Greater Cambridge Local Plan Net Zero Carbon Policy Support:

Carbon budget assessment

26 August 2025

Version 2

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Bioregional

Contents

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Introduction & overview

Bioregional is commissioned by Greater Cambridge Shared Planning Service (GCSPS) to provide evidence to inform net zero carbon policymaking, to underpin the emerging Greater Cambridge Local Plan (GCLP). This report is part of that evidence. This report's purpose is to explore, through reasoned analysis, whether the emerging GCLP Policy CC/NZ can be demonstrated necessary in order for this local plan area to remain in line with **Cambridge's net zero aspirational goal[i] of 2030, or the national net zero target date of 2050**. This is part of the policy justification as per the NPPF tests of soundness.

This is relevant to fulfilment of the following expectations laid on the local plan:

- The legal duty to mitigate climate change (Planning & Compulsory Purchase Act 2004)
- The NPPF requirement that this mitigation should entail "radical reductions in [carbon] emissions … in line with the objectives and provisions of the Climate Change Act 2008"
- The expectation that during the pursuit of sustainable development in plan-making, local circumstances should be taken into account (NPPF 2024, paragraph 9).

Draft Policy CC/NZ requires net zero operational emissions in new buildings, using absolute energy metrics, which diverge from the stipulations of the 2023 WMS[1]. This study concludes that there are demonstrable local circumstances to justify divergence from the 2023 WMS, as the approach set out in Policy CC/NZ is necessary for Greater Cambridge local plan area to align to local and national net zero target dates, including the national carbon budgets legislated via the Climate Change Act (thus part of the "objectives and provisions" that the NPPF instructs the local plan to pursue).

To determine whether local circumstances are demonstrated, this study sets a local carbon budget for the specific scope of operational carbon of new build housing in Greater Cambridge (derived from legislated national carbon budgets). This study then models operational emissions in 2025-2045 (the plan period[2]) associated with new homes in two policy scenarios: draft Policy CC/NZ, and Future Homes Standard (FHS) Option 1 (which represents a 2023 WMS-compliant policy approach and is anticipated to pass into Building Regulations in 2025/26).

Where the carbon budget for new build housing's operational emissions is exceeded by a policy scenario, this demonstrates that the policy scenario is not aligned with the net zero targets (and therefore the climate mitigation mandate in law and policy as

above). It is key to understand that all sectors and associated subsectors in Greater Cambridge (as in all local areas across the UK) will need to stay within their reasonable share of the overall area-wide carbon budget, in order to meet that climate mitigation mandate while avoiding a situation in which certain sectors must overcompensate for sectors that produce excessive emissions. The Climate Change Act does not legislate limits on individual sectors, but the national carbon budgets rely on steep falls in all sectors' emissions[ii], to a level that will be challenging for each sector to achieve even without trying to balance any underperformance by other sectors. It is thus effective to pursue indicative sectoral carbon budgets to avoid imbalances and keep the national mitigation target feasible. This is therefore an appropriate and logical test to apply when determining what policies are appropriate for the climate mitigation mandate laid on the local plan.

[1] Written Ministerial Statement 2023 on local energy efficiency standards. See separate report for GCLP "Policy changes since 2020" for a fuller explanation of what that WMS entails.

[2] Although GCLP's 2021 consultation stated a plan period up to 2041, we base our study on housing growth figures from GCSPS in Spring 2025 which refer to 2045 as the final plan year.

