of climate change".

A review of other local authority development plan policies confirmed that most focus on the protection of existing trees and woodland or on new planting as part of development. The current Policy DPN4 includes text on proposals for new woodland creation. It states that proposals will need to follow best practice guidance and take into account a range of considerations such as the biodiversity value of the existing habitat, the local landscape and heritage, opportunities to connect to and extend existing woodland and resilience to the effects of pests, disease and climate change. We welcome this inclusion as only a small number of local plans take a *more proactive approach* which is appropriate given the national and local emphasis on increasing woodland cover.

A good example of taking a proactive approach to tree planting and woodland creation is the St Helen's Borough Local Plan (2020-35), which includes a policy for trees and woodland which states:

- *The Council will, working where necessary with the Mersey Forest and other partner organisations, seek to increase the extent of tree cover across the Borough and to protect and enhance the multi-purpose value of trees, woodlands and hedgerows.*
- *Proposals that would enhance the value and / or contribution of woodland in respect of: recreational or educational needs; health; the landscape or townscape; heritage; biodiversity; tourism; and / or economic regeneration will be supported.*

Similarly, Policy G1 in Cornwall's Climate Emergency DPD includes:

- *Street trees and other greening shall be integrated into street design and public open spaces wherever possible while remaining sympathetic to the historic environment. Streets should be designed to accommodate tree pits, whilst maintaining the space for the necessary runs of services (e.g. water, electric, sewerage).*

The same DPD also has a specific policy on tree canopy (policy G3) which includes the following:

- *All major development should provide, through the retention of existing and or / the establishment of new, canopy coverage equal to at least 15% of the site area (excluding areas of the site that are priority habitat types) in accordance with a Cornwall Council approved calculator or metric.*

The supporting text explains that *"In order to both encourage on-site retention of existing trees and to plant new trees, the Council has determined that a 15% canopy coverage, as measured by the overhanging spread of a mature tree, is an achievable aim for major developments in the Cornish climate and fits generally within the character of the Cornish landscape."* **Mid Sussex could consider drawing on the above examples to further strengthen the policy wording**.

Local plans have a key role in identifying the most suitable sites for development, but from a carbon sequestration perspective **ideally such site allocations would take into account land required for woodland expansion** i.e. a proactive approach would see the local plan identifying areas to be zoned for woodland expansion/creation. There is also potential to link woodland creation to off-site biodiversity net gain proposals, although it will be important to take expert ecological advice to ensure tree planting is appropriate on any given site.

A high-level estimate of carbon sequestration from existing woodland and potential new woodland (on low risk areas for woodland creation) is included in Appendix A.1. In summary, this high-level estimate found that new woodland could theoretically sequester up to an additional 31,000 tCO_2e per year under the right circumstances, although this depends on many factors such as correct management, species selection, and what land uses the woodland is replacing. More precise figures for carbon sequestration could be developed based on a more detailed assessment of the sites most suitable and feasible for woodland creation, taking into account competing land uses. This could include a review of opportunities for woodland creation on land in the South Downs National Park and High Weald AONB, both of which have been excluded here. Some of the council's own landholdings may offer good

opportunities e.g. parks, golf courses.. **We recommend that MSDC use this high-level estimate as a starting point for more detailed, site-specific work to identify key sites for woodland creation to boost carbon sequestration and provide wider benefits.**

Areas where *additional evidence* would be critical to implementing more proactive policies on woodland creation would include:

- A technical review to identify the tree species (native, locally sourced, resilient to disease and pests etc.) and recommended planting to support biodiversity, carbon sequestration, climate adaptation resilience and landscaping objectives.
- Development of a detailed forestry and woodland strategy to inform the most appropriate locations for forestry and woodland.

5.8 Performance gap

Various studies have shown that buildings often do not perform as well when completed compared to what was anticipated when they were designed. The difference between anticipated and actual performance is known as the performance gap. Factors that contribute to this gap include inaccurate energy calculations, poor quality construction and insufficient post-construction testing and commissioning. The Climate Change Committee[103] has highlighted this issue and identified the need for greater levels of inspection and stricter enforcement of building standards, alongside stiffer penalties for non-compliance.

National policy currently does not set out requirements regarding the performance gap. However, local planning authorities are in a good position to create policy to address this, and some authorities are already doing so. The London Borough of Islington's draft local plan (not yet adopted) sets out detailed requirements. Major developments must:

- Provide an assessment of predicted future energy use based on PHPP for residential and low energy non-domestic buildings; and CIBSE TM54 for non-domestic buildings (or any equivalent methodology), rather than Part L only assessments. Predicted energy use must be declared in kWh/m^2/yr and kWh/yr and this will become one of the Green Performance Plan (GPP) indicator targets in the future.
- Confirm the actual performance values achieved in comparison to the original energy targets, and to submit the associated evidence including site photographs of insulation installation and the construction manager's declaration. This information must be submitted to the Council prior to occupancy as part of the final GPP.
- Carry out an air tightness test and thermographic survey. The test reports, along with details of any remediation measures, must be provided to the Council prior to occupancy as part of the final GPP.

London Plan Policy SI2 sets out how development should follow the energy hierarchy with the final stage being "be seen: monitor, verify and report on energy performance". Supplementary guidance[104] indicates the requirement is to monitor and report energy performance post-construction. Web templates are provided to share the required information. MSDC could potentially adapt these templates for their use.

Alternatively, given MSDC technical energy capacity constraints in planning, **we suggest the performance gap could be managed by simply prescribing additional credit requirements in the BREEAM and HQM policy**. BREEAM V6 includes a credit for post-occupancy evaluation (POE) in the

[103] CCC, *'UK housing: Fit for the future?'* (2019). Available at: http://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/

[104] GLA, *'Be Seen: Energy monitoring guidance'* (2021). Available at: https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/london-plan-guidance/be-seen-energy-monitoring-guidance

category Man 05 Aftercare (though there is no requirement to achieve this credit to achieve an Excellent rating). The credit requires that:

"The client or building occupier commits to carry out a POE exercise [by an independent party] one year after the building is substantially occupied. This gains comprehensive in-use performance feedback… and identifies gaps between design intent and in-use performance. The aim is to highlight any improvements or interventions that need to be made and to inform operational processes."

Similarly, HQM includes post occupancy evaluation (POE) as an issue under 'Customer Experience' with 10 credits available.

Such requirements would help the council to collect data and monitor the performance gap, potentially informing future District Plan reviews (enforcement of under-performance would likely be challenging due to the variety of potential causes highlighted above and challenges of attribution). Anecdotal evidence from Islington Council suggests that simply requiring such information can also help to ensure that design stage energy and carbon calculations are handled with due care and attention.

According to the Post Occupancy Evaluation Guidance by RIBA[105], the cost of POE is *"a very small percentage of overall building costs. Research shows as a proportion of a project's cost, undertaking POE adds an additional 0.1% – 0.25%*." Thus, imposing a requirement for POE is not anticipated to have any significant impact on overall costs and viability.

Further to the above, we recommend that developers be required, or at least encouraged, to share POE information to ensure transparency and inform wider lesson learning. For example, LETI[106] recommends that operational energy data for a period of at least five years is uploaded to the CarbonBuzz online platform[107] to support wider analysis and create a culture of disclosure. MSDC should consider including wording to this effect in their policy.

5.9 Opportunities to set higher standards for significant sites

5.9.1 Introduction

In addition to general policy recommendations presented in above, the Council is also seeking advice on whether higher standards could be set on the following three significant sites:

- Crabbet Park
- Land west of Burgess Hill
- Land south of Reeds Lane

This section will consider opportunities to push standards further on these sites, based on a high-level review of existing site information, recognising the lack of design details at this early stage. It will include:

- A summary of existing policy requirements in DPH4 that are considered most relevant to energy and GHG emissions;
- A qualitative overview/commentary on reasons why significant (greenfield) sites could potentially meet higher standards;
- An assessment of site-specific opportunities for renewable energy systems; and
- Recommendations on additional or modified policies that MSDC could consider applying to significant sites.

[105] Royal Institute of British Architects, *'Post Occupancy Evaluation'* (2020). Available at: https://www.architecture.com/knowledge-and-resources/resources-landing-page/post-occupancy-evaluation

[106] LETI, *'Climate emergency design guide'* (2020). Available at: https://www.leti.uk/cedg

[107] Available at: https://www.carbonbuzz.org/

5.9.2 Regulation 18 policy requirements

At present, the draft plan includes several requirements for significant sites set out in Policy DPH4: General Principles for Housing Allocations that relate directly or indirectly to GHG emissions, notably:

- *Deliver a development which will support a vibrant and inclusive community which embodies the 20-minute neighbourhood principles* – As discussed previously, this is expected to contribute to lower reliance on cars and therefore lower emissions from transport.
- *Secure a minimum biodiversity net gain of 20% to be demonstrated through a Biodiversity Gain Plan which sets out how net gains for biodiversity will be achieved, secured and managed appropriately taking into account the Council's objectives and priorities for biodiversity net gain and nature recovery*
- *Meet at least 4* Rating of the BRE Home Quality Mark (HQM) with a minimum score of 55 credits in the energy category* – This would require new dwellings to achieve net zero regulated emissions and meet 10% of unregulated emissions via on-site renewable electricity generation. This would result in significantly better energy and GHG performance compared with standard practice, but it would not deliver net zero carbon buildings because 90% of unregulated emissions are still excluded.
- *Meet a maximum water consumption standard of 85 litres per person per day […] Water neutral developments will be encouraged where this is possible* – This would reduce indirect emissions that are associated with water supply.

5.9.3 General considerations

Table 4: Considerations for setting higher standards for significant development sites

Theme	Description	Higher standards could be achieved regarding…
Cost/viability	Viability is often better on greenfield sites as the existing use value will be much lower than the development value. Similarly, compared with brownfield sites, there is likely to be much less need for site clearance or remediation. (Infrastructure costs, on the other hand can be higher if the site is more remotely located – although as noted below this can offer positive opportunities as well.)	• Various topic areas; lower development costs offer a range of opportunities to deliver higher standards
Fewer design constraints	Generally there are fewer design constraints on large greenfield sites, so there may be more flexibility to implement sustainable design measures. For example, if there are no pre-existing roads or buildings, the layout of new roads and buildings, along with the building orientation, can be more easily designed to promote passive solar gains in winter and avoid overheating in summer. Similarly, it could be used to minimise noise or air pollution, e.g. if part of the site is adjacent to a road, the buildings can be located elsewhere, improving occupant health and comfort.	• More efficient building forms; greater energy efficiency • Lower material/ resource requirements • Maximise renewable energy provision • Potential to reduce noise or air pollution to occupants
Mix of uses	Large sites may be able to accommodate a wider mix of uses, including shops, schools and healthcare or community facilities, that residents	• Reduced numbers of parking spaces

	can easily access without needing to rely on private vehicles. (This links to the 20-minute neighbourhood concept discussed in Section 5.4.1)	• Better walking and cycling routes
Infrastructure provision	When providing new utility connections and infrastructure to a site, there is an opportunity to design systems to current best practices. An example would be using sustainable drainage systems (SuDS) that are integrated with green and blue infrastructure. For sites with no existing gas grid connection, developers can save money by not providing one and instead using electric heating systems such as heat pumps (note, this is recommended for all sites on the basis of GHG emissions but offers a cost saving on greenfield sites without an existing gas grid connection). Another example would be designing the development to reduce the need for water supply and treatment, e.g. rainwater collection, greywater recycling systems, and landscaping to reduce irrigation. If the development requires significant upgrades to existing infrastructure e.g. electricity grid, there may be an opportunity to provide additional upgrades so that the development (or adjacent sites) can accommodate more renewable energy provision.	• Sustainable drainage • Water efficiency and conservation • Potential to facilitate more renewable energy installations
Use of materials	Where large sites are brought forward over a longer period of time by the same developer, there may be opportunities to make strategic decisions about the use of construction materials, including ways to avoid waste and promote a circular economy. One specific example would be the opportunity to store and reuse demolition material, offcuts, and other products. Another example would be opportunities to utilise excavation material within the landscape – or even process it into cob or rammed earth construction (resulting in a cheap building material with very low embodied carbon).	• Lower material/ resource requirements • Waste and recycling • Circular economy measures
Biodiversity and green infrastructure	Compared with smaller or more constrained sites, there may be greater opportunities to improve biodiversity, deliver a range of habitats or new tree planting, adopt more sustainable land management practices, and so on. For example, the masterplan can be adapted to reduce the built environment footprint within the site. Another example would be providing green corridors that are linked to adjacent wildlife sites, open countryside and other green spaces. There are also more opportunities to incorporate greening into the public realm, walking and cycling routes, and other infrastructure.	• Biodiversity net gain • Habitat creation • Reduced water or soil pollution

Sustainable travel modes	While the site location, layout and mix of uses will significantly determine the travel modes that occupants choose or are able to use, there are also opportunities to incorporate design features that further promote sustainable travel modes. Examples include setting maximum parking standards (i.e. limiting the number per dwelling) but providing new bus routes or spaces for EV car clubs. Walking and cycling routes can also be co-located with green infrastructure to ensure that the routes are attractive and promote active lifestyles.	• Maximum parking standards • EV car club spaces • Co-locate walking and cycling routes with green infrastructure

In addition to the opportunities listed above, in some cases, significant sites could also theoretically contribute to lower emissions elsewhere in the vicinity – for instance, by providing shops or employment space that reduces the need for people in existing developments to travel by car. However, those wider impacts are highly complex and outside the scope of the current study.

5.9.4 Renewable energy opportunities

The opportunities for several renewable energy installations were assessed for three major development sites: Crabbet Park, West of Burgess Hill, and South of Reeds Lane. The full analysis can be found in Appendix A.3. The findings of the renewable energy opportunity assessment are summarised in Table 5. In brief:

- There are no apparent environmental constraints for roof-mounted solar technologies or ASHPs on all three development sites, so these could be rolled out at scale.
- We note that all of the sites are in close proximity to power transmission lines, which could potentially facilitate the installation of larger PV arrays (i.e. not just on rooftops, but potentially also ground-mounted solar, or panels being integrated into the public realm or over car parks) that could export to the grid.
- For Ground Source Heat Pumps (GSHPs), further analysis of ground conditions would be required to confirm suitability, but in most locations no constraints have been identified. However, records indicate the presence of some historic landfill sites.
- Another possible opportunity would be the installation of water source heat pumps (WSHPs) at the Crabbet Park site following further on-site analysis; this could potentially make a significant contribution to reducing energy use in that development due to the much higher efficiency of WSHPs compared with ASHPs (c. 400% for the former versus 250-300% for the latter).
- A high-level spatial analysis revealed that there may be potential for a heat network in the vicinity of Burgess Hill due to the presence of the wastewater treatment plant (WWTP); however, it is understood there may be another development site closer to the facility that might be better suited. This option would require a more detailed feasibility study to be carried out.
- The use of biomass, wind, hydropower and hydrogen (to heat buildings) is not likely to be suitable for the selected sites for reasons explained in Appendix A.4.

MSDC could require developers on significant sites to undertake feasibility studies to further assess the potential to include these technologies on-site.

Table 5. Summary of renewable energy opportunities on significant sites

Technology	Development Site		
	Crabbet Park	West of Burgess Hill	South of Reeds Lane

Roof mounted solar	Likely to be suitable; no constraints identified		
Ground mounted PV	Likely to be suitable; no constraints identified		
ASHPs	Likely to be suitable; no constraints identified		
GSHPs	Records indicate historic landfill(s) are present but potentially suitable elsewhere on the site		Likely to be suitable; no constraints identified
WSHPs	Potentially suitable water bodies on site	No opportunities identified	No opportunities identified
Biomass boilers/CHP	Not recommended due to air quality concerns and supply chain constraints		
Surplus/waste heat	No opportunities identified	Potential opportunity to make use of WWTP	No opportunities identified
Wind	Not likely to be suitable		
Hydropower	Not likely to be suitable		
Hydrogen gas	Not likely to be suitable		

5.9.5 Recommendations for significant sites

Based on the above considerations, recommendations for significant sites are summarised below.

Note that many of the topics discussed in Sections 5.9.3 are already addressed through existing draft policies. In some cases, a qualitative judgement would need to be made as to whether proposals on significant sites "go further"; we have not proposed additional policy wording for requirements that are not measurable. However, there are some examples where MSDC *could* introduce measurable higher standards.

- Operational energy use and renewable energy supply – The current Policy DPH4 wording sets higher GHG reduction targets for significant sites. Our recommendation (see Section 3.2) is to adopt net zero operational targets for *all* development sites. However, recognising that it may be easier to reduce energy consumption (e.g. using GSHPs) and provide more renewable energy (e.g. by optimising roof geometry and orientation) on significant sites, MSDC could consider requiring these sites to supply *more* renewable energy than is used in the domestic buildings on site, i.e. achieve net negative operational emissions. In practice it may be preferable to prioritise embodied carbon reductions (see next bullet point) but nonetheless this is an option that could be explored. An example of how this could be implemented in practice would be to incorporate PV into the public realm or use PV canopies above parking areas. This would be assessed through the same HQM or BREEAM credits described in Section 3.2 which recognise provision of additional on-site renewables.
- Embodied carbon – Whilst there is a cost associated with undertaking an embodied carbon assessment, for larger sites this is likely to be very small compared with the overall costs of development. Reducing embodied carbon does not necessarily increase build costs. Therefore, we recommend that larger sites be required to undertake a whole life carbon (WLC) assessment using a nationally recognised assessment methodology. Recognising MSDC's limited in-house capacity to evaluate such assessments, in the short to medium term, the main benefits of this would be to (a) increase carbon awareness among design teams and (b) provide MSDC with an evidence base to support the adoption of stricter embodied carbon requirements in future. In the longer term this would be used as evidence to support adoption of a quantitative

embodied carbon target. The RICS sets out a procedure for undertaking WLC assessments which does not require use of HQM or BREEAM, but if MSDC wishes to retain the approach of assessing compliance via third-party schemes then the relevant requirements would be:

  - For domestic developments, undertake a Building Life-cycle Assessment under the HQM Environmental Impact of Materials category
  - For non-domestic developments, achieve at least 7 credits under BREEAM Mat 01 category

- Water efficiency – Whereas the 85 l/p/d target is likely to be ambitious but realistic on smaller sites, on significant sites where there is no existing infrastructure, this is likely to be easier to achieve so we recommend that this target is retained. We also recommend retaining the wording that expresses support for water neutral developments. In practice, note that achieving water neutrality would likely require developers to offset water use elsewhere (via their own arrangements, rather than a Council offsetting scheme) and this would be secured using an S106 legal agreement, as is the case with Horsham.[108]
- Sustainable transport – The 20-minute neighbourhood concept is recommended for all new developments and the mix of uses on significant sites is likely to facilitate this. Some specific additional requirements that could be set for large sites (if they are not set for all scales of development) would be to include spaces for EV car clubs and require developers to investigate the feasibility of providing low-car developments with fewer parking spaces.
- Biodiversity net gain (BNG) – The Environment Act 2021 would require a minimum 10% BNG, which is expected to become mandatory in late 2023. According to DEFRA, this is 'the lowest level of net gain that the department could confidently expect to deliver genuine net gain, or at least no net loss, of biodiversity' and LPAs are able to set higher targets.[109] It is outside the scope of this report to advise on a specific numerical BNG target, so we recommend that MSDC seek further advice on this topic. Examples of planning policies that address BNG can be found at the Local Government Association's Planning Advisory Service website.[110]

6 Viability and cost implications

6.1 Introduction

As set out in Section 3, from a scientific, legal and policy standpoint there is clear justification for MSDC to require new developments to aim to achieve net zero operational GHG emissions. This is a key recommendation of the study which goes beyond the requirements of the Regulation 18 draft policies. This section considers the cost implications of net zero operational emissions, 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 brief information on the broader costs and benefits to developers, building owners and occupants, and MSDC as a planning authority.

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[108] For more information, refer to the Horsham District Council website: https://www.horsham.gov.uk/planning/water-neutrality-in-horsham-district/water-neutrality-and-planning-applications

[109] DEFRA, *'Biodiversity Net Gain Consultation Impact Assessment'* (2018). Available at: https://consult.defra.gov.uk/land-use/net-gain/supporting_documents/181121%20%20Biodiversity%20Net%20Gain%20Consultation%20IA%20FINAL%20for%20publication.pdf

[110] Local Government Association, *'Biodiversity Net Gain in Local Plans and Strategic Planning'* (n.d.) Available at: https://www.local.gov.uk/pas/topics/environment/biodiversity-net-gain-local-authorities/journey-biodiversity-net-gain

The Mid Sussex Local Plan Viability Study (published May 2022) tested a 10% cost uplift for both residential and non-residential development to align with MSDC's net zero-related Reg 18 draft policies.[111] It concluded that, 'With the exception of brownfield sites, the Council can be confident that development will be forthcoming if it pursues the proposed policies and a zero carbon strategy.' Since there are few brownfield allocations, this meant that the majority of development would still be viable even with the proposed net zero standard. The evidence presented below strongly suggests that 10% is likely to be an overestimate for residential developments, which should give MSDC further confidence in this approach, including therefore potentially on brownfield sites as well.

6.2 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). A similar approach was taken in the existing Mid Sussex Local Plan Viability Study; relevant sources cited within that study have been incorporated into this review. We have also referred to viability assessments from other Local Authorities that have sought to implement similar policies.

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.[112] 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.