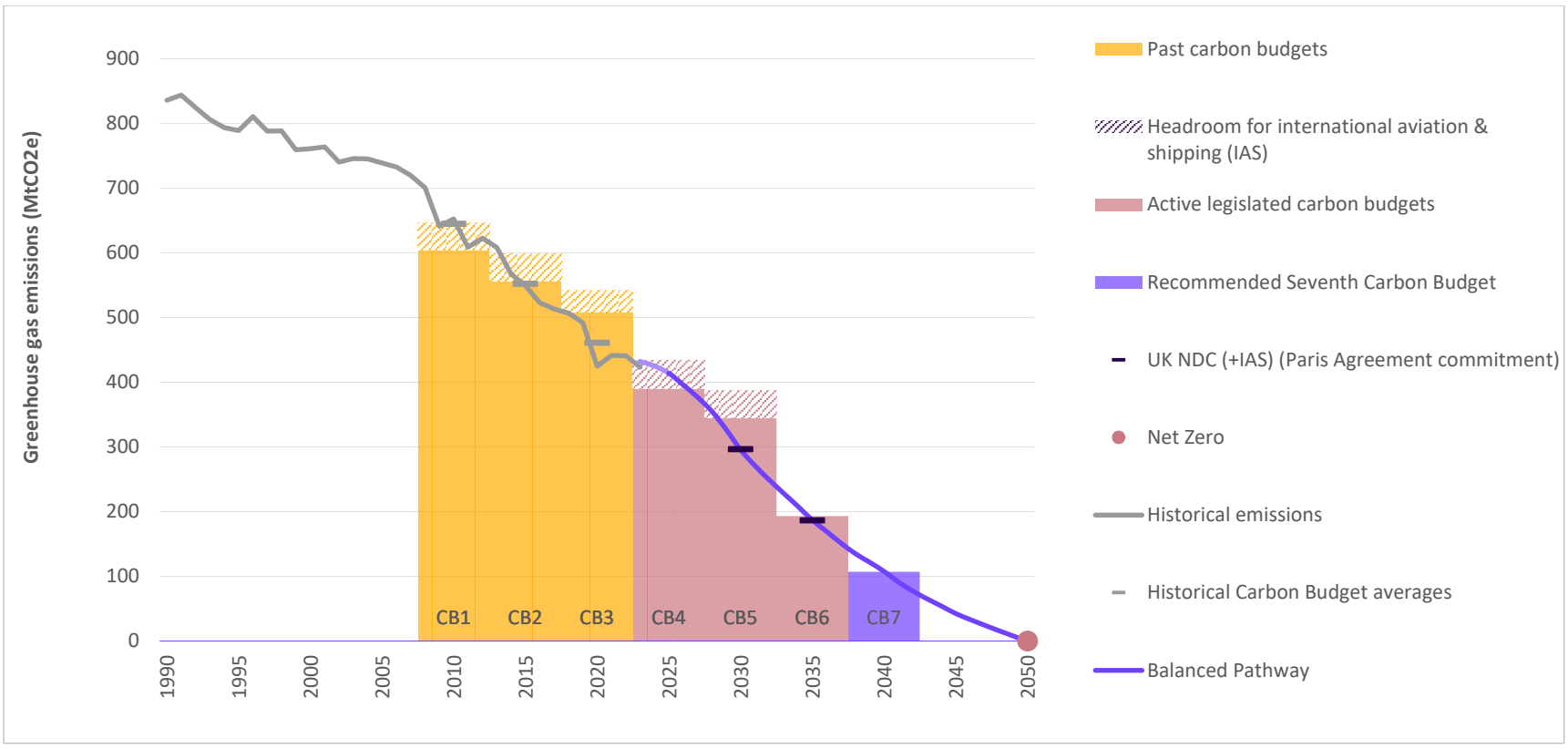


Figure 1: The UK's legislated carbon budgets (past, present and future) within the Climate Change Act. Adapted from: Climate Change Committee, 7th Carbon Budget report, 2025.

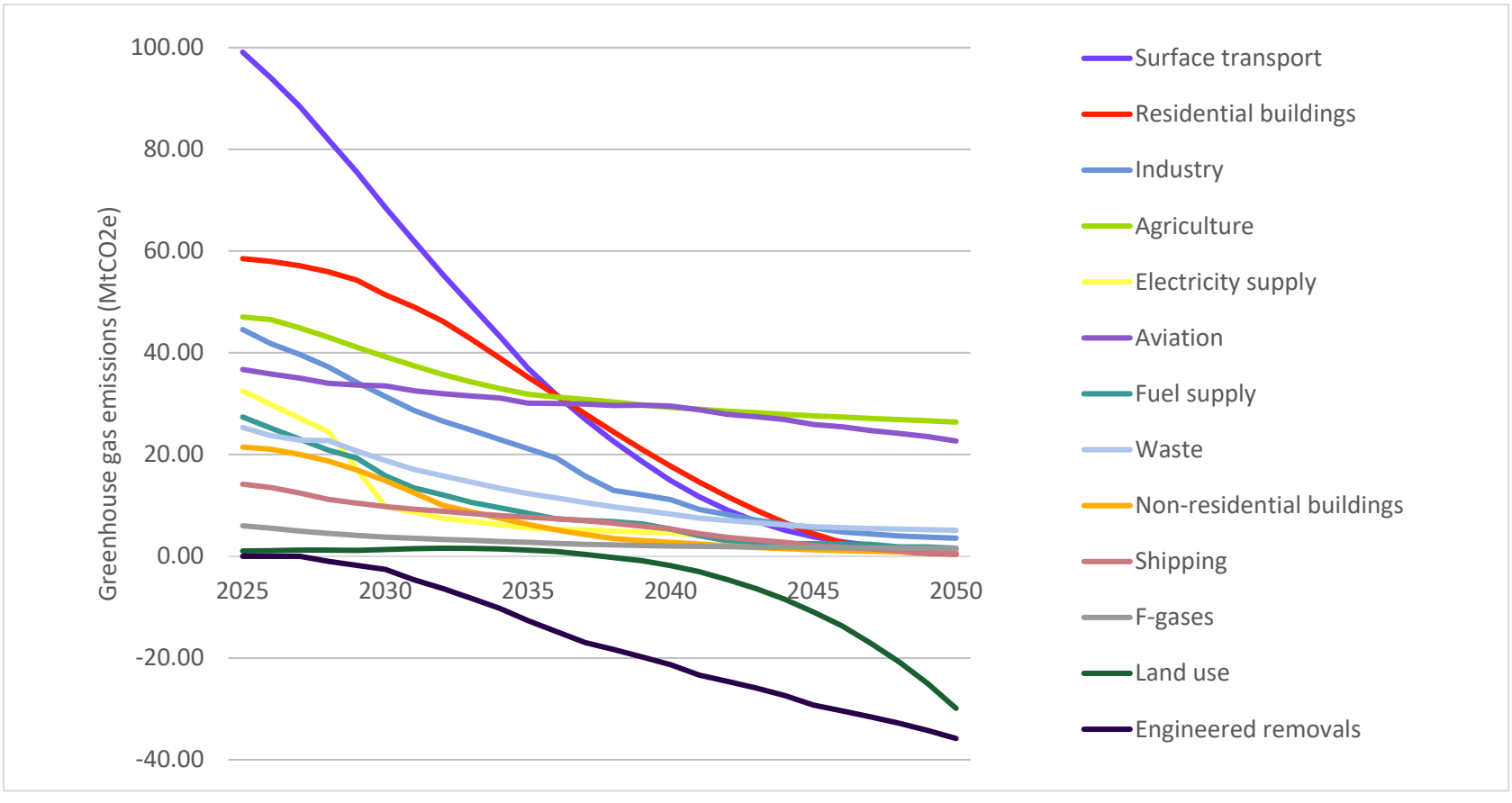


Figure 2: Chart showing how each UK sector's emissions must fall in the 'balanced' pathway to net zero in 2050. Adapted from: Climate Change Committee, 7th Carbon Budget report, 2025.

1. Comparison of policy scenarios

Scenarios tested

The first step of this study was to identify energy use data to reflect the situation with the emerging GCLP policy CC/NZ "true net zero" standard, versus an alternative policy that aligns with the stipulations of the Written Ministerial Statement 2023 (WMS). This energy use would then be converted to carbon emissions, to determine which policy scenario is best aligned to UK's legally binding net zero target of 2050 and a locally envisioned aspiration [i] of reaching net zero 2030.

- To represent the emissions of a fully WMS-compliant policy, the Option 1 specification from the Future Homes Standard 2023 consultation was selected. This is anticipated to most likely reflect the new updated Building Regulations some time in 2025[3], and is a standard that can be expressed as a Target Emissions Rate % reduction, as the WMS seeks. Future Homes Standard Option 1 (FHS1)

[3] This anticipation appears to have been correct, as on 6th June (after the initial analysis had been completed) national government confirmed that the Future Homes Standard will indeed include rooftop solar panels. Of the two FHS options consulted upon by national government in 2023-24, only Option 1 had solar PV.

includes a heat pump and on-site solar PV, but barely any fabric improvement compared to today's building regulations (Part L 2021).

- In contrast, emerging GCLP Policy CC/NZ, which does not wholly align with the requirements of the 2023 WMS because it does not use the Target Emissions Rate metric, is tested as a standard that would more effectively assist fulfilling Greater Cambridge's contribution to the UK's national net zero target of 2050. Policy CC/NZ is aligned with industry best practice absolute energy metrics and represents a 'true net zero operational carbon' policy by requiring that on-site renewable energy generation is equal to total energy consumption.

For the purpose of this study, it is assumed that policy scenarios are delivered entirely on-site and there is no use of offsetting to compensate for a lack of on-site mitigation measures.