When interpreting the cost information in the following sections, it is important to note that some of the sources were originally making a comparison against Part L 2013. Because the baseline has changed in terms of both costs and energy and GHG emissions performance, the headline figures (% uplift or extra-over costs) have been re-calculated where necessary to provide a rough estimate of the cost difference compared against a Part L 2021 baseline, i.e. current Building Regulations. Since Part L 2021 has higher build costs than Part L 2013, this will always result in a smaller uplift than if costs are compared against Part L 2013 as illustrated in the diagram below. *This diagram is not to scale.*

[111] HDH Planning and Development on behalf of MSDC, *'Mid Sussex Local Plan Viability Study'* (2022). Available at: https://www.midsussex.gov.uk/media/8671/dpr-viability-study-may22.pdf

[112] 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/

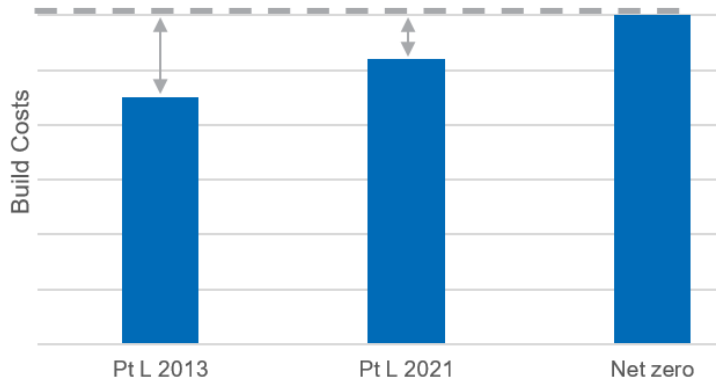

Figure 10. Illustrative diagram showing why comparisons against Part L 2021 result in a smaller cost uplift than comparisons against Part L 2013

6.3 Results

The costs of achieving net zero emissions will depend on the package of measures that is selected to meet this standard. In general, this would involve measures such as:

- High levels of insulation
- Double or triple glazing
- Low energy (LED) lighting
- Using construction methods that ensure the building is very airtight, and that reduce heat loss at junctions and edges (which is known as “thermal bridging”)
- Heat pumps instead of gas boilers
- Mechanical ventilation with heat recovery (MVHR)
- Wastewater heat recovery (WWHR)
- Renewable energy technologies such as solar PV

If heat pumps are used, the building would also likely require:

- Hot water storage
- Underfloor heating and/or large radiators

Overall, the evidence suggests that net zero regulated and unregulated emissions can be achieved in domestic buildings at a cost uplift of roughly 3-5% compared with Part L 2021. There would be some additional costs associated with undertaking an HQM assessment, which MSDC is proposing to use as evidence that the net zero requirement has been met. Those would primarily include registration, certification and consultancy fees and are not expected to have a significant impact on capital costs. However, MSDC may wish to test the impact of a small (c. 0.5%) increase in capital costs associated with other sustainability measures used to obtain HQM credits. An optional route to compliance would be to construct dwellings to the Passivhaus standard and meet 100% of energy demands via on-site renewables. This is not considered to have an impact on viability overall since it is optional.

For non-domestic buildings, it would be reasonable to assume cost uplifts in the range of 5-10%, but these could be significantly higher or lower for individual developments. This range is assumed to include the comparatively small capital costs of achieving other BREEAM credits.

Note that non-domestic buildings vary more in their scale, usage, and energy consumption patterns than domestic buildings. Our review found that published cost information covers a relatively limited number of non-domestic building archetypes, while at the same time indicating a relatively wide range of potential outcomes. Considering this, a cautious approach would be to require non-domestic

buildings to achieve net zero regulated emissions, but *not* require them to achieve net zero unregulated emissions until there is clear evidence that it is technically feasible and viable for all development types.

Further information is provided below.

6.3.1 Domestic buildings

Costs of achieving net zero emissions in domestic buildings

A small number of Local Plan viability assessments have considered the cost implications of achieving net zero carbon new developments in recent years. Examples include Local Plan evidence base studies for Cornwall, Greater Cambridge, West Oxfordshire and Winchester Councils.[113,114,115,116] All four studies were based on modelled building archetypes, with cost information provided by Currie & Brown.

The Cornwall study assessed the impact of the following requirements for new domestic 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)

In the Cornwall study, modelling was carried out to evaluate how these standards could be achieved via different 'packages' of energy efficiency measures (that is, using various specifications for glazing, insulation, airtightness, heating systems, etc.) Results showed that the cheapest package of measures 'would deliver net zero carbon homes for a construction cost just 0.5-2.7% more than a home that is compliant with Part L 2021.'[117] Some more ambitious energy efficiency measures were also modelled; results showed that these could be adopted 'with a cost uplift of less than 5%' in most of the domestic building typologies.

The Cornwall study was used as evidence in the viability assessment of the recently adopted net zero policy for domestic buildings in Bath & North East Somerset (BANES).[118]

More recently, an assessment carried out by the same consultancies on behalf of Winchester City Council in 2022 found that the cost uplift compared with Part L 2021 was c. 5-6% for domestic buildings.

The Greater Cambridge and West Oxfordshire studies used the same study modelling approach, but an earlier version of Building Regulations (Part L 2013) was used as the baseline for cost comparisons. Converting these results to provide a comparison against Part L 2021 would equate to cost uplifts averaging *approximately* 4% for domestic buildings.

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[113] The main viability assessment was produced by Three Dragons on behalf of Cornwall Council, *'Climate Emergency Development Plan Viability Assessment Update'* (2021). It is available at: https://www.cornwall.gov.uk/media/vtigrrk3/sd06-ce-dpd-viability-report-nov-2021.pdf The technical evidence base produced by Currie & Brown and Etude *'Technical Evidence Base for Policy SEC 1 – New Housing'* (2021) is available at: https://www.cornwall.gov.uk/media/fkzp45mv/eb042-20200359-climate-emergency-dpd-technical-evidence-base-rev-g.pdf

[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] Currie & Brown, 'Assessing the trajectory for net-zero buildings for the Oxfordshire Cotswolds Garden Village' (2020). Available at: https://www.westoxon.gov.uk/media/hdnjcnnf/trajectory-for-net-zero-buildings-for-the-oxfordshire-garden-village.pdf

[116] Elementa, Currie & Brown and Etude on behalf of Winchester City Council, *'Net Zero Carbon Targets: Evidence Base for the Winchester Council'* (2022). Available at: https://www.winchester.gov.uk/assets/attach/33574/WCC-Elementa-Consulting-Etude-and-Currie-and-Brown-Evidence-Base.pdf

[117] Currie & Brown and Etude, *'Technical Evidence Base for Policy SEC 1 – New Housing'* (2021). Available at: https://www.cornwall.gov.uk/media/fkzp45mv/eb042-20200359-climate-emergency-dpd-technical-evidence-base-rev-g.pdf

[118] BNP Paribas on behalf of Bath & North East Somerset Council, *'Bath and North East Somerset: Local Plan Partial Update Viability Study'* (2021). Available at: https://beta.bathnes.gov.uk/sites/default/files/2021-08/B%26NES%20LPPU%20Viability%20Study.pdf

In 2020, UKGBC published a report on the feasibility of achieving operational net zero emissions for new buildings.[119] The study explored costs for a high-rise residential project that was at design stage; the designs were modified to ensure that the building 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 costs were originally compared against Part L 2013, but if these are re-baselined then the equivalent cost uplifts compared with Part L 2021 would be *approximately* 0-1%.

Costs of HQM

The cost uplifts above are for domestic buildings that achieve net zero operational emissions. At present, MSDC's preference is for developers to show they have achieved this by carrying out an assessment under the Home Quality Mark (HQM).

According to the BRE, *'As with other schemes within the BREEAM family, costs will partly depend on the targeted rating.'*[120] Our policy recommendations (Section 3.2) suggest that if HQM is being used as a vehicle for showing compliance with a net zero policy, then the focus should be on achieving energy credits rather than the overall rating, since none of the ratings would necessarily deliver net zero buildings on their own.

On that basis, most of the cost uplift of complying with MSDC's policy will be associated with energy and GHG reduction measures, the costs of which are described above.[121] Achieving HQM certification would also incur registration and certification fees, but these are expected to be small in comparison to build costs. (For context, the registration and certification fees are updated periodically, but for developments of up to 6 dwellings the charges may total c. £400, and for larger developments there may be an additional charge of c. £30-50 per dwelling.[122])

There are also consultancy fees which, according anecdotal research, can range from c. £4,000 for a small scheme, or where the design team is new to HQM, down to c. £1,000 per unit. [123] As noted in the MSDC Viability Study, *'From discussions with assessors, we understand that there is a "learning curve" with the costs falling as developers and their design teams become more familiar with the different requirements. The scale of a scheme is also a material factor."*[124]

We note that slightly lower estimates of consultancy fees have been used elsewhere. The authors of a viability study carried out for **Leeds** City Council[125] observed that, *'in the majority of cases it is anticipated that what is required for HQM Level 4 will be achieved if satisfying the full suite of existing and proposed policies. In this regard there is an argument that this policy will result in no additional costs other than the certification and registration fees […] However, in order to be prudent we have included a budget estimate of £750 per apartment and £1,000 per house.'*

Costs of Passivhaus – *an optional route to compliance*

Although Passivhaus is not a net zero standard per se, the energy efficiency levels represent best

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[119] 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/

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

[121] This is the case with BREEAM and is assumed to hold true for HQM as the schemes follow similar principles. Refer to CSE, *'Cost of Carbon Reduction in New Buildings'* (2018). Available at: https://www.bathnes.gov.uk/sites/default/files/sitedocuments/Planning-and-Building-Control/Planning-Policy/LP20162036/cost_of_carbon_reduction_in_new_buildings_report_publication_version.pdf

[122] BRE, *'FS036: BREEAM, HQM and Code for Sustainable Homes Schemes Fee Sheet'* (2019). Available at: https://www.escuk.com/wp-content/uploads/2019/10/FS036-BREEAM-HQM-and-CSH-Scheme-Fee-Sheet-Rev-28-1Dec19.pdf

[123] Based on discussions between HDH Planning & Development and various consultancies, in correspondence shared with MSDC.

[124] HDH Planning and Development on behalf of MSDC, *'Mid Sussex Local Plan Viability Study'* (2022). Available at: https://www.midsussex.gov.uk/media/8671/dpr-viability-study-may22.pdf

[125] Avison Young on behalf of Leeds City Council, *'Leeds Local Plan Update Economic Viability Study'* (2022). Available at: https://www.leeds.gov.uk/docs/Local%20Plan%20Update/Local%20Plan%20Update%20-%20Economic%20Viability%20Study%20.pdf

practice and are in line with those that would be required as part of a net zero standard. Buildings constructed to meet Passivhaus standard and meet all their operational energy needs via on-site renewables would meet the net zero policy. The latter approach is being proposed as an *optional* route to showing compliance with MSDC's policy, so is assumed not to impact viability overall.

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.[126] Across these projects, the extra-over costs compared with a Part L 2021 baseline were around 18% on average, ranging from 7% to 30%. However, the authors noted that costs decrease as developers gain experience with the requirements of the scheme.

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.'*

It is also worth emphasising that, for some projects, the costs could be much lower. Research carried out by Currie & Brown and AECOM on behalf of the CCC in 2019 examined the costs of introducing 'ultra-high' energy efficiency standards 'similar to a Passivhaus level of performance' and found that the uplift was around 1-4% compared with Part L 2013.[127] This represents a negligible cost difference against Part L 2021. A more recent 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% based on two case study projects where the teams worked with Passivhaus designers to 're-imagine' the schemes.[128]

Overall conclusion on domestic buildings

These studies highlight the range of outcomes that can be obtained depending on the precise building specification that is modelled. On average, they indicate that domestic buildings can achieve net zero operational emissions at a cost uplift of roughly 3-5% compared with Part L 2021.

6.3.2 Non-domestic buildings

Costs of achieving net zero emissions in non-domestic buildings

A study conducted by the UKGBC explored different options for a high-rise office block to achieve net zero operational (regulated and unregulated) emissions based on a real-world case study. It found that this standard could be achieved through different packages of measures, resulting in cost uplifts of anywhere from 6-17% compared with Part L 2013 (roughly a c. 2-13% increase compared with Part L 2021).

Viability studies conducted by Currie & Brown on behalf of Greater Cambridge and West Oxfordshire Councils have also evaluated the costs of achieving net zero operational emissions via the LETI standard in schools and offices, based on modelled building archetypes. The results indicate that the uplift for schools and offices would be c. 0-7% compared with Part L 2013 (which is *approximately* 0-4% compared with Part L 2021).

A separate Currie & Brown report published in 2018 found that achieving a 100% reduction in regulated emissions through a combination of onsite measures plus contribution towards a carbon offsetting fund would result in a cost uplift of around 5-7% compared with Part L 2013 (*approximately* 1-4% compared

[126] Passivhaus Trust, *'Passivhaus Construction Costs'* (2019). Available at: https://passivhaustrust.org.uk/UserFiles/File/research%20papers/Costs/2019.10_Passivhaus%20Costs(1).pdf

[127] Currie & Brown and AECOM on behalf of the CCC, *'The costs and benefits of tighter standards for new buildings'* (2019). Available at: The costs and benefits of tighter standards for new buildings (Currie & Brown and AECOM) - Climate Change Committee (theccc.org.uk)

[128] 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/

with Part L 2021.[129] Note that this only covered regulated emissions, not unregulated emissions, so is not directly comparable with the two previous examples. This was cited as evidence by Cornwall and BANES Councils, both of which have recently adopted policies that would require net zero regulated emissions for non-domestic buildings.

Costs of BREEAM

As with domestic buildings and HQM, MSDC's preferred approach is for developers to demonstrate compliance with a net zero requirement via a BREEAM assessment. This would incur registration and certification fees, plus consultancy fees, but these are likely to be very small compared to build costs.

Research conducted by the BRE in 2016 suggests that the capital cost uplift of obtaining BREEAM certification depends on the rating that is achieved, but an 'Excellent' rating (which is required by the current draft MSDC policy wording) would increase capital costs by around 1-2% whereas an 'Outstanding' rating would increase costs by 5-10%.[130] (This was cited as evidence in the Climate Change Local Plan review for Lancaster City Council in 2021.[131]) These costs use Part L 2013 as a baseline so might equate to *approximately* a 1-6% increase compared to Part L 2021.

Figure 11. Increase in capital costs for different building types and certification levels. Source: BRE (2016) citing Tata Steel, British Constructional Steelwork Association Limited, AECOM, Cyril Sweett, The Steel Construction Institute, and Development Securities Plc.

Rating	School (Education)	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%

Although BREEAM requires developers to consider sustainability topics other than energy and GHG emissions, energy and GHG reduction measures account for most of the increase in capital costs. This is supported by research conducted by Currie & Brown on behalf of the Centre for Sustainable Energy (CSE) which found that, for a building that achieved a BREEAM 'Excellent' rating and a 100% reduction in regulated carbon emissions, only about 1/5th of the cost uplift was associated with the wider sustainability measures. The rest was associated with energy efficiency and other on-site carbon reduction measures, plus contributions towards a carbon offsetting fund.[132] So, looking at MSDC's policy proposals, it is safe to assume that the net zero requirement, not the overall BREEAM rating, will have a more significant impact on costs.

Overall conclusion on non-domestic buildings

Based on this review, it would be reasonable to assume cost uplifts in the range of up to 5% for non-domestic buildings to achieve net zero regulated emissions, and up to 10% to achieve net zero regulated *and* unregulated emissions. However, costs could be higher or lower for individual

[129] BNP Paribas, '*Bath and North East Somerset: Local Plan Partial Update Viability Study*' (2021). Available at: https://beta.bathnes.gov.uk/sites/default/files/2021-08/B%26NES%20LPPU%20Viability%20Study.pdf

[130] 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

[131] Three Dragons, 'Climate Change Local Plan Review: Viability Assessment' (2021). Available at: https://www.lancaster.gov.uk/assets/attach/10887/P_20.1.pdf

[132] CSE, *'Cost of Carbon Reduction in New Buildings'* (2018). Available at: https://www.bathnes.gov.uk/sites/default/files/sitedocuments/Planning-and-Building-Control/Planning-Policy/LP20162036/cost_of_carbon_reduction_in_new_buildings_report_publication_version.pdf

developments. This range is assumed to include the comparatively small capital costs of achieving other BREEAM credits.

Non-domestic buildings vary more in their scale, usage, and energy consumption patterns than domestic buildings. Our review found that published cost information covers a relatively limited number of non-domestic building archetypes, while at the same time indicating a relatively wide range of potential outcomes. Considering this, a cautious approach would be to require non-domestic buildings to achieve net zero regulated emissions, but *not* require them to achieve net zero unregulated emissions until there is clear evidence that it is technically feasible and viable for all development types.

6.4 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 on-site

… for planning authorities

- If adopting a carbon offsetting scheme, this provides a new 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, with running costs up to 50% lower[133,134]
- Higher property or rental values, with buyers and renters willing to pay more than 10% extra for low carbon homes[135] and BREEAM certified office space[136,137]
- 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
- Avoided costs of retrofitting at a later date – research has shown that retrofitting carbon saving measures could cost up to five times as much as if the buildings were constructed to a high standard at the outset[138]

[133] Currie & Brown and Etude, *'Technical Evidence Base for Policy SEC 1 – New Housing'* (2021). Available at: https://www.cornwall.gov.uk/media/fkzp45mv/eb042-20200359-climate-emergency-dpd-technical-evidence-base-rev-g.pdf

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

[135] Legal & General, *'Enabling the transition: The value of energy efficient homes'* (2022). Available at: https://www.legalandgeneralcapital.com/media-centre/thought-leadership/the-value-of-energy-efficient-homes/

[136] Hodkinson, *'The commercial value of BREEAM certification'* (2021). Available at: https://www.hodkinsonconsultancy.com/the-value-of-breeam/

[137] UKGBC, *'Capturing the value of sustainability: Identifying the links between sustainability and business value'* (2018). Available at: https://ukgbc.org/wp-content/uploads/2018/01/Capturing-the-Value-of-Sustainability.pdf

[138] Currie & Brown and AECOM on behalf of the CCC, *'The costs and benefits of tighter standards for new buildings'* (2019). Available at: The costs and benefits of tighter standards for new buildings (Currie & Brown and AECOM) - Climate Change Committee (theccc.org.uk)

7 GHG emissions assessment

7.1 Introduction

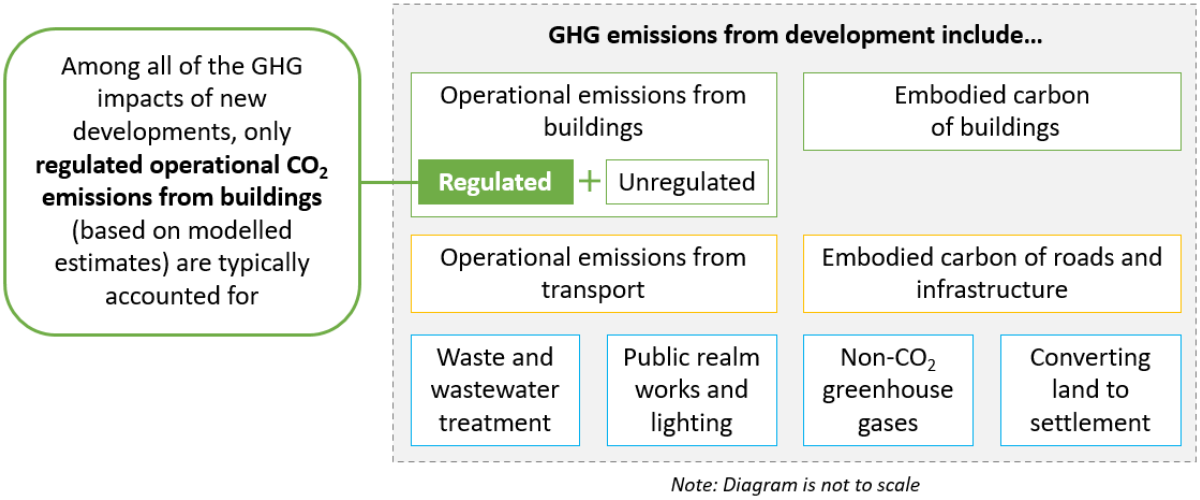
This section seeks to address the question, 'What are the GHG emissions arising from growth associated with the proposed spatial strategy in the Plan and allocations?' The objectives are to:

- Estimate the scale of GHG emissions from new developments under different policy scenarios;
- Explain the implications, both for the spatial strategy and the District Plan more broadly; and
- Use this information to inform the policy recommendations, presented in Section 3.2.

7.2 Sources of GHG emissions from development

In the context of the UK built environment, GHG performance 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 12: Sources of GHG emissions associated with new developments.



Note: Diagram is not to scale

7.2.1 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, lifts, escalators, 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 on-site. It is also due to the fact that unregulated energy uses are not adequately reflected in the modelling methodology.

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.

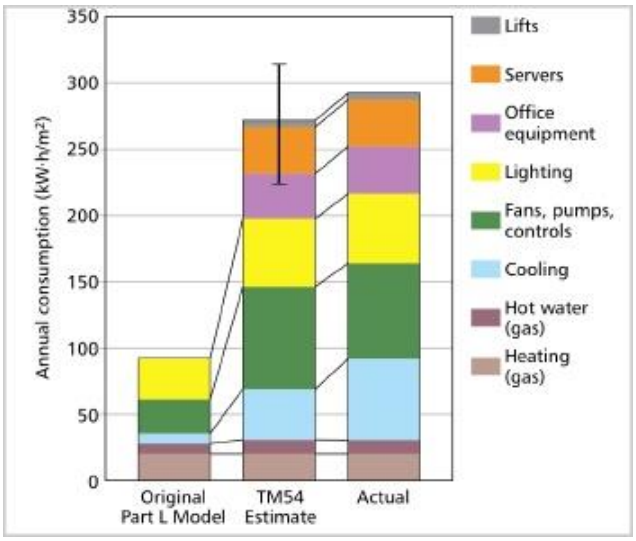


Figure 13. Difference between Part L compliance model and actual fuel consumption in a case study (non-domestic) building. Source: CIBSE TM54

First, there is no standard (national) calculation methodology for estimating unregulated emissions at design stage.[139] 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 MSDC 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.