	FHS Option 1 (WMS-compliant)	**GCLP draft policy CC/NZ**
Metrics used	Target Emissions Rate (63% reduction on today's TER); calculate with SAP or Home Energy Model[4]	Energy Use Intensity (EUI) and space heating demand, via an accurate method
On-site renewable energy generation (i.e. solar PV panels)	PV equivalent to ~40% of ground floor area	Match total energy consumption on an annual basis
Net zero building?	Once grid is fully decarbonised	Yes, from year 1
Fully aligned with the 2023 WMS?	Yes	No

WMS-compliant approach (FHS1 or FHS2)	**EUI-based approach (draft policy CC/NZ)**
• Target Emissions Rate metric based on % improvement, not absolute values, which makes comparison difficult due to different baselines used • Only considers emissions of regulated energy use (heating, cooling and lighting), not unregulated energy use (plug-in appliances) • SAP is a compliance tool and does not accurately model energy use • Cannot be verified during operation to understand potential performance gap between designed and as-built building • Not fit for development of true net zero buildings, due to modelling inaccuracy • Will not deliver net-zero-carbon buildings (until the energy grid is fully decarbonised via future development of extensive standalone renewable energy)	• Uses absolute energy-based targets that directly limit energy consumption, which are measurable post-construction by the building occupier at the meter • Uses a predictive energy modelling tool (e.g. Passivhaus Planning Package) that is proven to accurately predict energy use, thus will reflect real-life performance of the building • Supported by industry evidence as a best-practice approach to deliver true net zero buildings • Easier to predict impact of design and construction on resident's energy bills • Prioritises renewable energy on-site, rather than assuming that standalone renewable energy schemes will decarbonise the grid

Establishing the energy use in each of the two policy scenarios

To reflect the energy use in each of the two respective policy scenarios, this analysis sampled data generated by predictive energy modelling data from recent published evidence sources that used accurate energy prediction methodologies.

The primary source was two separate energy modelling documents from the evidence base of the emerging South Oxfordshire and Vale of White Horse Local Plan (South & Vale):

- 'Task 3: Feasibility study (2023)' – this study included energy modelling of a proposed policy with the same residential energy targets as emerging GCLP policy CC/NZ. It also included energy modelling for homes built to the indicative Future Homes Standard specification that was consulted upon by Government in 2020-21.
- Local circumstances addendum (October 2024) – this study included updated energy modelling in which the Future Homes Standard was updated to reflect the two indicative two FHS options that Government consulted upon in December 2023.

These figures are used instead of the 2021-21 energy modelling produced for GCLP, because the GCLP work did not cover the latest (2023) Future Homes Standard version. The figures are reasonably applicable to GCLP area; see endnotes[iii]. The South & Vale study tested different

[4] It is nationally proposed that SAP will be replaced by the Home Energy Model (HEM) once the Future Homes Standard is implemented. Consultation indicates that HEM will retain the Target Emissions Rate but also offer other outputs. Whatever the metric used, both FHS options will represent national technical standards.

inputs of building elements for each policy scenario (for detail, see tables in Appendix 1). The modelling then used a highly accurate energy prediction method to identify the total energy use of homes either with the proposed policy, or with the Future Homes Standard.

This predicted energy use for each policy scenario was then combined with projected grid decarbonisation factors during 2025-2030 (period for Cambridge Council's local net zero aspiration) and 2025-2050 (period for national net zero target). The emissions for each policy scenario can then be compared against the available local carbon budget for new build housing, as a share of the national carbon budget (explained later).

For both policy scenarios, the cited energy use data from the South & Vale study came from energy modelling using Passive House Planning Package (PHPP[5]), despite that the FHS1 policy scenario would use SAP for compliance rather than PHPP. This is because if Policy CC/NZ was tested using PHPP, whilst FHS1 was tested using SAP, inconsistency between the modelling tools would result in incomparable figures between the two scenarios. Also, SAP is inaccurate at predicting actual energy use (see separate full net zero evidence report). Instead, the use of PHPP data for both policy scenarios ensures consistent and accurate predictions of energy use (and thus of carbon).

The cited PHPP modelling data includes both regulated and unregulated energy use of each of the home types, giving a detailed picture of home energy use[6]. Our analysis uses the modelled energy use of two archetypes: an apartment block (10 dwelling units) and a semi-detached house. The same archetypes were used for both policy scenarios. (see Appendix 1).

Energy modelling results per individual new-build home

		Apartment (1 unit)		**Semi-detached (1 house)**	
Metric	Unit	**FHS 1**	**CC/NZ**	**FHS 1**	**CC/NZ**
EUI balance after PV (same in each year)	*kWh/yr*	*411*	*0*	*1901*	*0*
Net annual carbon (in first year; 2025)	kg CO_2e/yr	54	0	250	0
Total operational carbon emissions (2025 to net zero end date of 2030)	**kg CO_2e/yr**	**193**	**0**	**892**	**0**
Total operational carbon emissions (2025 to net zero end date of 2050)	**kg CO_2e/yr**	**320**	**0**	**1480**	**0**

The above rows for carbon emissions reflect national figures[iv] for electricity grid carbon intensity, both today's and for future grid decarbonisation in the stated period.

As expected, policy scenario FHS1 results in a considerable degree of emissions.

- Policy CC/NZ is 'true net zero' thus zero emissions, by requiring renewable electricity to equal annual energy demand, which is made feasible by the policy's tight energy efficiency targets. The previous Greater Cambridge modelling in fact found that some houses could generate more than they use, which would mean net negative emissions, but for the sake of not overestimating policy benefits, we here use a zero figure.
- The FHS1 policy option has some solar PV on-site (a PV area equal to 40% of ground floor), but still has residual grid energy use because the FHS does not make the building energy efficient enough that this PV area would be sufficient to equal energy use.
    - The apartment block was assumed to be low-rise (two residential storeys above one retail storey, with PV allocated proportionally to each use). If it had more storeys, the final emissions would be larger (in the FHS-based policy), because the extra storeys would increase energy use but the PV would not increase because the PV amount in the FHS policy is tied to the building footprint area not height. By contrast, with GCLP policy CC/NZ's tight energy efficiency targets, net zero is feasible[v] up to at least 4 storeys using PV that fits easily on its own roof.

Scaling up the per-home results to reflect Greater Cambridge's total new housing delivery

According to the housing projection figures in Greater Cambridge (received from GCSPS in Spring 2025) approximately 24,389 would be subject to this energy policy throughout the plan period of 2025-2045 (including all new allocations in the emerging GCLP, plus existing local plan allocations except those not expected to be delivered according to the April 2025 housing trajectory report[vi] and minus those that

[5] PHPP is a modelling tool used to accurately predict buildings' energy use. PHPP is used in the design of Passivhaus buildings, but can also be used without pursuing Passivhaus certification. It takes a range of input variables to predict heat loss, energy and broader comfort metrics.

[6] In practice, a WMS-compliant policy would not assess unregulated energy as the WMS' stated metric (Target Emissions Rate) only considers the regulated. Yet buildings in a WMS-compliant policy would still *have* unregulated energy & carbon until the grid is zero carbon.

already won permission and thus will not be subject to the proposed new GCLP carbon reduction policy[7]). Those housing growth trajectory figures we received from GCSPS also indicate a further 6,500 homes anticipated to be delivered in years beyond the end of the plan period, through to 2050. As this study needs to cover the total period through to the UK's net zero carbon date of 2050, we also include those. This gives a total of 30,889 new build homes between now and 2050 that are relevant to assess for the current two potential GCLP carbon reduction policy options.

To determine the relative contribution from houses[8] and apartment archetypes to the overall carbon emissions in Greater Cambridge from the two policy scenarios from 2025-2030 and 2025-2050, a % split is set based on the recent track record of new build housing types in Greater Cambridge.

According to the latest EPC data for new dwellings by housing type, the latest 5 years[9] of data show that 64% of new domestic buildings in Greater Cambridge are houses, whilst the remaining 36% are flats/apartments. This % split is assumed to remain constant for the delivery of new homes from now on, in the absence of other data to define a split.

Applying the aforementioned split of 36% flats to 64% houses to the total of 30,889 new build homes in the study period, this is thought to comprise 11,235 flats and 19,654 houses.

The received GCLP trajectory figures are helpfully broken down by year of anticipated delivery (see Figure 3). That trajectory assumes several years' lag before the first completions.

This means that if the carbon budget period is 2025-2030 (to follow the aspirational local aim of net zero 2030, as explained in previously cited endnote), a total of only 1475 homes are built (including financial year 2029/2030). Or if the period is 2025-2050 to align with the national net zero goal, then the total number of new homes built is the previously mentioned figure of 30,889 (of which 24,389 in the plan period).