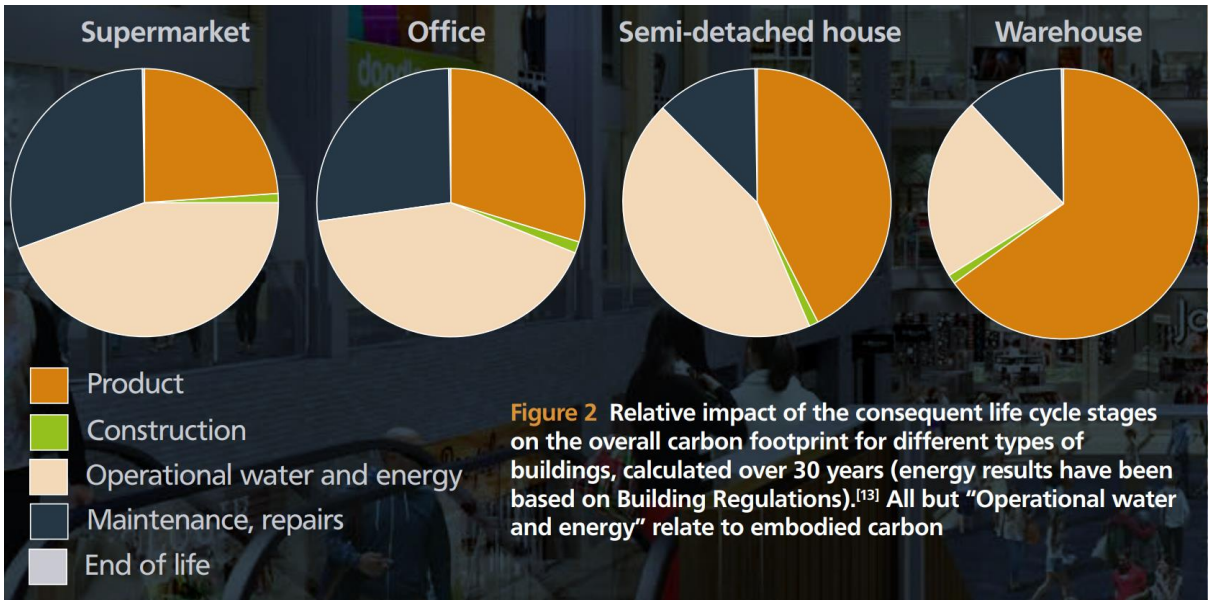
[139] Although there is no national standard at present, there are several options:

- 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.

7.2.2 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, these account for a very significant proportion of whole life-cycle (WLC) emissions from buildings.

Figure 14. 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 on-site. It would need to rely on some form of carbon offsetting or carbon removals.

7.2.3 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 on-site
- 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.

7.3 Estimating GHG emissions from buildings and cars

7.3.1 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.

Three scenarios have been modelled, to highlight the potential scale of emissions reductions that could be achieved, as follows:

Scenario 1: Minimum Standards

This scenario assumes that the new developments are constructed to meet the minimum standards stipulated by the Building Regulations, currently Part L 2021, with higher standards introduced in 2025 as part of the Future Homes Standard (FHS) and Future Buildings Standard (FBS).

Scenario 2: Reg 18 Draft Policies

This scenario represents the current policies MSDC have drafted within the Regulation 18 version of the District Plan. The key policies included within the analysis are DPS2 and DPH4.

Scenario 3: Recommended Reg 19 Policies

This scenario assumes that the new developments are constructed to meet the following higher standards, which reflect the policy recommendations in Section 3.2:

- Net zero operational energy use in domestic buildings
- Net zero regulated energy use in non-domestic buildings
- New developments to achieve a reduction in demand for private vehicle journeys compared with the District-wide average, due to design measures prioritising active and sustainable transport modes and the 20-minute neighbourhood principle

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.

7.3.2 Benchmarks used

For this analysis, we have used the following benchmarks:

Table 6. Benchmarks used to estimate emissions from buildings and cars

Category	Benchmarks used
Buildings – operational energy	**Scenario 1: Minimum Standards** This scenario assumes that all buildings meet minimum standards, i.e. Part L 2021 and subsequently the FHS or FBS. For domestic buildings, we have first estimated the operational energy use of recent new builds; benchmarks are taken from BEIS research[140] into the annual energy use of domestic properties first occupied between 2015-2017. These are assumed to represent the performance of buildings constructed to meet Part L 2013. This in turn is used as the basis for estimating the performance of buildings constructed to meet Part L 2021 (which achieves a c. 30% reduction in regulated CO_2 emissions compared with Part L 2013) and the Future Homes Standard (expected to achieve a c. 75-80% reduction in regulated CO_2 emissions. This is modelled by assuming a modest reduction in space heating demand plus on-site PV. Buildings constructed to Part L 2021 are assumed to have gas boilers while those constructed to the FHS have heat pumps, based on a boiler efficiency of 85% and heat pump coefficient of performance (COP) of 3.0 Energy benchmarks for non-domestic buildings constructed to meet Part L 2021 are based on CIBSE 'Good Practice' benchmarks for each use category. Fuel consumption for heating has been adjusted to reflect the use of heat pumps once the Future Buildings Standard is adopted. **Scenario 2: Reg 18 Draft Policies** Assumptions are based on the draft policies DPS2 and DPH4. Our modelling accounts for the fact that these require higher energy and GHG performance requirements for significant sites compared with other sites. Most domestic buildings are assumed to meet the minimum standards set out above. This is because, as stated previously, HQM has not yet been updated to reflect current Building Regulations (Part L 2021) and the current credit requirements for those buildings might not result in any GHG reduction. Dwellings on significant sites are assumed to achieve net zero regulated emissions plus a 10% reduction in unregulated emissions. Non-domestic buildings would be required to achieve an 'Outstanding' rating in the energy category of BREEAM. This does not directly equate to a % reduction in emissions compared with Building Regulations as BREEAM uses a different metric for measuring performance. However, we have assumed that this could be achieved with a c. 20% reduction in energy use. **Scenario 3: Recommended Reg 19 Policies** All domestic buildings are assumed to achieve net zero operational emissions throughout the Plan period. Energy benchmarks for are based on the LETI standard which requires all electricity to be generated on site meaning a net

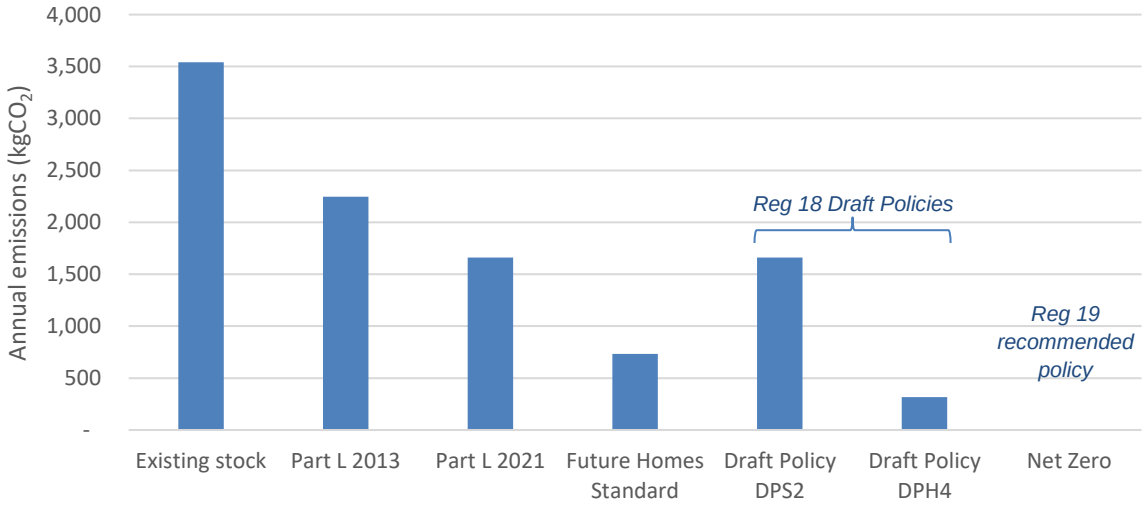
[140] BEIS, *'Energy consumption in new domestic buildings 2015-2017'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/853067/energy-consumption-new-domestic-buildings-2015-2017-england-wales.pdf

Category	Benchmarks used
	electricity consumption benchmark of 0 kWh/m^2/year (see Appendix A.3 for details); compliance with this standard would meet the recommended HQM requirement. Non-domestic buildings would be required to achieve net zero regulated emissions and aim to minimise unregulated emissions. We have assumed an average of 90 kWh/m^2/year electricity use for non-domestic buildings in this scenario, which is higher than the LETI standard of 55-65 kWh/m^2/year but significantly lower than the CIBSE benchmarks, and could meet the BREEAM requirements that have been recommended.
Buildings – embodied carbon	Benchmarks are taken from the GLA's Whole Life-cycle Carbon Assessment Guidance.[141]
Transport – operational energy	Benchmarks are based on sub-national road transport fuel consumption statistics for Mid Sussex, with scaling factors for rural/urban locations based on analysis of the National Transport Survey.[142]

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

The annual CO_2 emissions for dwellings are shown in the chart below. These are provided in order to highlight that there is a large difference between the average performance of the existing stock, buildings that meet modern building regulations (Part L 2013, 2021 and the FHS), and those that go further to achieve best practice energy and GHG performance standards. Achieving these uplifted performance standards will require a step-change in design and construction methods.

Figure 15. Typical annual operational emissions in a dwelling constructed to different standards



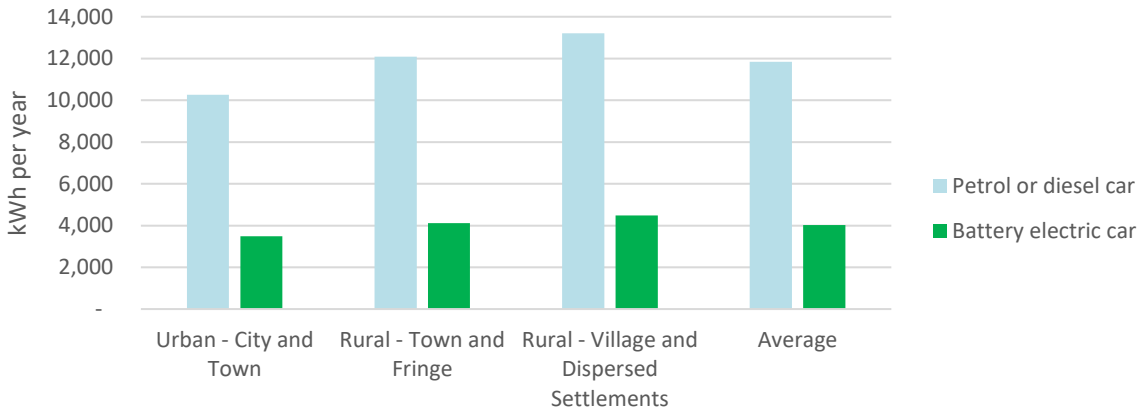
The benchmarks for energy use in residents' cars, shown in the chart below, demonstrate that although site location has an impact – higher annual mileage for properties in more rural locations – the shift to EVs may have an even bigger impact. This is an example of the benefits of technological change, although (as mentioned previously) it is still crucial to locate and design developments to minimise the

[141] GLA, *'Whole Life-cycle Carbon Assessment Guidance'* (2022). Available at: https://www.london.gov.uk/sites/default/files/lpg_-_wlca_guidance.pdf

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

need for private vehicle travel due to wider impacts e.g. embodied carbon, battery production, and electricity demands.

Figure 16. Annual road transport fuel consumption in cars



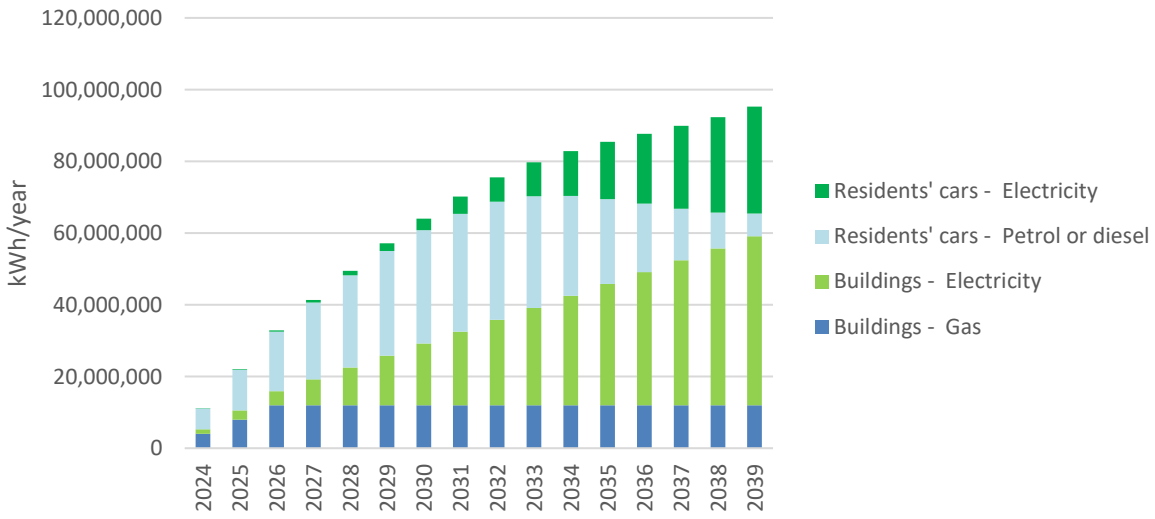
7.3.3 Calculating annual and cumulative emissions

The graphs below show some of the underlying model outputs from Scenario 1. The purpose of showing these is to illustrate how these benchmarks have been used to calculate annual and cumulative emissions; results of the assessment are presented in the next section.

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

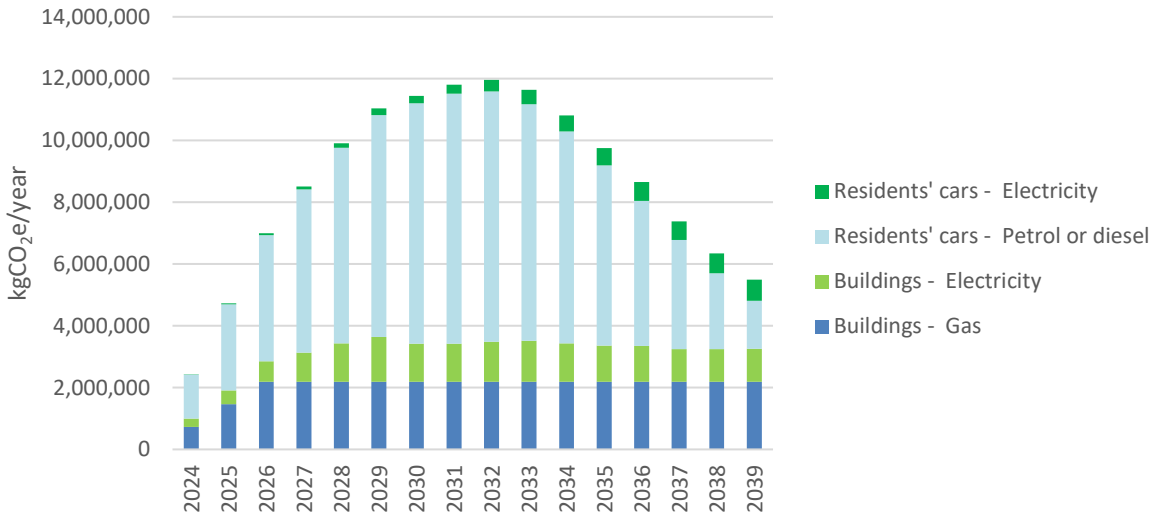
- Annual gas consumption increases up to 2025, then holds constant, because any additional new buildings constructed after that time are assumed to use heat pumps once the FHS is introduced (see Section 5.2.1 for details).
- Annual emissions from electricity use in new buildings increases year-on-year 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 17. Additional energy use from buildings and residents' cars in Scenario 1



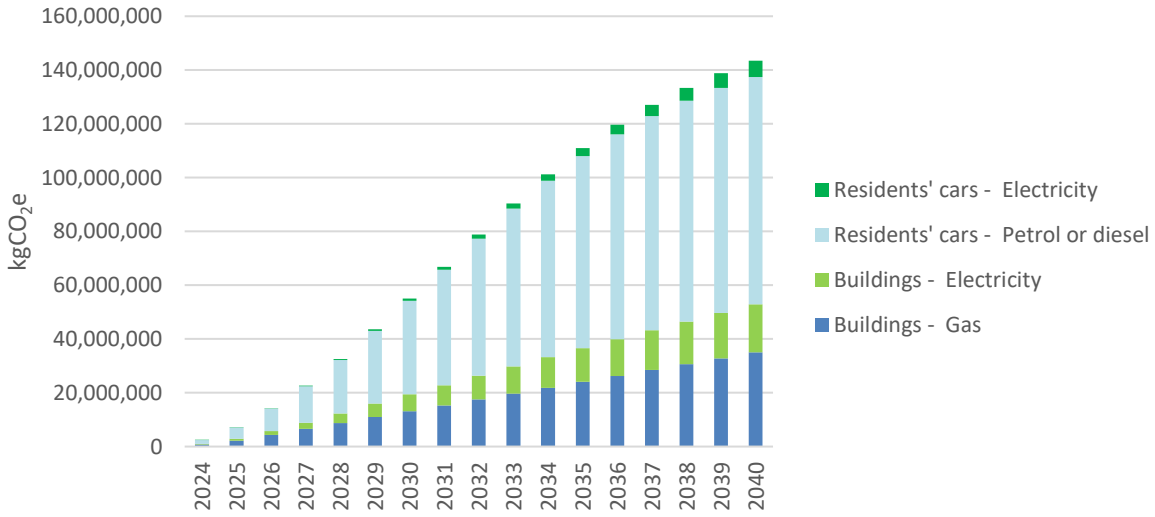
Second, annual energy use in buildings and transport is converted to GHG emissions ($kgCO_2e$ per year) using BEIS GHG conversion factors for company reporting.[143] In the graph below, electricity use is continuing to increase, but the emissions factor for electricity is decreasing due to grid decarbonisation. 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 7.3.4.3).

Figure 18. Annual operational GHG emissions from buildings and residents' cars in Scenario 1



Finally, annual emissions are added together to obtain an estimate of cumulative emissions from the proposed new development over the period. (In other words, for a given year, this graph shows the sum of all the emissions from that year plus all previous years.)

Figure 19. Cumulative operational GHG emissions in Scenario 1



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

7.3.4 Results and discussion

7.3.4.1 Impact on GHG emissions

The graph below presents a comparison of the cumulative operational GHG emissions from buildings and cars for:

- Scenario 1, where new development simply meets the standards set out in the Building Regulations
- Scenario 2, where new development meets the standards set in the Reg 18 MSDC District Plan; and
- Scenario 3, where new development is constructed to achieve net zero operational emissions, new buildings take steps to reduce embodied carbon emissions, and developments are designed and located to facilitate sustainable travel choices, reducing car mileage by 10%. This represents the recommended standards for the Reg 19 District Plan.

Figure 20. Cumulative operational GHG emissions from 2024-2039

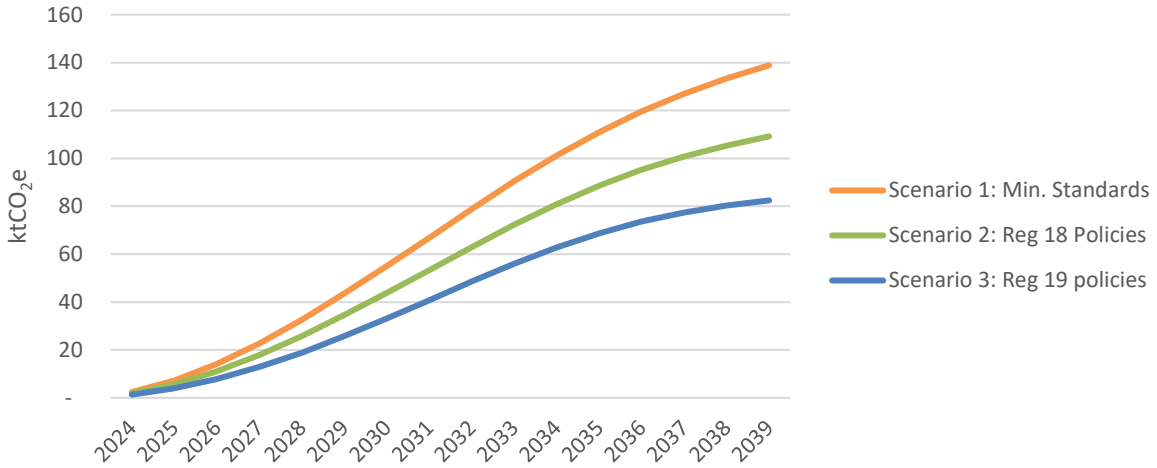


Table 7. Cumulative operational GHG emissions from 2024-2039

	Scenario 1	Scenario 2	Scenario 3
Cumulative operational emissions ($ktCO_2e$)	139	109	82
% improvement on Scenario 1	n/a	20%	40%

In Scenario 1, cumulative operational emissions in the period 2024-2039 are c. 139 $ktCO_2e$, for Scenario 2, cumulative operational emissions are 109 $ktCO_2e$, whereas for Scenario 3 cumulative operational emissions are c. 82 $ktCO_2e$. The Reg 18 policies modelled in Scenario 2 therefore represent a c. 20% compared with simply relying on improved standards in the Building Regulations. The recommended Reg 19 policies (Scenario 3) would provide a c. 40% saving, roughly doubling the emissions savings already being achieved by the Reg 18 draft policies. This is an estimate based on benchmarks and is not a forecast of actual emissions, but indicates the scale of improvement that can be achieved.