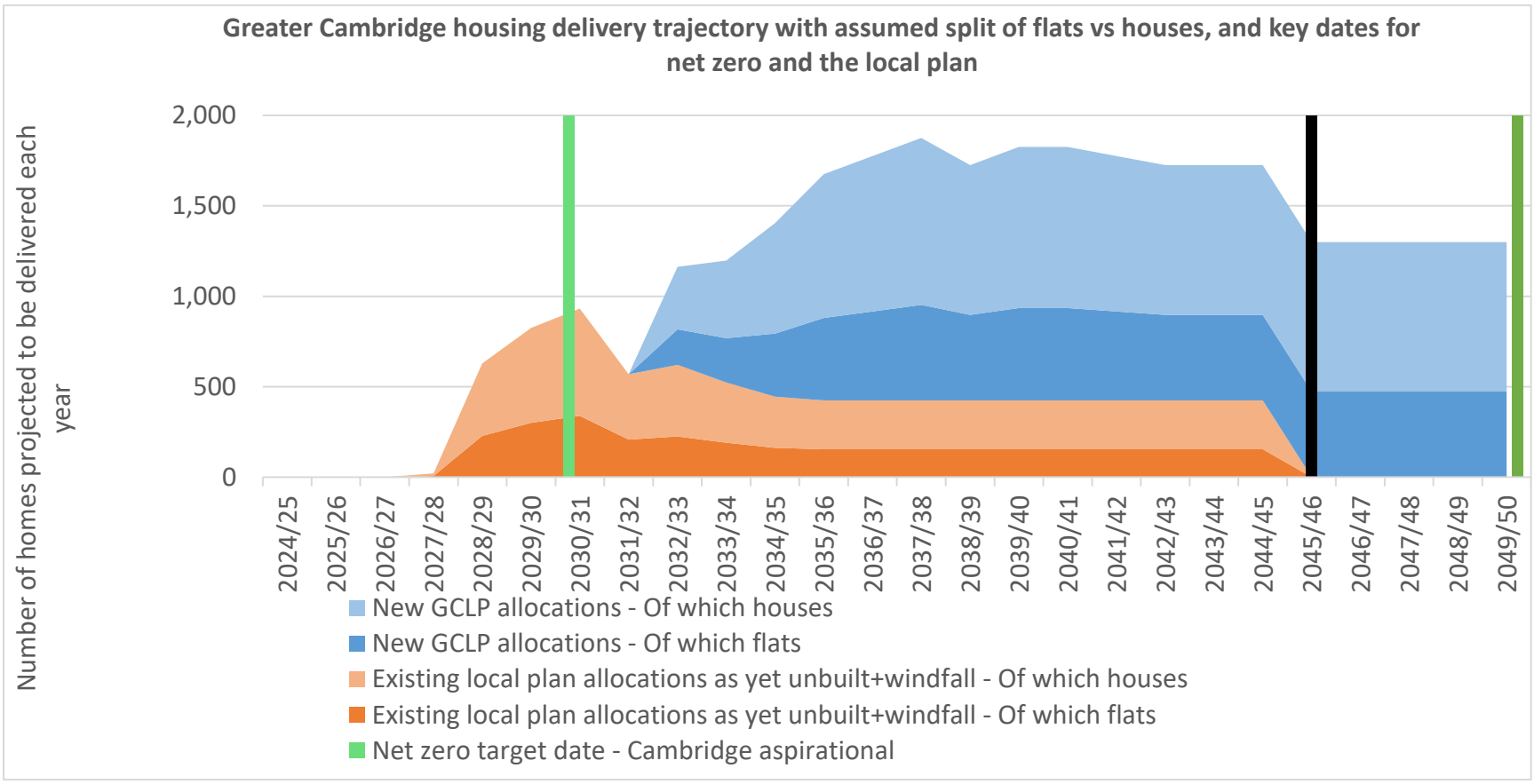


Figure 3: Graph of Greater Cambridge housing trajectory cumulative homes delivered over time, excluding those with existing permissions. Graph also shows key dates marking local and national net zero target dates, and the end of the plan period.

[7] The received GCLP trajectory figures indicate that of the total 49,894 existing local plan allocations and estimated existing local plan windfall, a total of 4,815 have already been built and a further 27,957 unbuilt homes that already have any level of permission (or resolution to grant permission) under a different policy regime and therefore wouldn't be affected by whichever policy regime the emerging GCLP imposes. As we are only interested in what gets *built*, all of the above are excluding the very small numbers of negative allocations or negative completions in the figures (which represent demolitions to make way for the trajectory's targeted *net* number of completions). The GCLP trajectory figures received further show that approximately 1,575 of the existing local plans' unbuilt allocated homes are now not anticipated to come forward by 2050 (for a variety of reasons including developer capability, site suitability, site redevelopment with other uses) and thus do not appear in the delivery trajectory here.

[8] Based on semi-detached houses. The energy modelling source data did not offer other house archetypes other than semi-detached (e.g. terraced or detached) for both policy scenarios. However, for the purpose of this exercise, the semi-detached archetype can be reasonably assumed to be representative of houses as a whole. Semi-detached housing can be considered a 'middle ground' between the various types of house, to represent an average house size and carbon emissions.

[9] At the time of conducting the analysis. This national dataset is released quarterly.