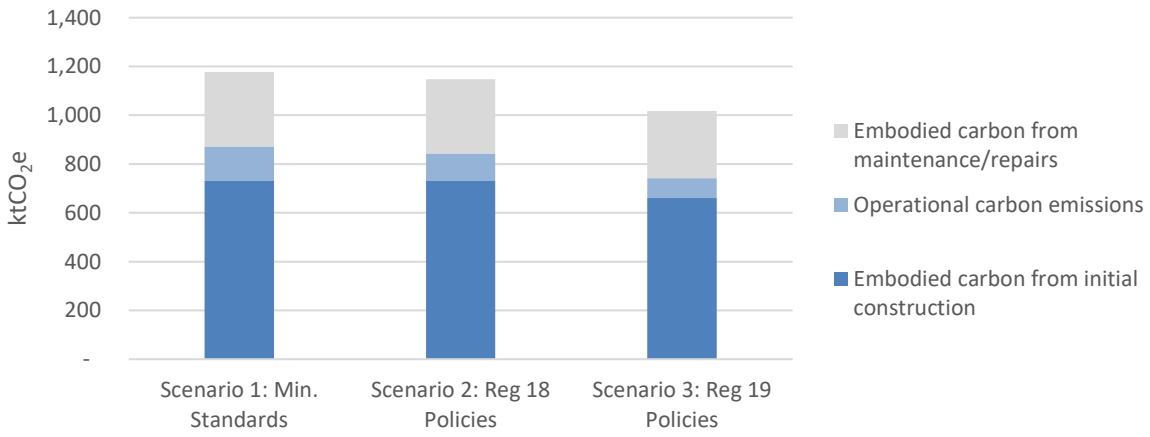
These represent the cumulative operational emissions from development over the course of the Plan period. For context, annual GHG emissions in Mid Sussex in 2019 and 2020 were 651 $ktCO_2e$ and 573 $ktCO_2e$, respectively.[144] So, without seeking higher standards (Scenario 1), the operational emissions

[144] BEIS, *'UK local authority and regional greenhouse gas emissions national statistics'* (2022). Available at: https://www.gov.uk/government/collections/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics Figures are published two years in arrears.

from new development over the next 15 years may equate to around 1/5th of District-wide emissions in one year. Although this may seem small, the MSDC Net Zero Feasibility Study (2022) found that, 'significant action will be needed to avoid *any* increase in emissions' given the scale of the challenge in reducing existing sources of emissions and the urgency of climate change. Emissions associated with new development in the Plan are those that MSDC has the best control over.

The above results do not include embodied carbon, because they do not necessarily occur in the year that the development is constructed. The graph below therefore shows the estimated cumulative emissions at the end of the Plan period (2039) once all the buildings are constructed. It includes the estimated cumulative operational *and* embodied GHG emissions, highlighting their relative scale.

Figure 21. Cumulative operational and embodied GHG emissions in 2039



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 2039, 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 2024-2039 would be roughly 870-11,180 $ktCO_2e$ for Scenario 1 (Min. Standards), 840-1,150 $ktCO_2e$ for Scenario 2 (Reg 18 Draft), and 740-1,020 $ktCO_2e$ for Scenario 3 (Recommended Reg 19 Policies), depending on the embodied carbon from maintenance and repairs. The ranges that are provided represent higher and lower estimates depending on the scale of embodied carbon from repairs and maintenance (see above). When embodied carbon is included in these estimates, the Reg 18 draft policies would only provide a small c. 3% reduction in emissions compared with the minimum standards, and the improved policies would provide a c. 14% reduction.

Table 8. Cumulative operational and embodied GHG emissions in 2039

	Scenario 1	Scenario 2	Scenario 3
Cumulative operational and embodied emissions ($ktCO_2e$)	870-11,180	840-1,150	740-1,020
% improvement on Scenario 1	n/a	3%	14%

What are the implications for Mid Sussex?

These results provide a useful insight into the likely sources of emissions from new development in Mid Sussex, along with potential responses MSDC can take to minimise their impact.

As was shown in Figure 19, by 2039, cumulative operational emissions are likely to be dominated by the petrol/diesel used in cars, and gas used in buildings if MSDC sets no additional targets in the District Plan and instead relies on the minimum standards in Building Regulations to promote decarbonisation. This is despite the fact that a phase-down of petrol/diesel vehicles was modelled, and that only buildings constructed in the next few years will use gas boilers. It suggests that, even though annual emissions would start to decline as the grid decarbonises (as was shown in Figure 18) there is a significant carbon penalty associated with the continued use of gas heating systems and petrol/diesel cars.

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. The Reg 18 draft policies are an improvement on minimum standards, but developments could still use gas boilers. On this basis we have recommended not only introducing a net zero policy for buildings, but also specifically introducing policy wording that prohibits fossil fuel heating. For transport, this highlights 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, as shown in Figure 21. Embodied carbon is to a large extent determined by design choices made at an early stage of development, and therefore MSDC 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, because this would have the single largest impact on the total emissions associated with new development.

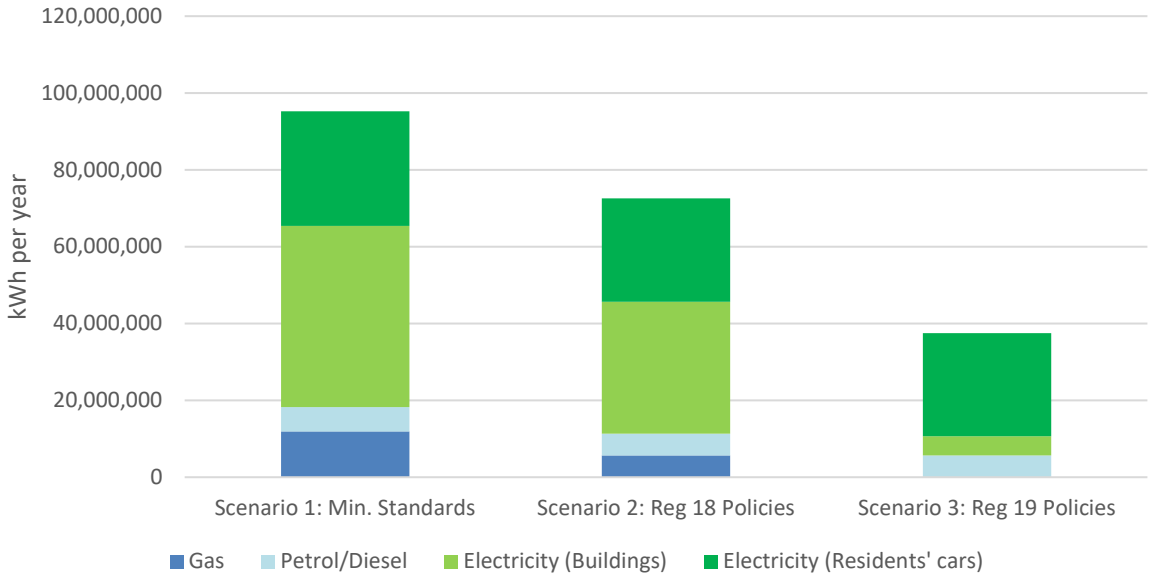
To put this in context: The Scenario 3 model assumes that a small (c. 10%) reduction in embodied carbon will be achieved, since the recommended policy wording (see Section 3.2) would require developers to undertake WLC assessments. The LETI standard recommends a 40% reduction in embodied carbon. If that target was adopted starting in 2024, the cumulative total emissions in Scenario 3 would be in the region of 520-700 $ktCO_2e$ rather than 740-1,020 $ktCO_2e$. These figures are high-level estimates that do not account for the practical challenges of implementing such a target, but they demonstrate the importance of considering whole life-cycle emissions.

7.3.4.2 Impact on fuel consumption

Operational emissions in this model are associated with fuel consumption in buildings and cars. The chart below shows the net additional fuel consumption for each scenario as of 2039, i.e. it excludes the electricity use that is met via on-site renewable technologies such as PV.

In 2039, assuming that buildings continue to be constructed with gas boilers for the next few years until the adoption of the FHS and FBS, there would be some use of gas in both Scenarios 1 and 2. In Scenario 3 this is absent because it is assumed that the District Plan would require new buildings to be heated using electricity or other zero emission fuels.

Figure 22. Net additional fuel consumption (kWh per year) in 2039



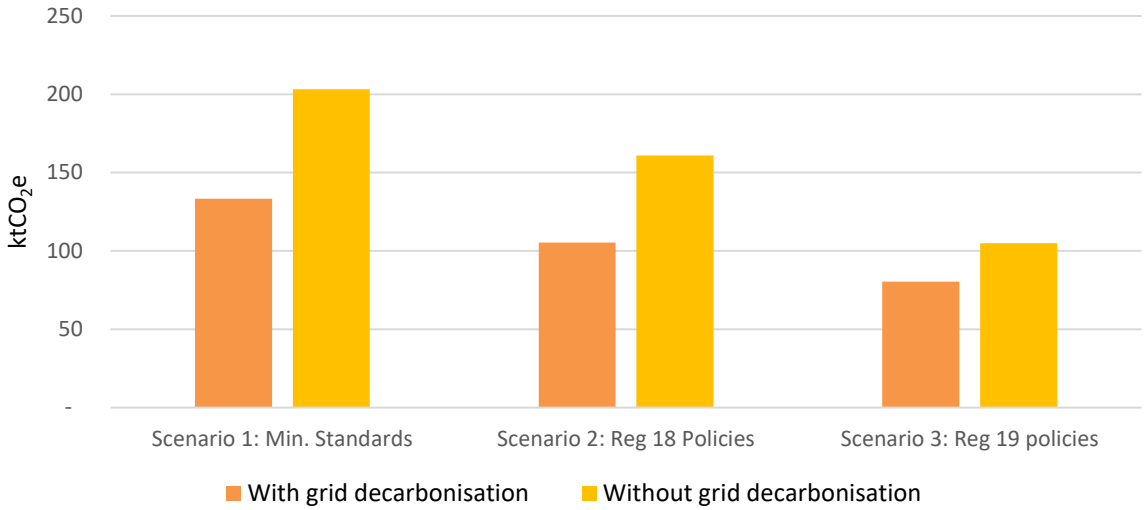
7.3.4.3 Sensitivity testing

As mentioned previously, embodied carbon is one of the most significant factors impacting total emissions. Some of the other notable factors that were found to influence emissions were:

- **Quantity of development** – Delivering fewer homes and/or less non-domestic floorspace would result in 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 District Plan period would have lower emissions; however, this is solely due to assumptions about the energy and GHG performance standards of those buildings (see below).
- **Energy and GHG performance standards for buildings** – 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 now and when the Future Homes Standard and Future Buildings Standard are introduced. Similar results have been demonstrated by the CCC[145] 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
- **Electricity grid decarbonisation** – 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, in Scenarios 1 and 2 the cumulative operational GHG emissions could be more than 60% higher than originally modelled. In Scenario 3, there is less exposure to this risk due to the developments having lower energy demands and higher levels of on-site generation. Delivering 'net zero ready' buildings, as is the Government's intention with the FHS and FBS, creates a risk that those developments will not actually reach net zero operational emissions, if the grid does not decarbonise at the rate that the Government hopes it will.

[145] 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/

Figure 23. Cumulative operational emissions by 2039, with and without the effects of electricity grid decarbonisation



This affirms the need to:

- Reduce energy demands and 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 Mid Sussex, as this will contribute towards grid decarbonisation.

Note, embodied carbon emissions from roads and other infrastructure have not been quantified in this study but could be significant – research by UKGBC suggests[146] that these could increase embodied carbon by around 10%– 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.

7.4 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. The main purpose of this is to raise awareness of sources of emissions that are not typically accounted for in the planning process or Building Regulations and identify potential actions that MSDC could take to address these.

Note: Unlike the previous section, which modelled three policy scenarios, this section considers a single dwelling and aims to describe the relative scale of emissions from different sources. In some cases, the data will be presented as a range. These ranges do not directly align with the scenarios presented above; they are intended to show how each source of emissions compares to the others. This approach has been taken because in some cases there is limited data to support a more precise estimate.

7.4.1 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

[146] UKGBC, *'A case study for low carbon residential developments'* (2022). Available at: https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/03/08122558/UKGBC-Masterplan-Report-version-2.pdf

can therefore cause a net increase or decrease in carbon emissions.[147] For example, conversion of agricultural land or pasture to new settlements will release CO_2 to the atmosphere.[148]

The Land Use Change, Land Use, and Forestry (LULUCF) subset[149] 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, and this resulted in emissions of approximately 187 $ktCO_2e$.

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 other sites was closer to 5 tCO_2e/ha.

These metrics cannot be directly applied to individual sites due to the number of variables involved. 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.[150]

7.4.2 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[151] 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[152]
- Annual leakage rate: 3.5%[153]
- 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.

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[147] 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

[148] It will also potentially result in operational emissions from agricultural activities or livestock either moving elsewhere or being replaced with the operational emissions from the new land use; however, these interactions are highly complex and it is difficult to estimate the net change in global GHG emissions that would result from this process.

[149] Buys, Chilverd, and Nickerson, *'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

[150] EPC data suggests that regulated emissions from recent new builds are around 2-3 tCO_2e per dwelling per year.

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

[152] WSP, *'The importance of refrigerants in heat pump selection'* (n.d.). Available at: https://www.wsp.com/en-gb/insights/the-importance-of-refrigerants-in-heat-pump-selection

[153] 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

7.4.3 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[154] which report that emissions from water supply are approximately 149 $kgCO_2e$ per million litres. Assuming that there is an average of 2.3 people per dwelling and water consumption of 85-125 litres per person per day (l/p/d)[155] the water supply for each new dwelling would result in emissions of approximately 30-44 $kgCO_2e$ per dwelling per year.

7.4.4 Waste and wastewater treatment

According to the LA GHG data, emissions from waste and wastewater treatment in Mid Sussex in 2020 were 55.8 $ktCO_2e$, which equates to roughly 367 $kgCO_2e$ per capita per year.[156] If again we assume 2.3 people per dwelling, this would result in emissions of around 844 $kgCO_2e$ per dwelling per year.

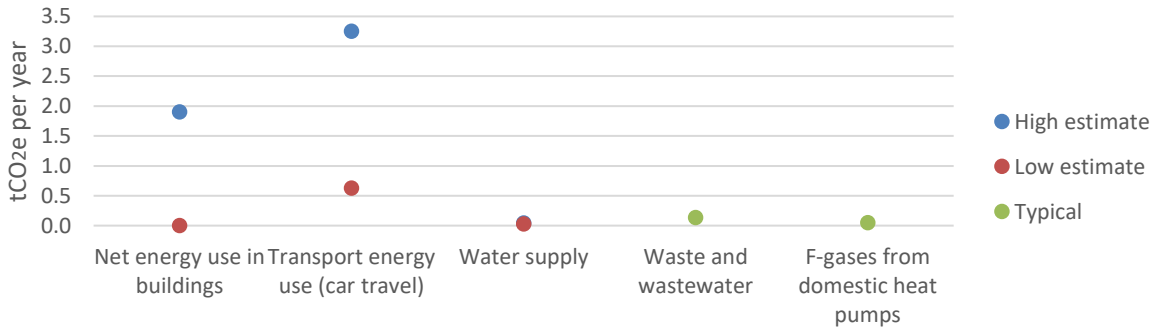
7.4.5 How do these sources of emissions compare?

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 24. Annual emissions are shown in Figure 25; 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.6.3.

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 24. One-off emissions from the construction of 1 new dwelling

Figure 25. Annual emissions from 1 new dwelling operating in 2023



[154] BEIS, *'Government conversion factors for company reporting of greenhouse gas emissions'* (2022). Available at: https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

[155] 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. MSDC has chosen to require a higher standard of 85 l/p/d for significant sites in the draft Reg 18 Plan.

[156] 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: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1086990/UK-local-authority-ghg-technical-report-2020.pdf

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.
- Mid Sussex and the surrounding area is classified as being under 'serious' water stress, so water use should be reduced as much as possible.[157]
- 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.

7.5 Implications for the District Plan

The table below summarises some of the key findings from the GHG assessment, based on a comparison of the scenarios modelled along with the sensitivity testing that has been undertaken. It provides suggestions for how MSDC can respond, either through planning policy or more broadly.

Table 9. Key findings from the GHG assessment

Consideration	Suggested response
Adopting higher standards for new developments, and ensuring that they are designed and located to facilitate sustainable transport modes, can have a significant beneficial impact on GHG emissions.	MSDC should seek to adopt the highest standards that are practical and viable and seek to bring these into force at the earliest opportunity. This is reflected in the recommendation to set a net zero target for all new developments.

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

Consideration	Suggested response
Over the District Plan period, emissions will likely be dominated by…	
1) Embodied carbon	Strongly encourage developers to assess whole life-cycle carbon (WLC). In future, this must become a requirement, and needs to be accompanied by a quantitative target for reducing embodied carbon. This is reflected in the recommendation to require major sites to assess WLC and expand the requirement to other sites in future. The timing is subject to MSDC's capacity to review and evaluate applications.
2) Petrol/diesel use in transport	Developments must be designed to minimise reliance on travel, and also have sufficient infrastructure to support EV charging. This is reflected in the recommendation to continue to promote the 20-minute neighbourhood concept, which is already referenced in the Reg 18 draft.
3) Continuing use of gas boilers	Phase out use of gas in new builds as soon as possible. This is reflected in the recommendation to require all heating to be supplied via low carbon fuels (i.e. not fossil fuels).
Grid decarbonisation may not happen at the rate anticipated, which is a significant risk (potentially increasing cumulative operational emissions by >50%)	MSDC can respond to this by: - Requiring new development to maximise renewables (for domestic developments, it is likely that 100% of their energy demands could be met on-site); 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. This is reflected in the recommendations that new development must include on-site decentralised, renewable or low carbon energy, and aim to meet 100% of its operational energy demands on-site.
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 – this is reflected in the recommendation that the District Plan should refer to GHG emissions rather than carbon emissions. - Take strong measures to protect existing areas of trees or grassland that act as carbon sinks – this is reflected in the recommendations to strengthen policy wording relating to new trees/woodlands. - Setting stringent targets for water efficiency – this is reflected in the recommendation to require sites to achieve 85 l/p/d.

8 Summary of key points

As a local planning authority, MSDC has an opportunity to influence both the operational energy use and embodied carbon emissions of new development in the local area. This study has evaluated the potential impact that the draft District Plan policies and site allocations might have on GHG emissions and energy use through the year 2039.

The scale of GHG emissions from new development is expected to be *relatively* small compared with total District-wide emissions. However, the Net Zero Feasibility Study (2022) produced by Ricardo on behalf of MSDC found that, 'significant action will be needed to avoid *any* increase in emissions' given the urgency of mitigating climate change. Therefore, it is important for MSDC to adopt ambitious policies to tackle these emissions. This is one of the Council's key areas of influence to reduce emissions and will provide various co-benefits, including much lower energy bills for occupants.

In the Reg 18 draft, MSDC set out a variety of policies that would go above and beyond minimum requirements of Building Regulations and help to drive down emissions from new buildings. We have systematically identified and assessed policy options that could strengthen these requirements and provided a range of case studies along with sample policy wording. We have recommended a set of policies that would result in significant additional GHG reductions, as well as reducing the net additional energy demands of the new developments.

A key recommendation which goes beyond the Reg 18 draft is to adopt a net zero target that applies to all developments. There are some recent examples of adopted Local Plans that have taken this approach. A review of published research on viability impacts suggests that the proposed standards could be achieved with less than a 5% uplift in build costs.

In light of MSDC's limited in-house technical expertise and resources, we recommend using recognised off the shelf assessment schemes such as BREEAM, HQM or Passivhaus as a means of assessing whether developers have met these standards. The additional cost uplift associated with certification is expected to be minor compared with the cost uplift associated with achieving the net zero requirement.

In addition to emissions from buildings, consideration has been given to the operational emissions and energy use of residents' cars. The GHG analysis highlights the importance of development sites being located and designed to facilitate sustainable travel modes, reduce reliance on private vehicle use, and facilitate EV uptake. This theme comes across strongly in the draft District Plan; for example, the draft Plan references the 20-minute neighbourhood concept, which is strongly supported.

However, there are other steps that MSDC can and should take to tackle GHG emissions. Over time, cumulative emissions from new developments are likely to be dominated by (a) the embodied carbon of buildings and infrastructure and (b) ongoing use of fossil fuels, whether in heating or transport. We therefore also recommend that:

- MSDC should strongly encourage developers to reduce embodied carbon and look towards making this a requirement (accompanied by a quantitative emissions reduction target) as soon as practical. This is subject to MSDC's capacity to review and evaluate applications.
- Policy wording should clarify that onsite fossil fuel combustion to heat new buildings will not be permitted.

This report has identified a variety of other opportunities to strengthen District Plan policies that directly or indirectly relate to climate change mitigation. Some of the key points include:

- Strongly supporting renewable energy provision (and reducing barriers to deployment)
- Supporting the transition towards a circular economy
- Prioritising sustainable reuse and refurbishment of existing buildings over demolition
- Promoting measures that increase biodiversity and carbon sequestration
- Addressing the performance gap to ensure that buildings operate as intended

Appendices

A.1 UK Building Regulations – Part L 2021

The most recent changes to Part L, which came into effect in 2022, are summarised below.

- New-build homes need to produce, on average, roughly 31% less carbon emissions compared to the previous Part L 2013 building regulations requirement (electric heating systems and renewable energy such as solar are seen as enablers)
- New non-domestic builds need to produce c. 27% less carbon emissions than Part L 2013with similar low energy measures to the previous building regulations requirement
- A new metric for measuring energy efficiency has been introduced. 'Primary energy' will be used to measure the efficiency of a building's heating as well as the energy required to deliver fuel to a building (this extends to including the efficiency of the power station supplying the electricity)
- New minimum efficiency standards have been provided for walls, windows and door for new domestic builds (and domestic extensions) and separate values for non-domestic builds.
- New and replacement heating systems in both domestic and non-domestic builds must have a maximum flow temperature of 55°C.
- Existing non-domestic buildings must improve the efficiency of heating and hot water boiler systems through installation of new controls.
- In new buildings (non-domestic), the minimum lighting efficacy has been raised.
- The Fabric Energy Efficiency Standard (FEES) level in new homes will be set by a 'full fabric specification' and SAP compliance will now be applied to extensions built on existing properties.
- The new Approved Document O introduces glazing limits in new-build homes, care homes, schools and student accommodation to reduce unwanted solar gain. It also enforces new levels of cross-ventilation.
- The new Approved Document S requires all domestic new builds with associated parking to have access to an electric vehicle charging point.

A.2 Case study: Lancaster City Climate Emergency Review of Local Plan Part 2

Policy DM53: Renewable and Low Carbon Energy Generation

"The Council is committed to supporting the transition to a lower carbon future as a matter of urgency and will seek to maximise the renewable and low carbon energy (electricity and thermal) generated in the district where this energy generation is compatible with other sustainability objectives.

The Council will support proposals for renewable and low carbon energy schemes, including ancillary development, where the direct, indirect, individual and cumulative impacts on the following considerations are, or will be made, acceptable (unless material considerations indicate otherwise):

I. As a result of its scale, siting or design impacts on the landscape character, visual amenity, impact on the setting of nationally designated landscapes, biodiversity, geodiversity, water quality, flood risk, townscape and historic assets of the district, highway safety, aviation and defence navigation system/communications are satisfactorily addressed;

II. Impacts on the amenities of sensitive neighbouring uses and local residents are minimised (including by virtue of noise, dust odour, shadow flicker, air quality or traffic);

III. The wider environmental, economic, social and community benefits directly related to the scheme outweigh any significant adverse effects; and

IV. The proposal is consistent with other relevant policies within the local development plan.

In areas that have been designated for their national importance, as identified in the National Planning Policy Framework, large-scale renewable energy infrastructure will only be permitted where it can be demonstrated that it would be appropriate in scale, located in areas that do not contribute positively to the objectives of the designation, is sympathetically designed and includes any necessary mitigation measures.

The Council will require that where renewable energy installations become non-operational the facility will be removed and the site will be fully restored to its original condition as soon as is reasonably practical.

Community led schemes are encouraged and for all schemes it will be expected to allow for community investment where applicable.

Onshore wind energy generation

Proposals for wind turbines will only be supported where they are located within an area identified as suitable for wind energy as shown on the Local Plan Policies Map and in Figure 13.1 (Areas identified as suitable for Wind Energy).

Applications for turbines will be acceptable where the relevant national and local policy, and up to date legislation can be met.

Wind turbines in the areas identified as suitable for wind energy will be considered acceptable where the development can be positively assessed against the criteria outlined in (I) to (IV), National Planning Policy, the relevant Ministerial Statements and/or Guidance and following consultation, it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing.

Hydro energy generation

The Council will be supportive of proposals for hydropower providing proposals are in conformity with other policies in the Local Plan. Any applications for hydropower schemes will be expected to be accompanied by a Flood Risk Assessment, Water Framework Directive Compliance Assessment and evidence of discussions with the Environment Agency around requirements.

Consideration must be given to the location, siting and design of the scheme, ensuring that there are no individual or cumulative adverse impacts on the environment and amenity. In all cases mitigation will be required to protect river flow, river continuity for fish and provide for sediment transfer.

Solar energy generation

The Council will be supportive of proposals for solar energy generation providing proposals are in conformity with other policies in the Local Plan.

For standalone solar panel arrays, it is expected that:

- *The impact of glare and glint should be taken into account;*
- *Site security (if used) should aim to be as unobtrusive as possible;*
- *Where necessary, the site should be screened (wherever possible with coppice, hedges or trees) and measures taken to mitigate harm to visual amenity;*
- *Where possible a plan for seasonal grazing of livestock should be included;*
- *It is expected that applications will include quantified plans for biodiversity net gain; and*
- *It will not adversely affect the use of the best and most versatile agricultural land.*

Other renewable and low carbon technologies

The Council will support renewable or low carbon energy schemes compatible with this policy, other policies within the Local Plan, and where impacts can be satisfactorily addressed.

In addition to the above renewable and low carbon energy sources, other forms of renewable and low carbon electric and thermal technologies may include:

- *Heat pumps;*
- *Geothermal heat;*
- *Energy and/or heat from waste;*
- *Biomass;*
- *Solar thermal;*
- *Combined heat and power;*
- *Pumped storage hydroelectricity; and*
- *Battery storage.*

This is not an exhaustive list and it is recognised that technologies will evolve and emerge.

Thermal Energy Distribution: Heating and Cooling Networks

The Council will support proposals for, and encourage the inclusion of, heating and cooling distribution networks, providing they are in conformity with Local Plan policies.

Where feasible, new major development should connect to existing networks, or provide new/purpose built heating/cooling networks.

It is expected that networks:

- *Are designed for cost effective future connection to a proposed or planned network.*
- *Employ individual or communal sustainable, renewable, or low carbon heating and/or cooling.*
- *Make use of ambient or secondary heat sources (in conjunction with heat pumps where required).*
- *Demonstrate compliance with appropriate technical standards (currently CIBSE's Heat Networks Code of Practice for the UK);*
- *Be registered with the Heat Trust;*

- *Use renewable and/or low carbon sources for their energy centre or provide an evidenced timeline and technology pathway towards system decarbonisation by 2030;*
- *Provide heat and/or cooling services at a fair and affordable price; and*
- *Where refrigerants are to be used, the global warming potential should be taken into account.*

Energy Storage

The Council will support proposals for battery storage facilities and infrastructure providing that they are in conformity with Local Plan Policies and that:

- *A clear and evidenced operational lifespan for the facility is defined;*
- *It is clearly stated which type of batteries will be used and of what size the units are;*
- *A clear and funded plan for site failure including fire and material leakages is provided;*
- *A clear definition of what the human and environmental receptors for smoke and materials from potential fires are, and that a plan for mitigating receptor risk is provided;*
- *An evidenced decommissioning plan is put into place prior to site development. The plan must include;*
    - *The responsible party for decommissioning;*
    - *A disposal plan for all solid and hazardous waste including proposed receiving waste facility/facilities;*
    - *Information detailing how a decommissioning fund structure has been set up with a funding timeline (with the fund preferably held by a third party);*
    - *Evidenced cost estimates for site decommissioning;*
    - *A clear outline of how the decommissioning fund will be kept current and up to date; and*
    - *An evidenced timeline for facility decommissioning and site restoration.*

The requirements of this policy are to be evidenced in a Sustainable Design Statement to be submitted with the planning application."

A.3 Emerging standards for net zero development

In the last decade there has been an increasing focus on what truly sustainable and net zero carbon developments would entail. This section summarises some of the emerging industry standards and best practices that MSDC should be aware of even if they are not adopted into this iteration of the District Plan.

A.3.1 UKGBC, LETI and RIBA policy details

The UK Green Building Council (UKGBC) has developed a framework for net zero carbon buildings based on the following definitions: [158]

- 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.'*

Building on this definition, the London Energy Transformation Initiative (LETI)[159] 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:[160]

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.

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

[159] For more information, refer to the LETI website: https://www.leti.london/

[160] LETI, *'Net Zero Operational Karbon: Ten key requirements'* (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

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.

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.[161] 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 10: 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$_2$e/m^2	1200 kgCO$_2$e/m^2	<800 kgCO$_2$e/m^2	<625 kgCO$_2$e/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

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

MSDC could require developers to adopt the above targets, as this would be fully in line with its climate change commitments and reflect the recommendations of the Net Zero study. However, these standards do not form part of an off the shelf assessment scheme and so would require developers to undertake bespoke calculations to prove compliance. This, in turn, would require in-house expertise to scrutinise energy statements. For these reasons, **following discussions with MSDC we suggest these standards would not be practical to adopt at this stage**.

However, it is recommended that the Council consider options for bringing in more technical expertise to assess such applications in future. This is because, going forward, net zero requirements are likely to become an increasing focus of development proposals, and (regardless of if or when these are adopted into the Building Regulations), officers will need to be able to evaluate the merits of individual schemes.

A.3.2 The AECB Building Standard

The AECB Building Standard is aimed at those wishing to create high-performance buildings using widely available technology. It focuses on energy efficiency through a 'fabric-first' approach, similar to Passivhaus and also making use of the Passivhaus Planning Package (PHPP) to design and model the building.

Similar to the other industry best practice standards mentioned above, the technical knowledge required to verify performance and the lack of a formal requirement for independent certification we would not recommend use of this standard at this stage, but MSDC could indicate support for developments that meet this standard.

A.4 Opportunities to utilise renewable energy technologies on significant sites

A.4.1 Introduction

To assess renewable energy opportunities on significant sites, we have mapped environmental and policy constraints relevant to sustainable design and renewables e.g., ground conditions for GSHPs, topography for wind, orientation/overshading for solar. This analysis uses open source mapping data from the Environment Agency and DEFRA websites to generate a map of relevant constraints informed by the Government's Renewable Energy Capacity Methodology (2010)[162] such as environmental designations (SSSIs, SPAs, etc.), historic landfill sites, agricultural land classification, etc. This was undertaken for three major development sites, namely Crabbet Park, South of Reeds Lane, and West of Burgess Hill.

A.4.2 Previous energy studies

As part of this work, a review of previous renewable energy studies has been undertaken. These include the 'Mid Sussex District Council Sustainable Energy Study' carried out in 2014 by Amec and the 'West Sussex Sustainable Energy Study' carried out in 2009 by CSE.[163,164]

Key findings that are relevant to the current assessment are summarised below.

The **West Sussex Sustainable Energy Study** considered local resources and opportunities to generate renewable electricity or heat from wind, biomass, waste, and roof-mounted PV or solar thermal technologies. The main technologies considered for inclusion in new developments were biomass CHP with district heating and roof-mounted solar technologies.

It should be noted that, in the last decade, there has been a shift in focus away from using biomass or waste to provide heat, due to a range of factors including but not limited to supply chain constraints, air quality concerns, waste reduction initiatives, and a better understanding of the life cycle emissions from those fuels.

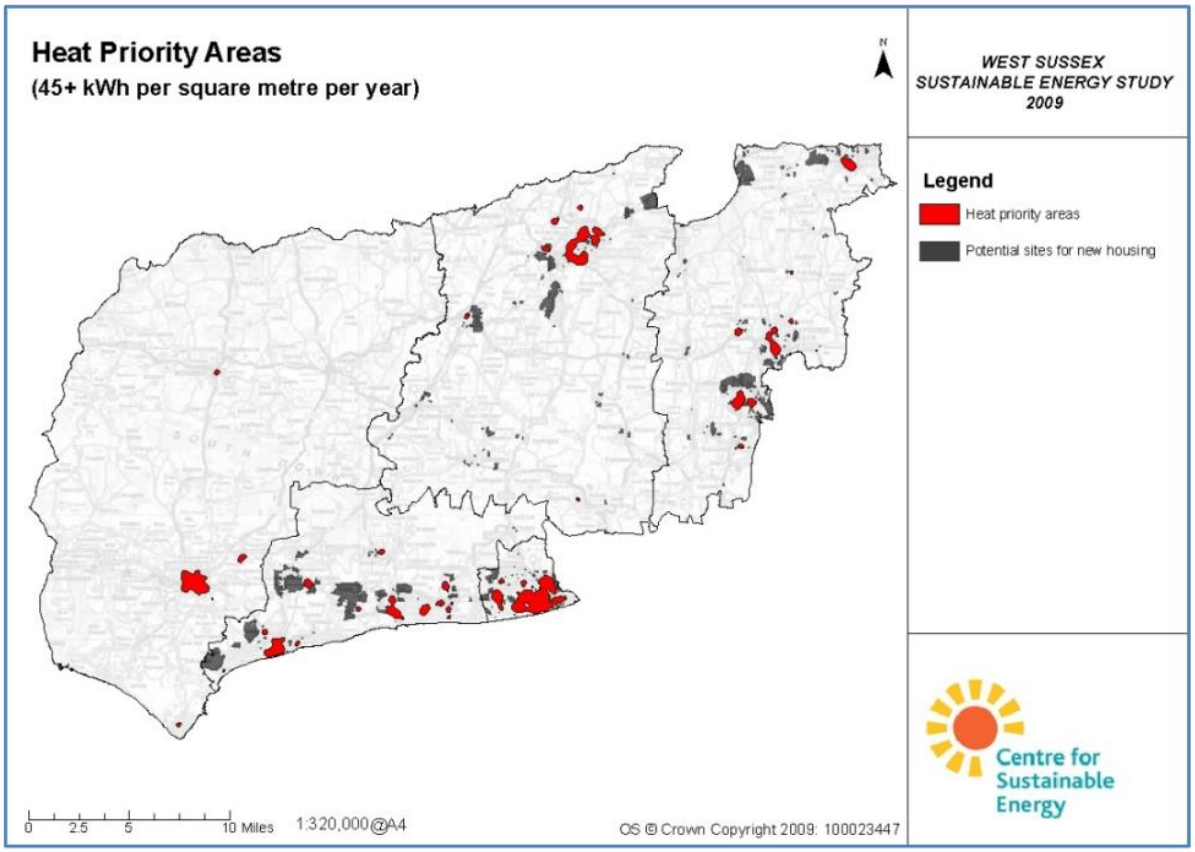
Opportunities for wind energy on any scale were found to be significantly constrained by landscape designations, including the SDNP and High Weald AONB – although, as noted in the Mid Sussex Net Zero Feasibility Study (2022), wind energy technologies could still be widely deployed within the District from a technical standpoint.

The CSE study also mapped existing heat loads to identify heat priority areas within the District. There are relatively few due to the predominantly rural nature of the District. 'Potential sites for new housing' were included in the map of heat priority areas on the assumption that new developments could potentially accommodate heat networks.

[162] LUC and SQW, *'Renewable and Low-carbon Energy Capacity Methodology'* (2010). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/226175/renewable_and_low_carbon_energy_capacity_methodology_jan2010.pdf

[163] Amec, *'Mid Sussex District Council Sustainable Energy Study'* (2014). Available at: https://www.midsussex.gov.uk/media/2591/mid-sussex-sustainable-energy-study-report.pdf

[164] CSE, *'West Sussex Sustainable Energy Study'* (2009). Available at: https://www.midsussex.gov.uk/media/2600/west-sussex-renewable-energy-study.pdf



The **Mid Sussex District Council Sustainable Energy Study** cited the earlier CSE study when providing an assessment of renewable energy resources and opportunities. The authors concluded that, "The overall assessment suggests that large scale low/zero carbon energy generation schemes are unlikely to come forward in major numbers. Instead there may be a few medium scale wind and solar projects potentially brought forward as community operated assets. Beyond this, contributions are individual dwelling led with the exception of a few potential district heating schemes."

Both of the previous studies assumed that large-scale renewable deployment was significantly constrained by landscape designations/character. While this is an important consideration, in light of the UK's significantly more ambitious climate change legislation, the energy crisis, and wider public acceptance of renewables, these assumptions should be kept under review.

A.4.3 Roof-mounted solar photovoltaic (PV) and solar thermal technologies

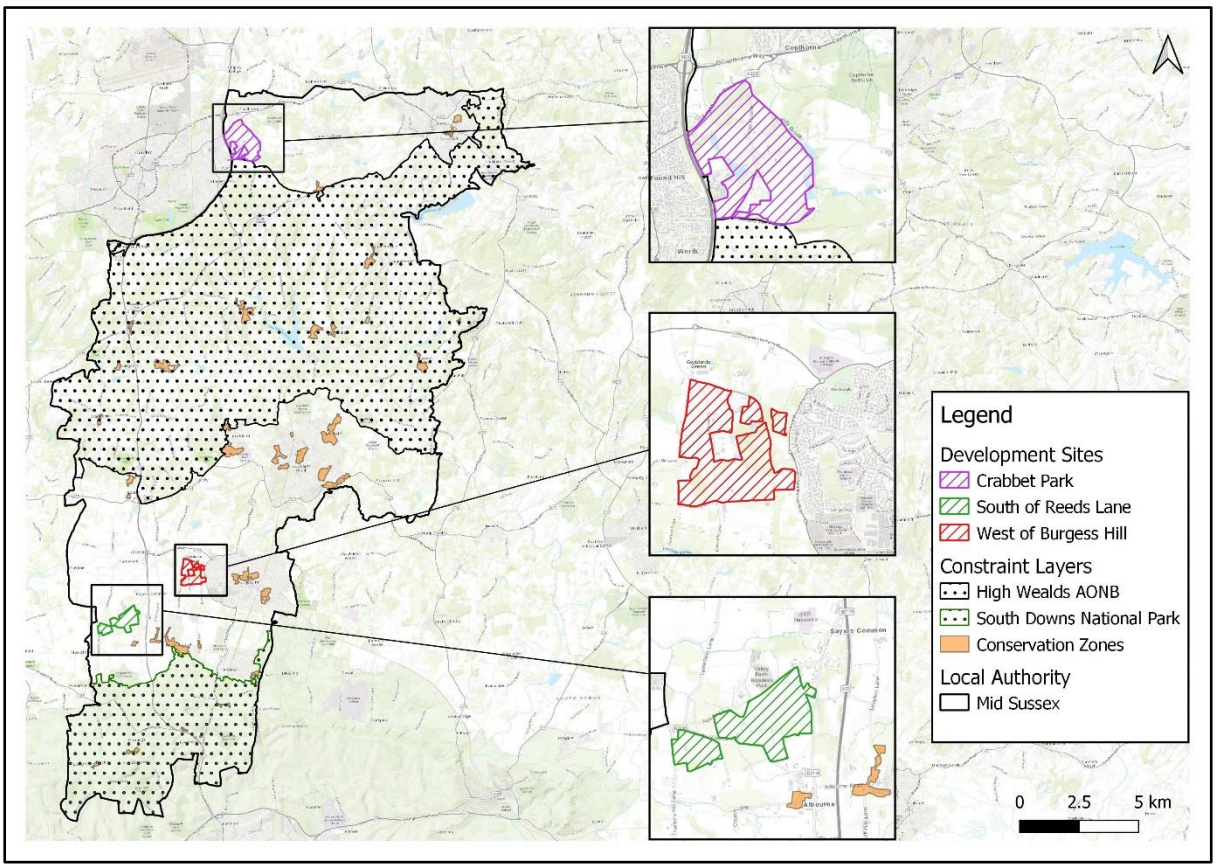
There are major opportunities to include roof-mounted solar technologies on all three development sites. While they are more expensive than ground-mounted PV (see Section A.4.4), they benefit from using existing built environment structures and not taking up any additional land. Their potential is not limited to buildings; PV panels could also be incorporated into other structures such as car parks or bus shelters. This has already been enshrined into development regulation elsewhere – in France, for example, large car parks with spaces for ≥80 vehicles must be covered by solar panels.[165] Ideally, some of these installations would be co-located with EV charge points as appropriate. The upfront investment in PV panels is recuperated down the line via energy savings for building occupants. The main downside of PV panels is the visibility and perceived undesirable appearance, but this can be mitigated through careful design.

[165] https://electrek.co/2022/11/08/france-require-parking-lots-be-covered-in-solar-panels/

The key factors for their effectiveness/viability are roof geometry and orientation. For example, if there is a parapet around the roof, this can cause overshading; the same building with a different roof shape could generate 3-4 times more electricity annually. In the case of solar thermal, the building also needs to include a hot water cylinder.

There are also some possible constraints depending on the location of the development site, e.g., if it falls into an AONB, conservation area or national park. To assess this, a high-level spatial analysis was carried out using QGIS to determine any possible constraints from overlaps of the development sites with the constraint layers. As shown in the figure below, there are no overlaps of the development sites and of the analysed constraints, which means that there are no apparent constraints to installing solar PV panels. This is also the case for Air Source Heat Pumps (ASHPs) as they are subject to the same general set of possible constraints.

Figure 26. Map of development sites and possible roof-mounted solar PV constraints



A.4.4 Ground-mounted solar PV

Ground-mounted solar PV is currently the cheapest form of electricity generation along with onshore wind. It is not usually directly incorporated into new developments, but has been assessed since there may be space on the significant sites to include it. Developments could benefit from a 'private wire' connection to a solar farm as this would significantly reduce the occupants' energy bills.

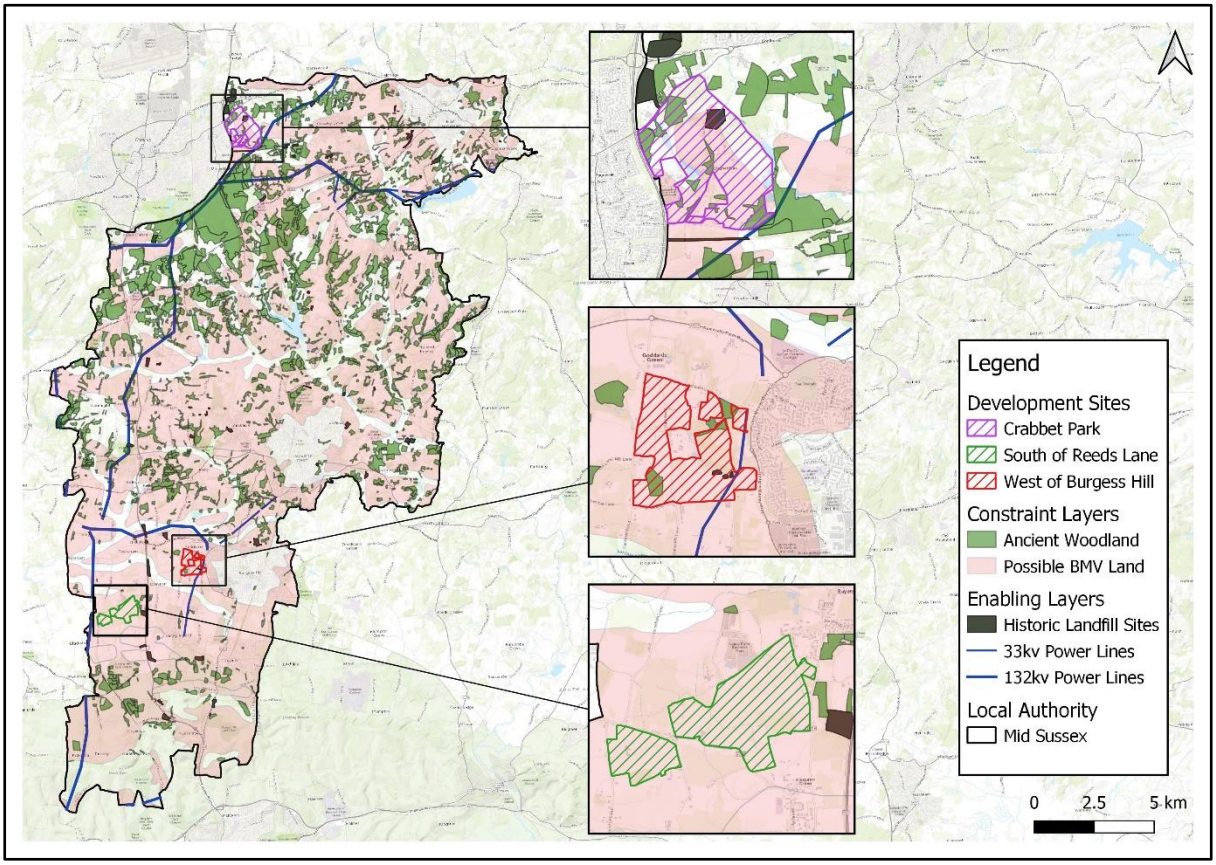
As ground-mounted solar PV installations or (if at a large scale) solar farms take up additional land, a set of possible constraints ought to be assessed in order to determine the feasibility of them for each development site.