We assume that as each home is delivered, it is occupied and begins consuming energy in that year[10]. Multiplying the cumulative number of new builds in each year (from the GCLP housing trajectory as above) with the annual energy use per home from the aforementioned energy modelling, we can identify the assumed total new build stock's energy use in each year of the carbon budget period (either 2025-2030, or 2025–2050 as previously noted).

All of these homes are assumed to be all-electric (using electric heating not gas – as this is the specification for both the proposed GCLP policy CC/NZ, and for the Future Homes Standard). Therefore, the total energy use in each year (from the cumulative number of homes completed up to that year) is multiplied by the electrical grid carbon factor for that year[11], to get the operational carbon emissions of the cumulative number of new homes in each year of the carbon budget period. The emissions in each year can then be summed to give the total operational carbon emissions from new builds completed within the carbon budget period.

Please note: As previously mentioned, our 'new housing emissions' figure here does not include any of the existing local plan allocated-but-as-yet-unbuilt new homes that already have any degree of permission or resolution to grant permission. This is a significant number of homes (27,957 in the study period through to 2050) and would therefore represent a significant additional amount of energy use. We exclude them from our 'new housing emissions' figure because they would not be subject to the carbon reduction policy (the options for which this current report's purpose is to assess). We do later model the portion of those homes that already have 'full or reserved matters' permission and therefore are thought to be allowed to be built to current or even previous building regulations (Part L 2021 or 2013) as part of the 'existing housing' category. We do not in this study ever attempt to account for the emissions of the existing allocations with existing 'outline' permission because although their carbon emissions would be relevant to the total eventual carbon budget, but there is no efficiently accessible source of data to confirm what version of local policy or building regulations they will each be made to comply with (whether Part L 2013, Part L 2021, the Future Homes Standard, or an existing local plan policy requirement for improvement on Part L). Even if it were clear which building regulations or existing policy standard these 'outline' permitted homes would have to meet, we would still be in need of further accurate energy modelling to show the energy use that these homes would have in order to accurately predict the carbon emissions in a way that would be comparable to the figures we use throughout the rest of this report (modelling as previously cited which only covered for Part L 2021 and the Future Homes Standard, not any local policy nor Part L 2013).

		New Build Flats		**New Build Houses**	
Period	Unit	**FHS 1**	**CC/NZ**	**FHS 1**	**CC/NZ**
Total operational carbon emissions from new housing (2025-aspirational net zero end date of 2030; cumulative total 1,475 homes*)	**tCO_2e**	**16**	**0**	**132**	**0**
Total operational carbon emissions from new housing (2025-net zero end date of 2050; cumulative total 30,889 homes*)	**tCO_2e**	**522**	**0**	**4,228**	**0**

[10] This avoids the potential error of assuming all 30,889 homes use energy from the first year of the plan period.

We recognise that there may also be some cases where newly completed homes may have a period of non-occupation for marketing purposes; however, such incidences should be rare and short if housing demand is as urgent as stated by industry and government, noting that half of new flats in the East region are sold before completion (and this rate has been higher in previous years). Also, in our ultimate comparison of Greater Cambridge's total carbon emissions against carbon budgets, any unoccupied periods in new builds should be more than balanced out by carbon missing in our analysis that would in fact occur from:

- Existing buildings: data on local areas' existing carbon emissions has a 2-year data lag and therefore misses out any new builds completed between the most recent published data year (2023; published 2025) and our carbon budget start date (2025).
- New housing that already has permission but is not yet built (27,957 homes as previously stated in the text).

[11] See Appendix 2.

Period	Unit	Policy: FHS1	Policy: CC/NZ
Total operational carbon emissions from new housing* from 2025 to aspirational net zero end date of 2030, kilotonnes CO_2e (Estimated 1,475 homes delivered in this period)	**ktCO_2e**	**0.148**	**0**
Total operational carbon emissions from new housing* from 2025 to net zero end date of 2050, kilotonnes CO_2e (Estimated 30,889 homes delivered in this period, of which 24,389 within the local plan period to 2045)	**ktCO_2e**	**4.75**	**0**

*New housing figures quoted here only include those that would be subject to the carbon reduction policy i.e. excludes existing permissions and existing local plan allocations that were already delivered before 2024/2025 year in housing trajectory received from GCSP.