Possible constraints for ground-mounted solar PV are National Natures Reserves (NNRs), Local Nature Reserves (LNRs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs), Designated wetland sites (Ramsar), Registered Parks and Gardens, AONBs, National Parks, 'Best and Most Versatile' (BMV) agricultural land, and Ancient Woodland.

Proximity to power transmission lines is considered an enabling factor because it facilitates grid connections.

The spatial analysis revealed that all three sites are potentially well located to connect to the grid based on the map of transmission lines. There are some areas of woodland and potential BMV land which would not be suitable. The presence of historic landfills is sometimes considered an opportunity if those areas would be difficult to use for other purposes (e.g. due to contamination) but this is subject to the planned uses and masterplan of the site.

Figure 27. Map of Development Sites and possible constraining and enabling factors for ground-mounted solar PV installations



It should be noted that BMV agricultural land corresponds to Grades 1-3a of the Agricultural Land Classification (ALC) data. However, as the ALC data does not differentiate between the 3a and 3b subgrades[166], further on-the-ground assessments would be necessary to determine its quality. Maps published by Natural England suggest that most of the 'Possible BMV land' shown in this map is only moderate quality (Grade 3b) so there may be more potential for ground-mounted PV than the spatial data suggests.[167,168]

In addition to this, there are examples with combining with grazing or crop growing, so even BMV land may not necessarily be a disqualifying factor.

[166] Natural England, *'Guide to assessing development proposals on agricultural land'* (2021). Available at: https://www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land

[167] Natural England, *'Likelihood of Best and Most Versatile (BMV) Agricultural Land - Strategic scale map London and the South East (ALC019)'* (2017). Available at: http://publications.naturalengland.org.uk/publication/6056482614804480?category=5208993007403008

[168] https://www.forestergis.com/Apps/MapBrowser/

Research Finding: Combining lamb grazing and solar panels to increase land productivity

A study from the Oregon State University (2021) showed that land productivity can be increased through dual use of land (renewable energy production and grazing). While solar pastures were found to produce 38% lower vegetative mass, this was offset by higher forage quality. In addition to this, lower water consumption could be observed during late spring.[169]

A.4.5 Air source heat pumps (ASHPs)

Following the introduction of the FHS in 2025, air source heat pumps (ASHPs) will likely be the default domestic heating option, as the FHS will require the installation of low-carbon heating technologies. As ASHPs need to be located externally, there is always some visual impact; however, this can be mitigated through careful design. The main other consideration is noise, but this is only audible in very close proximity to the ASHP. Therefore, ASHPs are assumed to be suitable for use on all of the significant sites. Along with other forms of electrically-powered heating, this can actually provide a cost saving to developers who will not need to provide a gas grid connection.

Internally, space will be required for a hot water storage tank and larger radiators (or underfloor heating).

Figure 26 and the accompanying text in Section A.4.3 should be referred to for a high-level assessment of constraints on ASHPs at the selected development sites, which are assumed to be the same as for roof mounted solar PV due to visual impact.

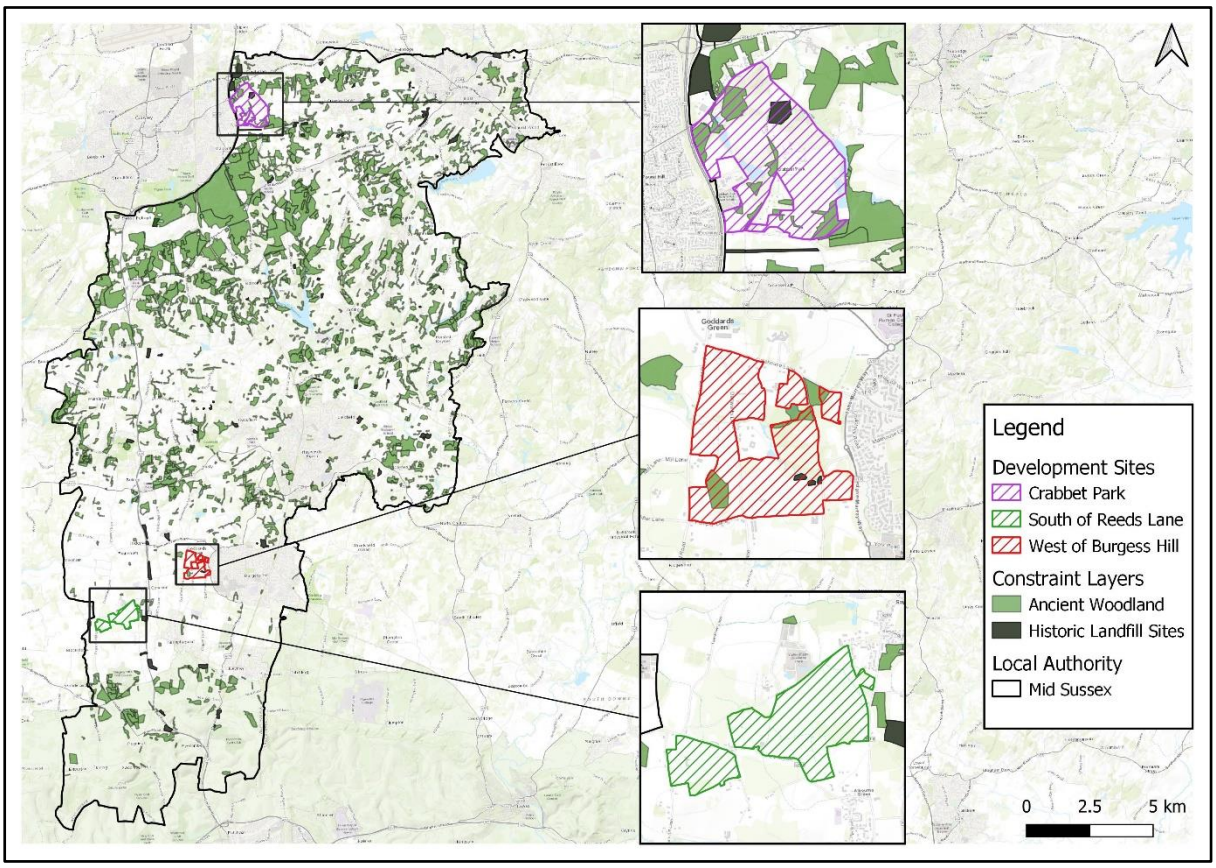
A.4.6 Ground source heat pumps (GSHPs)

Ground source heat pumps (GSHPs) have a higher Coefficient of Performance (COP) than ASHPs (3.5-4.5 compared to 2.5-3.5), which could lead to a demand reduction in electricity of around 25%-33%. However, GSHPs face more environmental constraints and a more time- and cost-intensive installation than ASHPs. To analyse the possible constraints to GSHP installation at the three development sites, a high-level spatial analysis was carried out to assess overlaps between the AONB, SDNP, Ancient Woodland, SACs, SPAs, NNRs, SSSIs, Parks and Gardens, LNRs, Historic Landfill Sites, Archaeological Notification Areas (ANAs), Source Protection Zones (SPZ), and Ramsar and the development sites. As only overlaps with ancient woodland and historic landfill sites could be found, the other data layers have been excluded from this analysis (see Figure 28). It should be noted that there may be overlap with ANAs, but as the data is only available in form of an online map (held by West Sussex County Council), this could not be included in the analysis.[170]

[169] Andrew et al., *'Herbage Yield, Lamb Growth and Foraging Behavior in Agrivoltaic Production System'* (2021). Available at: https://www.frontiersin.org/articles/10.3389/fsufs.2021.659175/full?utm_source=F-NTF&utm_medium=EMLX&utm_campaign=PRD_FEOPS_20170000_ARTICLE

[170] West Sussex County Council, *'Archaeological Notification Areas'* (2022). Available at: https://www.westsussex.gov.uk/land-waste-and-housing/landscape-and-environment/historic-environment-record/archaeological-notification-areas-1/

Figure 28. Map of Development Sites and possible constraints for GSHPs



To further assess the viability of GSPHs at the development sites, more detailed on-site investigations will be required, as there are other important variables, such as ground conditions. Greenfield sites are generally particularly suitable for GSHP installation if there are excavations happening already.

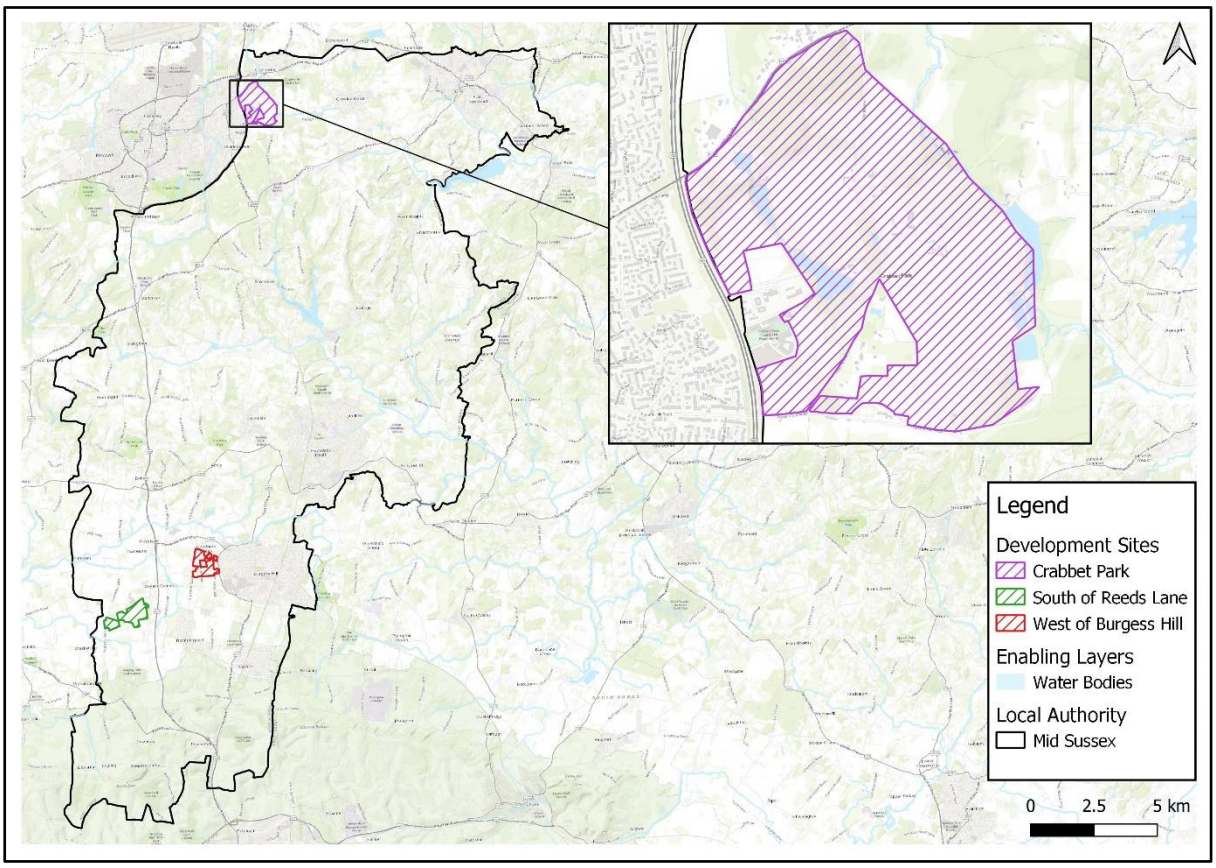
A.4.7 Water source heat pumps (WSHPs)

As with GSHPs (see above), the assessment for water source heat pump (WSHP) viability requires more detailed on-site investigations. The key enabling factor for WSHP viability is proximity to water bodies.

A high-level map produced in 2014 that shows potential locations for WSHPs does not identify significant resource within Mid Sussex. However, the map was intended to highlight rivers in urban areas with higher heat demand density, and therefore is not applicable to assess site-specific opportunities for new developments.[171] Our high-level spatial analysis has revealed some potential at the Crabbet Park site on the basis that it is located on and near several small water bodies (see Figure 29).

[171] Department of Energy and Climate Change, *'High Level Water Source Heat Map'* (2014). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/353979/decc_water_source_heat_map.pdf

Figure 29. Map of Development Sites and possible enabling factors for WSHPs



A.4.8 Biomass/Biofuel

Biomass heating systems are generally not recommended over heat pumps due to the negative effects on air quality. Biomass burners are only recommended when there is a nearby source of sustainable biofuel which was not analysed as part of this study.

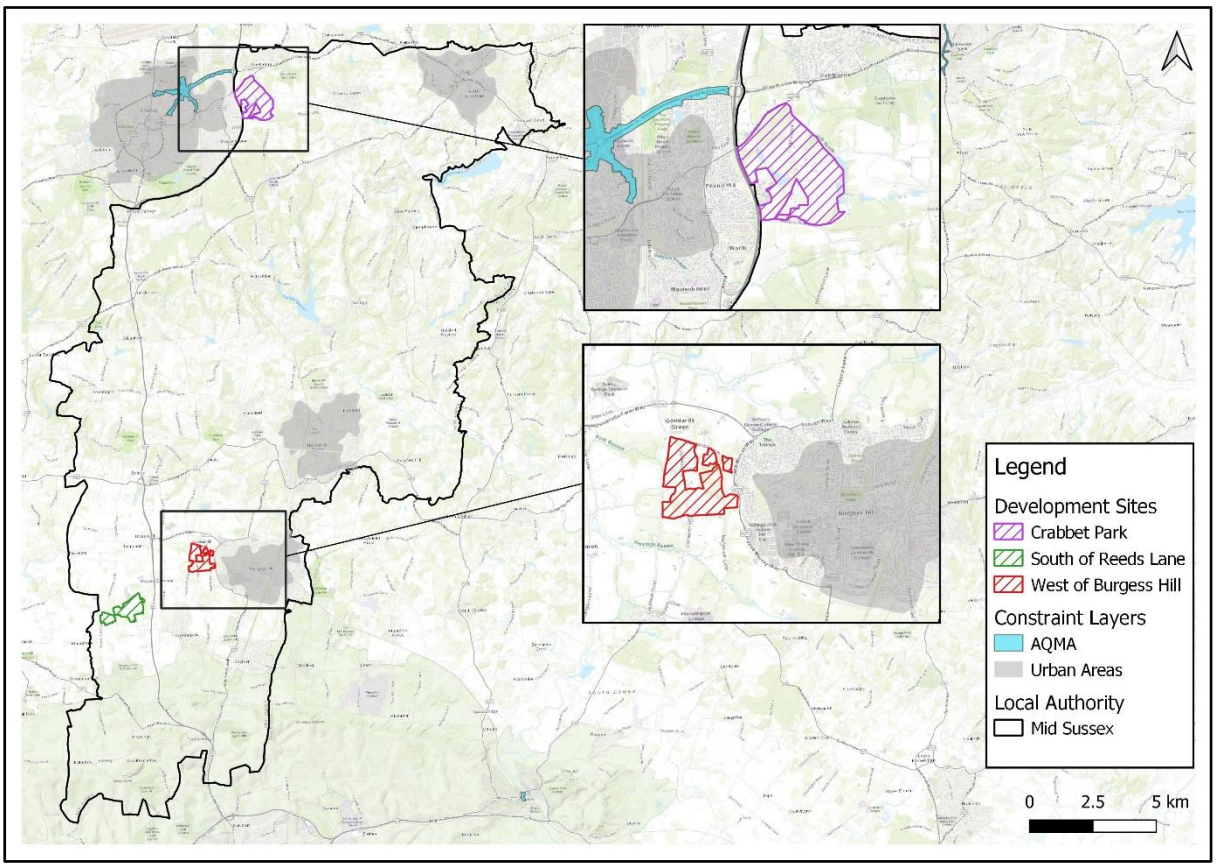
As such, the main constraint layer is Air Quality Management Areas (AQMAs) which are not present on any of the three sites (there is only one small AQMA near a small development site) (see Figure 30). Nonetheless, with the push for better air quality, other constraints may become relevant in the future, such as population density.[172] This has not been analysed in detail as part of this study; however, as both the Crabbet Park and West of Burgess Hill development sites are adjacent to relatively densely populated areas[173] as indicated by urban areas[174] in Figure 30, these are less likely to be suitable for biomass heating systems.

[172] Lu, Y., Zhang, Y., & Ma, K. (2022). The effect of population density on the suitability of biomass energy development. *Sustainable Cities and Society*, *87*, 104240.

[173] Based on population density maps produced by LuminoCity3D: https://luminocity3d.org/indexRetina.html#population_density_2011/11/50.9967/-0.2194

[174] The “urban area” data was taken from the ALC dataset and therefore does not fully match the base layer which already indicates built-up areas.

Figure 30. Map of constraints to biomass heating systems.

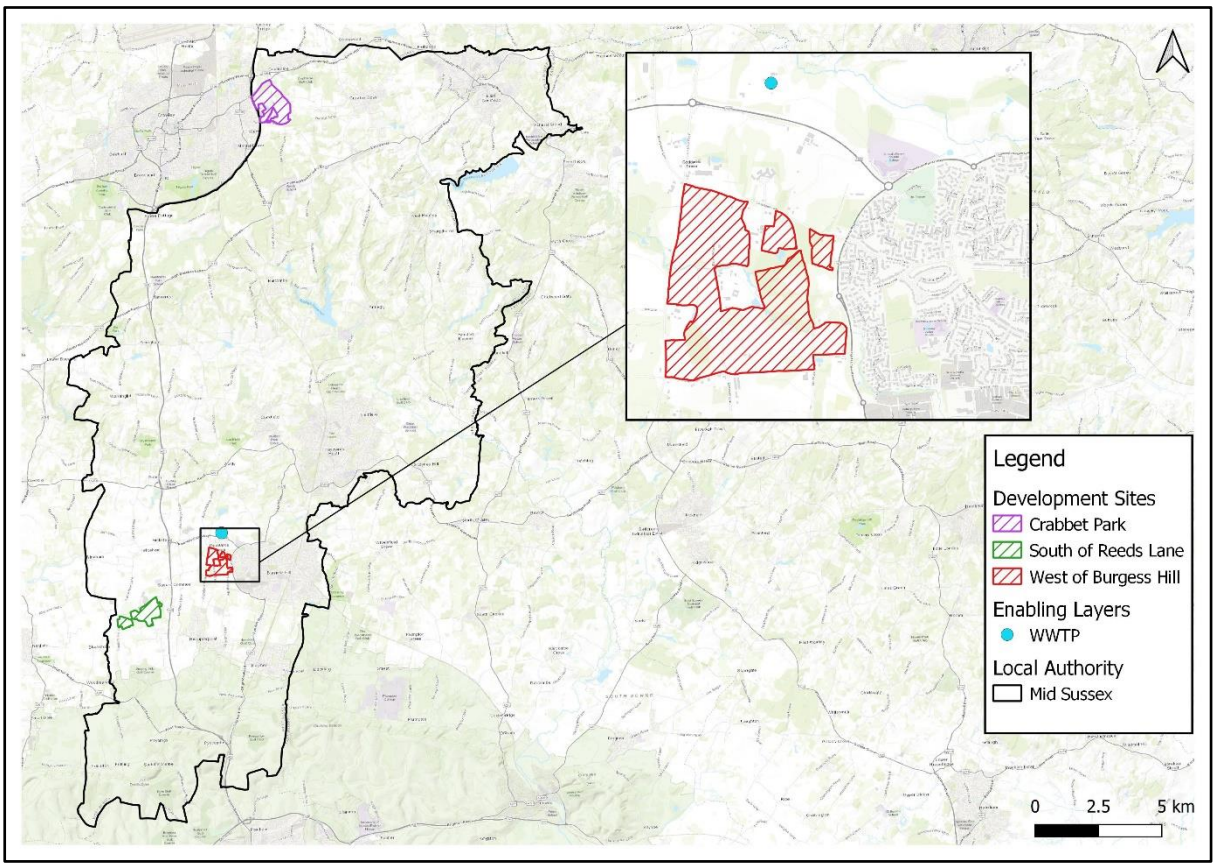


A.4.9 Potential sources of heat to supply heat networks

Heat networks are particularly suitable for high-density developments due to their reliance on high and consistent heat demand (with a minimum dwelling density of 50 dw/ha). As Mid Sussex is generally of relatively low population density, heat networks are likely less suitable than individual heating technologies such as heat pumps. They are further often not economical for highly energy efficient domestic properties with low space heating demand. Nonetheless, they could be considered for high-density residential or non-residential sites subject to more information becoming available about proposed use categories.

To analyse the potential for using waste heat (that is, surplus heat from buildings or industrial facilities) to supply heat networks, we have screened for any potential anchor loads or industrial facilities, using the National Atmospheric Emissions Inventory (NAEI) mapping tool. Our review of the NAEI suggests there are none close by. There is a wastewater treatment plant (WWTP) which is located in relative proximity to the West of Burgess Hill development site (~550m measured at the shortest distance), as shown in Figure 31 below. It is understood that there are other development sites closer to the WWTP that may be better able to utilise this as a heat source. It is understood that MSDC has previously engaged in discussions about this, which should be kept under review as a potential option unless a feasibility study has ruled it out.

Figure 31. Map of enabling factors for waste and wastewater treatment facilities



A.4.10 Wind

Wind power generation is not likely to be suitable near the development sites due to the shadow flicker and turbine noise as well as the disruption of the laminar wind flow by the buildings which would reduce the energy output. As mentioned previously, both existing renewable energy opportunity studies highlighted visual impacts and landscape designations as key concerns for this technology.

A.4.11 Hydropower

This study has not considered hydropower opportunities in detail; however, a study carried out by the Environment Agency in 2010 did not identify any significant opportunities within the District, and this is assumed to remain the case.[175]

A.4.12 Hydrogen

This study does not consider hydrogen as part of this study because our review has not identified any projects for green hydrogen production within Mid Sussex. However, there are projects not far outside of the District boundaries, such as the planned hydrogen hub at Shoreham port (to be operational as of 2024)[176] and the Greater Brighton: Hydrogen Sussex body, promoting the development of the hydrogen economy[177].

[175] Environment Agency, *'Mapping Hydropower Opportunities and Sensitivities in England and Wales'* (2010)

[176] Sussex World, *'Shoreham Port announces plans for green hydrogen hub'* (2021). Available at: https://www.sussexexpress.co.uk/business/shoreham-port-announces-plans-for-green-hydrogen-hub-3140167

[177] For more information, refer to the Local Government Association website: https://www.local.gov.uk/case-studies/greater-brighton-hydrogen-sussex

In principle, the green hydrogen produced as part of these projects could be used in Mid Sussex, for example, for fuel cell electric vehicle (FCEV) buses, HGVs, and waste collection vehicles. Hydrogen for heating does not appear to be a focus of these projects and would generally be recommended against, due to the indirect global warming potential (GWP) from leaked hydrogen[178], increased energy demand for the production of green hydrogen[179], and lower efficiency of hydrogen boilers compared to ASHPs or GSHPs.[180]

[178] BEIS, *'Atmospheric implications of increased Hydrogen use'* (2022). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1067144/atmospheric-implications-of-increased-hydrogen-use.pdf

[179] ReCharge News, *'A wake-up call on green hydrogen: the amount of wind and solar needed is immense'* (2020). Available at: https://www.rechargenews.com/transition/a-wake-up-call-on-green-hydrogen-the-amount-of-wind-and-solar-needed-is-immense/2-1-776481

[180] CCC, *'Sixth Carbon Budget - Charts and Data'* (2020). Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget/#supporting-information-charts-and-data

A.5 Further details on costs and viability

The table below provides further details of the cost information gathered from the literature review on viability. References and further information are provided in the main body report, Section 6.

Table 11. Cost and viability information

Source	Description	Capital costs (£/m²)	EO costs (£/m²)	£ uplift	% uplift	Standard assessed	Compared with…
Evidence from published viability studies that examined net zero carbon operational buildings, based on modelled archetypes							
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
Greater Cambridge	Mid terrace	-	-	£13,985	13%	15-20 kWh/m²/year	Part L 2013
Greater Cambridge	Block of flats	-	-	£302,735	5%	15-20 kWh/m²/year	Part L 2013
Greater Cambridge	School	-	-	£208,865	0%	55 kWh/m²/year	Part L 2013
Winchester	Semi-detached	1,535	85	7,905	6%	15 kWh/m²/year	Part L 2021
Winchester	Detached	1,508	68	9,656	5%	15 kWh/m²/year	Part L 2021
West Oxon	Mid-terrace	-	-	-	5%	"Good practice"	Part L 2013
West Oxon	Mid-terrace	-	-	-	7%	"Ultra-low energy"	Part L 2013
West Oxon	Medium rise flats	-	-	-	6%	"Good practice"	Part L 2013
West Oxon	Medium rise flats	-	-	-	6%	"Ultra-low energy"	Part L 2013

West Oxon	Office	-	-	-	6%	"Good practice"	Part L 2013
West Oxon	Office	-	-	-	7%	"Ultra-low energy"	Part L 2013
West Oxon	School	-	-	-	5%	"Ultra-low energy"	Part L 2013
Research based on design teams 're-imagining' two case study projects that were at design stage:							
UKGBC	High-rise office	£3,320	-	-	6%	Intermediate target	Part L 2013
UKGBC	High-rise office	£3,370	-	-	8%	Stretch target 1	Part L 2013
UKGBC	High-rise office	£3,660	-	-	17%	Stretch target 2	Part L 2013
UKGBC	High-rise residential	£2,810	-	-	4%	Intermediate target	Part L 2013
UKGBC	High-rise residential	£2,860	-	-	5%	Stretch target	Part L 2013
Case studies from the Passivhaus Institute *(note, each line represents as-built costs for a different project)*:							
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	Part L 2010
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 research on houses constructed to meet 'ultra-high' energy efficiency standards:							
CCC	Detached	£1,430	£59	£6,900	4%	15 kWh/m^2/year	Part L 2013
CCC	Semi	£1,522	£57	£4,800	4%	15 kWh/m^2/year	Part L 2013
CCC	Low rise flat	£1,389	£29	£2,000	2%	15 kWh/m^2/year	Part L 2013
CCC	High rise flat	£2,390	£26	£1,300	1%	15 kWh/m^2/year	Part L 2013

A.6 GHG emissions modelling methodology and assumptions

A.6.1 Methodology

A.6.1.1 Approach to estimating GHG emissions

At present, there is no standardised methodology for comparing the full GHG impacts of Local Plan spatial strategy options; 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. 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[181]
2. Quantify the GHG impacts of each source of emissions where possible, using bespoke energy and/or emissions benchmarks along with GIS mapping
3. 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

A.6.1.2 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 MSDC'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 LA GHG inventory for Mid Sussex. 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 Mid Sussex 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 Mid Sussex.

The majority of emissions from refrigerant leakage, water supply, waste and wastewater treatment will be included in Mid Sussex's LA GHG inventory, but it is possible that some emissions would be allocated to other Local Authorities (if, for example, waste is sent to landfill elsewhere).

Non-operational GHG emissions are expected to largely fall outside of Mid Sussex, assuming most construction products and materials are manufactured elsewhere. Therefore, these would *not* generally contribute towards Mid Sussex'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

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

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 she uses on-site would be classified within the industrial/commercial sector, not the domestic sector.

A.6.1.3 Limitations

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 policy recommendations.

Other key limitations are listed below.

- The actual quantity, type and phasing of development in Mid Sussex 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. Aside from building performance standards, 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 that 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.

A.6.2 New development assumptions

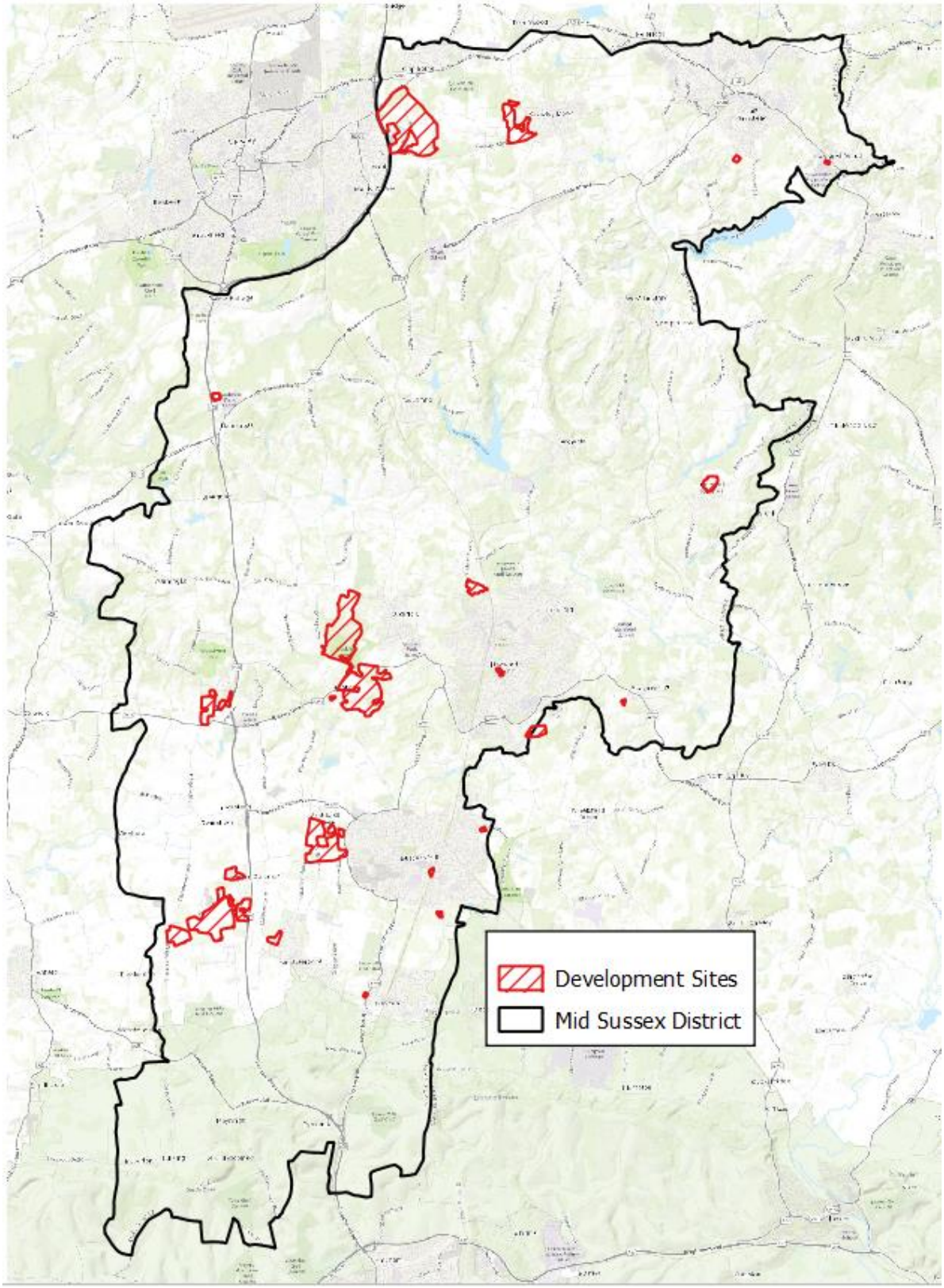
MSDC provided information on the anticipated quantity and type of new development in the draft District Plan, along with GIS data showing the site locations and boundaries, as shown below.

The information MSDC provided about each site included the numbers of new dwellings along with an indication of potential use classes and floorspace (m^2) for non-domestic development. Where the latter was not available, the following assumptions were used:

- Primary school: 2,000 m^2
- Secondary school: 6,500 m^2
- GP surgery: 375 m^2
- Community centre: 850 m^2
- Leisure centre: 6,500 m^2
- Commercial: 1,000 m^2
- Retail: 3,000 m^2

With the exception of the 'Commercial' and 'Retail' figures, which are based on floor areas for other proposed developments in the draft District Plan, these estimates were derived by measuring similar buildings within Mid Sussex using satellite images and cross-referencing recent planning applications.

Figure 32. Map of development sites assessed



A.6.3 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
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
Water supply	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 higher standard proposed by MSDC (85 l/p/d)
Waste and wastewater treatment			0.84	tCO_2e	Annual	Per capita emissions from waste management in Mid Sussex 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.

A.7 Carbon offsetting

A.7.1 Introduction

This section explores opportunities for MSDC to establish a carbon offsetting policy and central offsetting fund, drawing on best practice examples and considering implications for and risks to the Council.

A.7.2 What is a carbon offsetting policy and fund?

Carbon offsetting is the process of compensating for residual carbon emissions from a building by contributing, usually financially, towards measures to reduce emissions elsewhere.

Some LPAs allow carbon offsetting where a carbon target cannot be achieved on site. This involves developers making a payment into a carbon offset fund to pay for carbon reduction projects elsewhere in the LPA area (e.g. funding carbon emissions reductions from existing buildings by installing insulation, upgrading heating systems or solar PV panels).

As a matter of best practice in carbon management, offsetting should be understood a last resort after all direct mitigation options have been exhausted. There is evidence[182,183] that low or medium rise domestic developments can generally achieve net zero regulated emissions without offsetting but that it is more challenging for non-domestic or higher density developments.[184]

To achieve true net zero, eventually all sectors of the economy will need to make deep and expensive cuts, and not just rely on offsetting. 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.[185] Therefore, although offsetting may need to be considered for some types of developments at present, it is important to understand that it is not a long-term solution to the challenge of GHG mitigation.

A.7.3 Analysis of best practice examples

The most well-established carbon offsetting approach through planning is that used by the GLA in London. This has secured over £90 Million for carbon offsetting since October 2016[186]. Other examples include Milton Keynes (which has helped over 8,000 households with energy efficiency measures), Bristol and Southampton.

A.7.4 GLA carbon offsetting approach

The London Plan includes a net zero-carbon target for major development and they have published detailed guidance on carbon offset funds for LPAs (recently updated)[187] including on how to calculate the amount of carbon to be offset. The aim of the net zero-carbon standard is to achieve significant carbon reductions on site and to get as close to zero-carbon as possible. Only then should offsetting be considered i.e. as a *last resort* measure. We concur with this approach and would recommend MSDC

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[182] Bioregional, Etude, Currie & Brown, 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

[183] AECOM, *'Royal Borough of Kensington and Chelsea: Evidence Study on Greening Issues'* (2020). Available at: https://planningconsult.rbkc.gov.uk/gf2.ti/f/1308098/108488197.1/PDF/-/RBKC_evidence_study_on_greening_issues_210720.pdf

[184] Greater London Authority, *'Energy Assessment Guidance'* (2020). Available at: https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_april_2020.pdf

[185] CCC, *'Net Zero Technical Report'* (2019). Available at: https://www.theccc.org.uk/publication/net-zero-technical-report/

[186] GLA, *'Carbon Offset Fund Monitoring Report'* (2020). Available at: https://www.london.gov.uk/sites/default/files/2020_carbon_offset_survey_monitoring_report.pdf

[187] GLA, *'Carbon Offset Funds: Greater London Authority guidance for London's Local Planning Authorities on establishing carbon offset funds'* (2022). Available at: https://www.london.gov.uk/sites/default/files/gla_carbon_offsetting_guidance_2022.pdf

take a similar position as it ensures on-site carbon savings – which are more certain – are locked in before looking to offsetting.

Carbon offsetting involves a cash in-lieu contribution (via Section 106 agreement) to the relevant LPA's carbon offsetting fund. Alternatively, the development can make up the shortfall off-site by funding a carbon reduction project directly, provided the LPA has approved this approach.

The London Plan requires LPAs to:

1. set up a carbon offset fund to collect carbon offset payments from developers to meet any carbon shortfall from new development and ring fence these funds to secure delivery of carbon savings within the relevant LPA
2. set a price for carbon, i.e. price per annual tonne of carbon, that developers pay to make up any shortfall in on-site carbon savings, securing contributions through Section 106 agreements
3. identify a suitable range of projects that can be funded through the carbon offsetting fund
4. put in place suitable monitoring procedures to enable reporting to the GLA.

These steps are expanded on below. Please note that for MSDC an additional early step would be to clearly set out policy and guidance on how developers need to calculate the emissions to be offset and when offsetting is allowed. This is covered in the wider policy recommendations.

Key steps in establishing and operating a fund

1. Setting up the fund including setting the price

The GLA guidance states that LPAs should either establish a dedicated carbon offset fund or administer the funds through their Section 106 processes. In either case the funds should be ring-fenced for the sole purpose of delivering carbon reduction projects.

LPAs are directed to develop and publish a price for offsetting carbon based on either: a nationally recognised carbon pricing mechanism (see below), or the cost of offsetting carbon emissions across the LPA (based on an assessment of feasible carbon offsetting measures, their anticipated carbon savings and costs). The price set should not put an unreasonable burden on development and should be tested through a viability study.

In the latest guidance, the GLA's recommended price for offsetting carbon is £95 per tonne (previous to the new London Plan it was £60 per tonne). Bristol also uses the same carbon offset price. This price was tested as part of the viability assessment of the London Plan 2020 and was informed by a GLA commissioned study undertaken by AECOM188. Many London boroughs use this price, but some have commissioned their own research to set a bespoke price (e.g. Lewisham charges £104 per tonne) and Islington takes a different approach that factors in unregulated emissions as well as regulated emissions.

The GLA indicates that the overall funding contribution should be calculated over 30 years (the assumed lifetime of the development's services). For example, using the GLA's recommended price equates to £95 x 30 years = £2,850 per tonne of carbon to be offset.

2. Securing, collecting and spending payments

Mechanism: The GLA guidance states that LPAs should secure offsetting payments through Section 106 of the Town and Country Planning Act 1990 (as amended). Examples of such wording are included in Appendix A. Section 106 agreements are the appropriate mechanism to use (bearing in mind the

[188] GLA, *'London Carbon Offset Price'* (2017). Available at: https://www.london.gov.uk/sites/default/files/london_carbon_offset_price_-_aecom_.pdf

s.106 tests) as the mechanism is well established. Community Infrastructure Levy is a fixed charge per unit of floorspace and does not account for the varying carbon performance of developments.

MSDC is advised to avoid specifying actual projects to be funded within individual section 106 agreements as this would limit flexibility and could create issues if specified projects could not be progressed as anticipated.

Calculating the payment at the planning determination stage provides early certainty for the LPA about what funding will be available and encourages the developer to assess and consider their carbon impact early in the design process.

Note that if an LPA pushes developers hard to minimise carbon emissions on-site then the size of the offsetting fund will be reduced. Viability considerations may also act to reduce carbon offset funding. For example, Haringey Council in north London have identified that they have a smaller pot of collected funding compared to some other London Boroughs and two of the reasons they state[189] are:

- Officers have challenged developers to go further in reducing their on-site emissions, resulting in higher on-site carbon reductions and lower offset contributions.
- Balancing of s106 contributions against the viability of the proposal in providing other policy requirements such as affordable housing, which may result in contributions being capped.

Timing of collection: The GLA notes that LPAs generally choose to take payment on commencement of construction on site. Some choose to split the payment, with 50 per cent paid on construction commencement and 50 per cent prior to occupation. Taking payment later than commencement of works can increase uncertainty about when funding will be received and is likely to lead to a gap between the development being occupied and offset projects being implemented. LPAs should be aware of the time limits that apply to discharging Section 106 agreements and ensure funds are collected and spent in time.

Spending: The GLA recommends that LPAs pool offset payments for carbon offsetting projects. This will allow LPAs more flexibility in developing and delivering their carbon offsetting project pipeline. More details on identifying relevant projects to fund are provided in the next section.

LPAs can use existing Section 106 process to administer and monitor the use of offset funds. If an LPA determines that additional funds are needed to pay for staff to develop and manage identified offsetting projects, the GLA recommends a maximum of 10 per cent of the fund is allocated to cover this; this should be set out clearly in the agreement. Given MSDC's lack of internal energy expertise/resources, this approach might create an opportunity to either create and fund a new internal energy officer role; or fund external advice on project identification, costing and delivery.

3. Identifying projects to fund

Offsetting projects should deliver tangible carbon savings. The GLA's 2020 offsetting report indicates that projects on LPAs' corporate estates and in schools were the most popular and mainly included energy efficiency improvements and renewable energy installations e.g. solar PV panels.

Typical types of projects funded through carbon offsetting include:

- Energy efficiency retrofitting projects and fuel poverty alleviation projects.
- Renewable energy projects
- Heat decarbonisation projects and district heating.
- Vehicle electrification

In line with the widely used energy hierarchy, the GLA states that reducing energy demand is the first and often most cost-effective approach to decarbonise buildings, which is why they recommend that

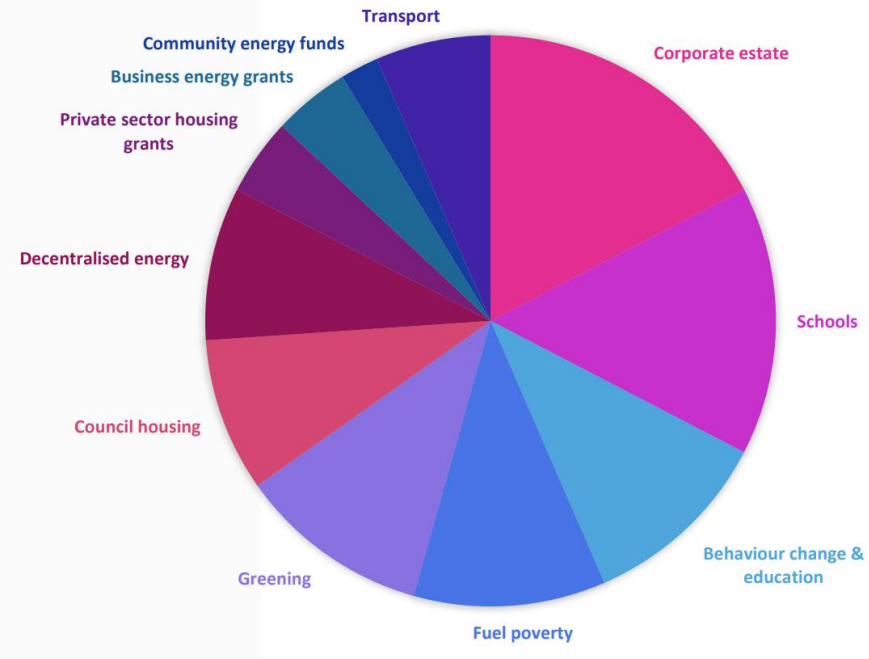
[189] Refer to Appendix A.7.8.2 for more details.

LPAs prioritise energy efficiency measures such as improvements to building fabric and upgrading to more energy efficient services. To maximise the impacts of these types of projects, particularly for more costly measures, LPAs are encouraged to combine offset funds with other sources of funding.

The primary focus for offset funds is to achieve carbon savings but, where possible, projects should maximise co-benefits, i.e. wider environmental, social and economic benefits that align with an LPA's strategic priorities identified in climate change plans/strategies and Local Plans (e.g. reducing energy bills of deprived communities).

The chart below shows the main project types targeted for offset projects in London (as of March 2021).

Figure 33. Eligible projects funded. Source: GLA carbon offset funds report (2021)[190]



Hard versus soft measures

The GLA encourages LPAs to prioritise spending on 'hard' measures, i.e. those that deliver a tangible physical asset with transparent and predictable carbon savings.

However, LPAs can also spend offset fund payments on 'softer' measures such as behaviour change campaigns. LPAs are advised to set stricter information and performance requirements for softer measures. For example, the GLA recommends that LPAs make it a requirement that all behaviour change projects set out an engagement strategy and monitoring plan in advance of receiving funding; and suggest that carbon savings should be adjusted to reflect the uncertainty over what outcomes will actually be delivered.

Clearly there is greater risk associated with the performance of softer measures and MSDC would need to bear this in mind when selecting projects to fund, considering the latest research on specific measures where relevant.

Assessing a project's eligibility

The core purpose of a project funded by carbon offset funds should be to deliver carbon savings. LPAs tend to require that projects be delivered within their administrative area. When selecting offsetting

[190] GLA, *'Carbon Offset Fund Monitoring Report'* (2020). Available at: https://www.london.gov.uk/sites/default/files/2020_carbon_offset_survey_monitoring_report.pdf

projects to fund, LPAs should also consider defining eligibility and marking criteria including in relation to:

- the carbon cost effectiveness of the project (i.e. £ per tonne of carbon saved). There are a range of existing methods/tools for estimating how much carbon different projects will save[191]. LPAs may want to set an upper limited on the cost per tonne of carbon saved.
- whether the project offers additionality i.e. will it result in carbon savings that would not have been delivered without the offset funding? As the GLA admits, this can be challenging! For example, would a domestic insultation project have happened anyway without the offset funding. MSDC would need to decide how they would determine this and how strict they wished to be.
- what co-benefits the project offers
- the deliverability of the project, over what timescales and with what monitoring (a proportionate approach is recommended to establishing monitoring requirements, with larger and more expensive projects required to provide more detailed reporting)

It is important to note that the GLA does NOT require a strict 1:1 ratio (i.e. the cost of the offset measure to save one tonne of carbon compared to the offset price per one tonne of carbon). Such a ratio would, they suggest, only allow simple retrofitting measures to be implemented and would leave more complex and costly measures without funding. Thus, they support a more flexible approach, including setting a carbon cost effectiveness cap (i.e. max price per tonne of carbon) as much as 3-5 times higher than the carbon offset price to give maximum flexibility.

Some LPAs have set up panels to review bids for funding and advise which projects are proposed to receive funding based on defined project criteria. Haringey's project criteria are included as an example in Appendix A.7.8.2.

How to find suitable projects

Most LPAs in London have tended to focus on identifying projects within their own estate, including social housing (presumably using a combination of in-house expertise and external advice).

The GLA reports that setting up an application process for individuals, community groups and businesses to apply for offset funding has worked well in multiple LPAs, making projects more visible whilst reducing the demands on LPAs to source projects. For example, Camden Council set up the Camden Climate Fund which is financed from carbon offset payments. There are three separate grants available for households, businesses and community groups to install renewable energy systems and make energy efficiency improvements. The application process should be made as simple as possible for residents, communities and businesses, with clear assessment criteria.

4. Reporting/transparency

The GLA reports annually on the overall progress of London's carbon offset funds and we would suggest that MSDC do similar to ensure transparency. Following the GLA model, this could be done by providing information on the following:

- Amount of carbon offset fund payments committed
- Amount of carbon offset fund payments collected
- Amount of carbon offset fund payments spent
- The type of projects being funded, associated co-benefits and cost per tCO_2 saved.
- The carbon offset price being used

[191] For example, this report provides values for £/t Carbon for different measures on p.37 with sources: GLA, *'London Carbon Offset Price'* (2017). Available at: https://www.london.gov.uk/sites/default/files/london_carbon_offset_price_-_aecom_.pdf

The specific questions asked in the GLA's annual survey are included in an appendix to their Carbon Offset Funds report[192].

A.7.5 Other examples of carbon offsetting

The **City of Westminster** has created guidance on a carbon offset fund to ensure funding is secured from any new developments which are unable to fully achieve the carbon savings required at the development site. The guidance sets out similar principles to the GLA guidance, however it sets out *essential and desirable criteria* as well as a *list of priority projects*. The priority projects are divided by theme: public sector buildings and assets, commercial buildings, sustainable travel and transport, knowledge and learning, low carbon energy and homes and communities. MSDC could utilise a similar approach as a guide for those that would like to apply for funding.

The **Milton Keynes** Carbon Offset Fund (administered by the National Energy Foundation) was launched by Milton Keynes Council back in 2008. It applies to all residential developments of 11 or more dwellings and non-residential developments with a floor space of 1000 sqm or more. Requirements are set out in a Sustainable Construction SPD[193]. The scheme has helped over 8,000 households in Milton Keynes to receive measures such as free energy efficient light bulbs, and subsidised loft and cavity wall insulation.

Bristol has also set out an approach to carbon offsetting in their Local Plan Review Draft Policies and Development Allocations (2019). The approach is broadly in line with the GLA's, focusing on reducing carbon emissions on site first and then allowing offsetting of residual emissions via a payment (same carbon cost of £95 per tonne of CO2 calculated over 30 years) towards "renewable *energy, low-carbon energy and energy efficiency schemes elsewhere in the Bristol area"* or via agreeing *"acceptable directly linked or near-site provision".*

Southampton City Council has implemented carbon offsetting since 2012. In 2015 the approach was amended to apply only to new developments of over 10 dwellings or 1000 sqm. The Southampton Carbon Offset Fund offsets one year of emissions rather than the lifetime of the development, at a cost of £210/ tCO2.

Greater Manchester is also considering establishing carbon offsetting. A detailed evidence base report was produced for the Greater Manchester Combined Authority in 2020. It proposed setting a carbon price of £113 or £118 per tonne but questions whether a higher price might be needed to achieve Greater Manchester's target of net zero emissions by 2038.

A.7.6 Risks/issues for MSDC

The overarching issue for MSDC in relation to carbon offsetting is MSDC's lack of internal technical expertise/resource to set up and run a carbon offsetting fund, including setting a carbon price, securing payments, selecting/designing suitable projects for funding, delivering projects and monitoring/reporting.

Islington Council has been operating carbon offsetting since 2012 but *they benefit from having an in-house Energy Services Team* who review energy strategies submitted with planning applications (as part of the development management process), identify projects to receive carbon offset funding and prioritise and deliver them. However, some London boroughs have reported that limited staff resource has constrained their ability to spend offset funds. According to the GLA's 2020 survey on carbon offset funds, 75% of collected funds remain unspent.

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[192] GLA, *'Carbon Offset Funds: Greater London Authority guidance for London's Local Planning Authorities on establishing carbon offset funds'* (2022). Available at: https://www.london.gov.uk/sites/default/files/gla_carbon_offsetting_guidance_2022.pdf

[193] Milton Keynes Council, *'Sustainable Construction: Draft Supplementary Planning Document'* (2020). Available at: https://www.milton-keynes.gov.uk/sites/default/files/2022-02/Sustainable%20Construction%20SPD%20Draft%20v4%2020201002.pdf

MSDC currently lacks such in-house expertise so would need to either buy this in (e.g. note example above of Milton Keynes working with the charity, National Energy Foundation) or take a decision to build this expertise in the council. The council could also consider the opportunity to invest in a shared expert resource with other LPAs, with might improve cost efficiency.

As highlighted earlier in the report, MSDC could decide to use some of the funding secured for carbon offsetting to create and fund a new internal energy officer role to manage the fund; and/or fund external advice on project identification, costing and delivery.

A.7.7 Implications for MSDC to establish carbon offsetting

In summary, to establish and implement a carbon offset key steps for MSDC would include:

1. Agreeing how to secure and fund the necessary expertise to establish and run a carbon offset fund (see key issue identified above)
2. Developing a clear planning policy (and supplementary guidance as necessary) setting out when offsetting will be accepted (e.g. as a last resort after on-site measures have been maximised), how (and when) payment will be secured (i.e. via s106) and what types of projects it will be spent on
3. Setting up a carbon offset fund with appropriate governance and ring-fenced funding for carbon reduction projects
4. Setting a price for carbon (simplest approach would be to use nationally recognised approach as per GLA and Bristol)
5. Identifying the types of projects to be funded and setting out clear eligibility and marking criteria to assess potential projects
6. Establishing monitoring and reporting procedures (e.g. annual reporting on spend and delivery) to ensure that funds are being spent effectively and efficiently and that delivery of the projects is achieved

Bibliography – useful carbon offsetting references

London:

- **GLA guidance (July 2022) –** https://www.london.gov.uk/sites/default/files/gla_carbon_offsetting_guidance_2022.pdf
- GLA carbon offset funds report (2021) - https://www.london.gov.uk/what-we-do/environment/carbon-offset-funds-report-2020
- Envision article on rise and fall of offsetting in London - https://www.envisioneco.com/the-rise-and-stall-of-carbon-offsetting-in-london/
- Draft LLDC Getting to Net Zero SPD (May 2022) - https://www.queenelizabetholympicpark.co.uk/-/media/lldc/planning/supplementary-planning-documents/planning-obligations-and-getting-to-net-zero/draft-getting-to-net-zero-spd.ashx?la=en
- Haringey Cabinet report on offsetting spending (2021) - https://www.minutes.haringey.gov.uk/documents/s124580/Cabinet%20Report%20-%20Community%20Carbon%20Fund%20-%20Jun%2021%20v.14_friday.pdf
- Islington report on offsetting spending (2018) - https://democracy.islington.gov.uk/ieIssueDetails.aspx?IId=13217&Opt=3
- Westminster offsetting guidance (downloaded 2020) and guidance on relevant projects - https://www.westminster.gov.uk/planning-building-and-environmental-regulations/neighbourhood-community-infrastructure-fund/funding-carbon-offset-fund
- Southwark Section 106 and CIL SPD (2020; includes carbon offset fund – 'green fund') - https://www.southwark.gov.uk/planning-and-building-control/planning-policy-and-transport-policy/development-plan/supplementary-planning-documents-spd/spd-by-planning-topic?chapter=7

Beyond London:

- Bristol's CCS2 policy: towards zero carbon development includes a section on carbon offsetting (2019) - https://www.bristol.gov.uk/files/documents/2275-local-plan-review-draft-policies-and-development-allocations/file
- Milton Keynes Sustainable Construction SPD (2021) – https://www.milton-keynes.gov.uk/sites/default/files/2022-02/2021%2012%2003%20Sustainable%20Construction%20SPD%20adoption%20version.pdf
- Greater Manchester Combined Authority Carbon and Policy Implementation Study – Part 2 - Carbon Offsetting - https://www.greatermanchester-ca.gov.uk/GMCAFiles/PFE/Supporting%20documents/04%20Sustainable%20and%20Resilient%20Places/04.01.03%20Carbon%20and%20Energy%20Implementation%20Part%202%20-%20Carbon%20Offsetting%202020.pdf

A.7.8 Further examples

A.7.8.1 Examples from LPAs of Section 106 agreement wording for carbon offsetting

Ealing Council

"Carbon Offsetting Contribution" means the sum of £X towards offsetting the annual residual carbon emissions of Y tonnes of the development payable on commencement of the development as set out in the approved Energy Strategy.

Ealing Council have an Additional Carbon Offsetting Contribution which is enforced in the event that the developer does not meet the approved CO2 emissions reduction targets:

"Additional Carbon Offsetting Contribution" means a carbon offsetting contribution to be calculated and be paid by the Owner to the Council towards the Council's Carbon Offset Fund to offset additional residual carbon emissions (in tonnes CO2 per year) in the event that the Development cannot fully meet the Actual Carbon Dioxide Emissions Target on-site as required by the Energy Strategy conditions [ ] & [ ]. The contribution shall be covered by a one off payment calculated at £60 per tonne for each tonnage difference between the overall regulated carbon dioxide savings and the target savings as set out in Energy Planning –Greater London Authority guidance on preparing energy assessments (March 2016) over 30 years.

Waltham Forest Council

Carbon Off-setting Contribution: means the contribution to be paid by the Owner to the Council prior to Occupation of the Development and calculated post construction and prior to Occupation in accordance with the following formula:

CO2 emitted from the development (tonnes) per year minus CO2 target emissions (tonnes) per year x £1800 and to be allocated by the Council (in the event of receipt) to its Carbon Offsetting Fund which is used for carbon reduction projects across the Borough to achieve the Council's overall carbon reduction targets.

Such projects could include but not limited to (i) building energy efficiency retrofit measures; (ii) building integrated renewable energy installations; and (iii) awareness raising or behaviour modification programmes and for the avoidance of doubt such monies can be used to assist in the administration of the Carbon Offsetting Fund or as grant funding or as a repayable loan provided that the aim of such grant/loan is to seek to reduce carbon emissions across the borough.

A.7.8.2 Haringey's project criteria

An extract from Haringey's Cabinet Report is provided below.[194]

"A panel will review the project bids, discuss and advise which projects are proposed to receive funding based on the project criteria and make a recommendation for sign off. The panel will be confirmed annually and is proposed to include five people, including three LBH officers and two community representatives.

"Project criteria - All bids will be scored based on a range of criteria including:

- *Effectiveness of delivering carbon reduction.*
- *Ability to deliver the project within one year of receiving funding.*
- *Value for money and assessment on relevant costs (on-going project maintenance, securing its long-term sustainability legacy).*
- *Contribution to Haringey's statutory equality objectives and benefit to the wider community: promotion of carbon reduction and energy efficiency; engagement, empowerment and reaching the community.*
- *Delivery plan setting out delivery requirements and timescales, risks, stakeholders, and monitoring of outcomes.*
- *Requirement for planning permission or other consents, or whether these have already been obtained.*
- *Delivery of the objectives under the Borough Plan and Haringey Climate Change Action Plan."*

[194] Haringey Council, *'Report for Cabinet, 15 June 2021: Community Carbon Fund'* (2021). Available at: https://www.minutes.haringey.gov.uk/documents/s124580/Cabinet%20Report%20-%20Community%20Carbon%20Fund%20-%20Jun%2021%20v.14_friday.pdf

A.8 Carbon sequestration through woodland creation

MSDC requested a high-level estimate of the extent to which carbon sequestration through woodland creation could help Mid Sussex to achieve net zero by 2050.

This appendix describes the method used and then sets out the findings.

A.8.1 Method

The method used was split into two parts, relating to carbon sequestration from existing woodland and from potential new woodland. For a complete picture we recommended looking at both elements.

A.8.1.1 Existing woodland

To calculate carbon sequestration from existing woodland we identified the National Forest Inventory (NFI) as the most useful dataset to use to understand existing woodland coverage (see map below). This dataset was overlaid with the Mid Sussex District boundary in GIS and the total area of woodland (ha) was calculated. Data on different woodland types and the areas of each (ha) was also extracted.

To convert this data into a high-level estimate of carbon sequestration we applied relevant carbon sequestration rates from the literature.

For any non-woodland habitat, carbon sequestration values were taken from:

R Gregg, J. L. Elias, I Alonso, I.E. Crosher and P Muto and M.D. Morecroft (2021) Carbon storage and sequestration by habitat: a review of the evidence (second edition) Natural England Research Report NERR094. Natural England, York.

For any woodland types, carbon sequestration values were taken from:

Matthews, R.W., Henshall, P.A., Beauchamp, K., Gruffudd, H., Hogan, G.P., Mackie, E.D., Sayce, M. and Morison, J.I.L. (2022) Quantifying the sustainable forestry carbon cycle: Summary Report. Forest Research: Farnham.

A.8.1.2 New woodland

To calculate carbon sequestration from new woodland involves making a high-level estimate of the additional area of land that would be suitable for woodland creation, taking into account key constraints such as biodiversity, heritage, agricultural land value, etc.

We identified the Forestry Commission's "Low Risk Areas For Woodland Creation" as a useful spatial dataset to use for this purpose. This is accessible on FC's online Map Browser. This GIS map layer screens land for environmental sensitivity (e.g. excludes designated nature and heritage sites; deep peaty soils; AONBs; high quality agricultural land[195]). Afforestation proposals on 'low risk land' are considered less likely to have a significant effect on the environment.

Note that the Low Risk Areas exclude the High Weald AONB – a landscape where woodland is one of the key characteristics as identified in the National Character Area profile and the AONB Management Plan. However, the management plan focuses on positive management of existing woodland, pointing to the need for careful assessment of opportunities for woodland expansion. By excluding this woodland creation in this area we ensure our estimate is conservative. Landscape-led analysis would be needed to identify the scale of opportunity within the AONB.

Land in the South Downs National Park is excluded. In practice there will be locations that are suitable (in terms of soil conditions, landscape character etc) for woodland creation in the national park but this would need more detailed investigation. There may be opportunities for MSDC to partner with the South

[195] Agricultural Land Class 1,2 or 3a.

Downs National Park Authority on woodland creation projects. Therefore, as noted above, the estimate presented here can be considered a conservative one.

This dataset was overlaid with the Mid Sussex boundary in GIS and the total area potentially suitable for new woodland (ha) was calculated. Given that more detailed analysis would identify various constraints to tree planting within this area (e.g. the area 'washes over' multiple roads) we recommend reducing the area by 20% for a more conservative theoretical high level estimate.

To convert this data into a high-level estimate of carbon sequestration we applied the carbon sequestration rate for broadleaved woodland from the source highlighted above, based on the assumption that the majority of new planting would fit this category (reflecting the fact that the vast majority of current woodland falls into this category, see below). Using this rate also helps to ensure the estimate is conservative as conifer planting would have a higher sequestration rate.

A.8.2 Findings

A.8.2.1 Existing woodland

Mid Sussex has a high level of tree cover, especially in the High Weald AONB, and lots of ancient woodland.

The existing woodland area in Mid Sussex District was calculated at 8459 ha in total. This was broken down into a range of woodland types from the National Forest Inventory (NFI) dataset, as summarised in Table 12 below and Figure 34 overleaf. The data indicates that the vast majority of the woodland (79%) is categorised as broadleaved (which accords with information from the Mid Sussex Tree Officer).

Table 12. Area data for existing woodland

NFI breakdown	**Area (ha)**
Assumed woodland	52.6
Broadleaved	6,678.7
Conifer	1,154.3
Coppice	3.7
Felled	147.9
Ground prep	15.2
Low density	7.2
Mixed mainly broadleaved	103.6
Mixed mainly conifer	118.3
Shrub	19.4
Young trees	158.2
Total	**8,459.1**

Assumptions applied:

- For 'assumed woodland' we used the rate for broadleaved as a conservative rate.
- For 'coppice' we used a rate (4.7) for 'conservation natural recolonisation'
- For 'low density' we used the same rate as above as a conservative rate.
- For 'young trees' we used the rate for mixed broadleaved (5.7) as a conservative rate.

Relevant carbon sequestration rates were applied to each of these categories of existing woodland from the literature sources highlighted in the method. This allowed a high-level estimate of the total carbon sequestration from existing woodland to be calculated at **48,800 tCO_2e per year**.

Note that this estimate is a little more conservative than the Land Use, Land-Use Change and Forestry (LULUCF) statistics for Mid Sussex from Department for Business, Energy, and Industrial Strategy (BEIS) which indicate that forests account for around 68 $ktCO_2e$ net carbon removals per year.[196]

Table 13. Carbon sequestration from existing woodland

NFI breakdown	Area (ha)	Sequestration rate (tCO_2e/ha/yr)	Total (tCO_2e/yr)
Assumed woodland	52.6	5.7	300
Broadleaved	6,678.7	5.7	38068
Conifer	1,154.3	6.7	7734
Coppice	3.7	4.7	18
Felled	147.9	0	0
Ground prep	15.2	0	0
Low density	7.2	4.7	34
Mixed mainly broadleaved	103.6	5.7	591
Mixed mainly conifer	118.3	9.4	1112
Shrub	19.4	3.7	72
Young trees	158.2	5.7	902
Total	**8,459.1**		**48829**

Note that the area of existing woodland and thus the carbon sequestration provided will be dynamic over time, even discounting woodland creation. For example, some trees will be felled and others will die from diseases (e.g. ash dieback) or other factors (e.g. damage by wind or animals, drought).

A.8.2.2 New woodland

Using GIS analysis of the Forestry Commission's "Low Risk Areas For Woodland Creation" (shown in yellow on Map 1 overleaf) the potential area for creating new woodland in Mid Sussex was calculated at 6,836 ha.

Given that more detailed analysis would identify various constraints to tree planting within this area we recommend reducing the area by 20% for a more conservative estimate i.e. use an area of 5,468 ha.

Applying the carbon sequestration rate for broadleaved woodland to this area gives a high-level estimate for carbon sequestration from new woodland of **31,000 tCO_2e per year.**

A.8.3 Discussion

The above figures represent indicative, high level estimates only. More precise figures for carbon sequestration could be developed based on a more detailed assessment of the sites most suitable and feasible for woodland creation, taking into account competing land uses. This could include a review of

[196] NAEI, *'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

opportunities for woodland creation on land in the South Downs National Park and High Weald AONB, both of which have been excluded here. Some of the council's own landholdings may offer good opportunities e.g. parks, golf courses.

In order to be effective at long-term carbon sequestration, there would be a need to ensure that woodland creation is secured for the long term (e.g. via conservation covenant) and that a suitable management regime was in place.

The forthcoming requirement for Biodiversity Net Gain may offer an opportunity to help fund new woodland creation on selected sites (e.g. on sites where woodland creation would help to strengthen the existing native woodland habitat network).

It is important to note that even if all of the land identified for woodland creation could be converted to woodland, there is a risk of 'carbon leakage' if agricultural activities on that land simply move elsewhere, either within the district or beyond. A holistic assessment of land use change opportunities and impacts needs to consider these displacement impacts as well as impacts on wider benefits provided by the existing land use (e.g. food production, biodiversity value, landscape character).

Figure 34. Existing woodland and low risk area for woodland creation in Mid Sussex District