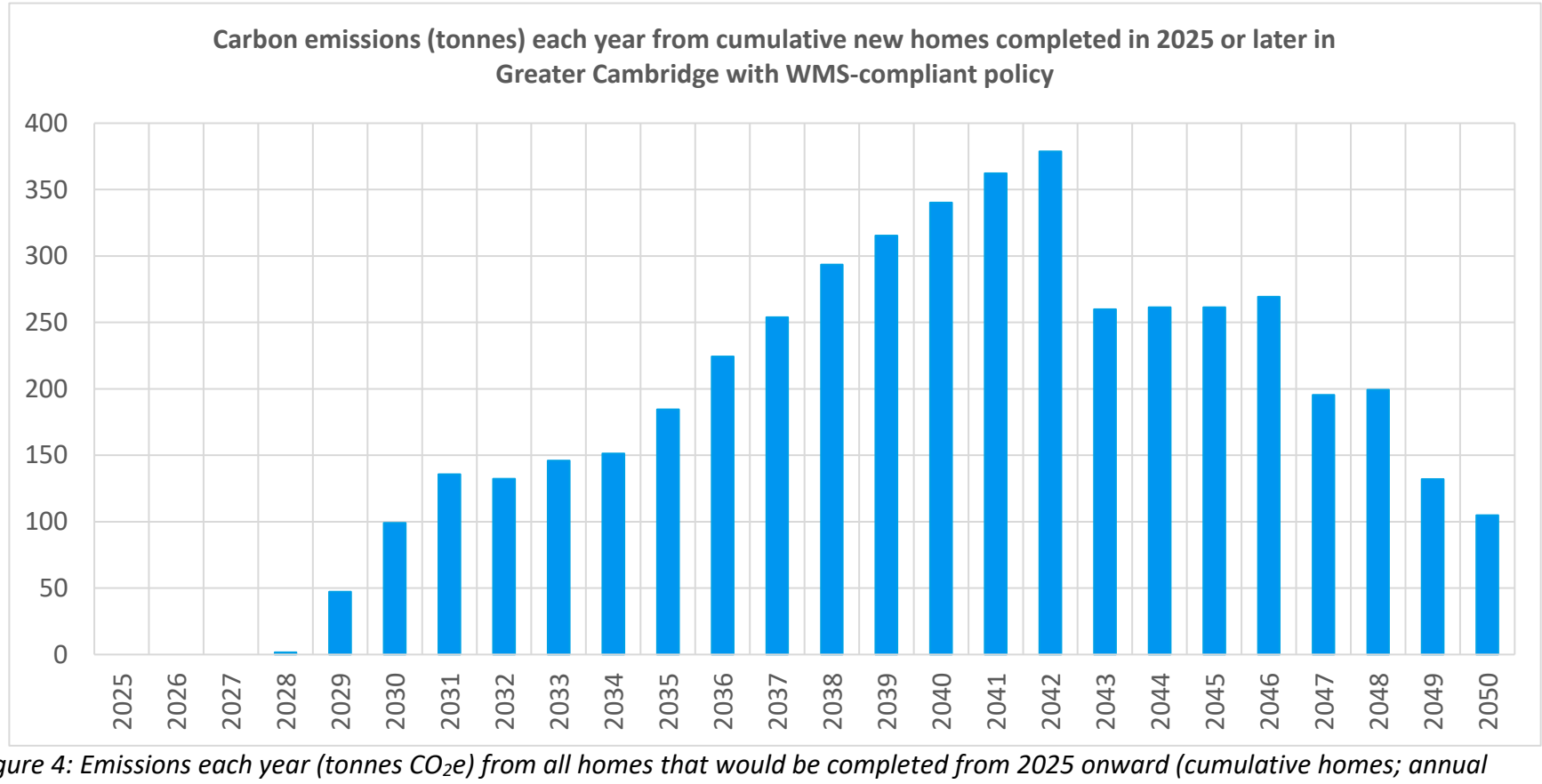


Figure 4: Emissions each year (tonnes CO_2e) from all homes that would be completed from 2025 onward (cumulative homes; annual emissions) with the assumed WMS-compliant policy option (FHS1).

This first graph (Figure 4) illustrates how grid decarbonisation does very significantly reduce emissions of the homes that have been built up to each year, even though the cumulative number of homes built is increasing in each year as previously explained. (As previously noted, these homes are all-electric and thus do not use gas or other fuel).

However, the second graph (Figure 5) shows that because the annual emissions figure is not zero, this **adds up to a significant cumulative amount of emissions in the total national carbon budget period (up to 2050)**. Although the Government has described this sort of building standard as "net zero carbon ready" because they are all-electric and will therefore decarbonise along with the grid, the Government's own electricity grid decarbonisation projections used to perform our analysis (see Appendix 2) do not show the grid getting all the way to zero carbon in this period. Although the electricity grid carbon is projected to get very low in the mid 2030s, the **fact that the homes are not zero carbon from day 1** means that their cumulative emissions do add up over time especially as the required housing delivery steadily increases the total number of homes that exist each year.

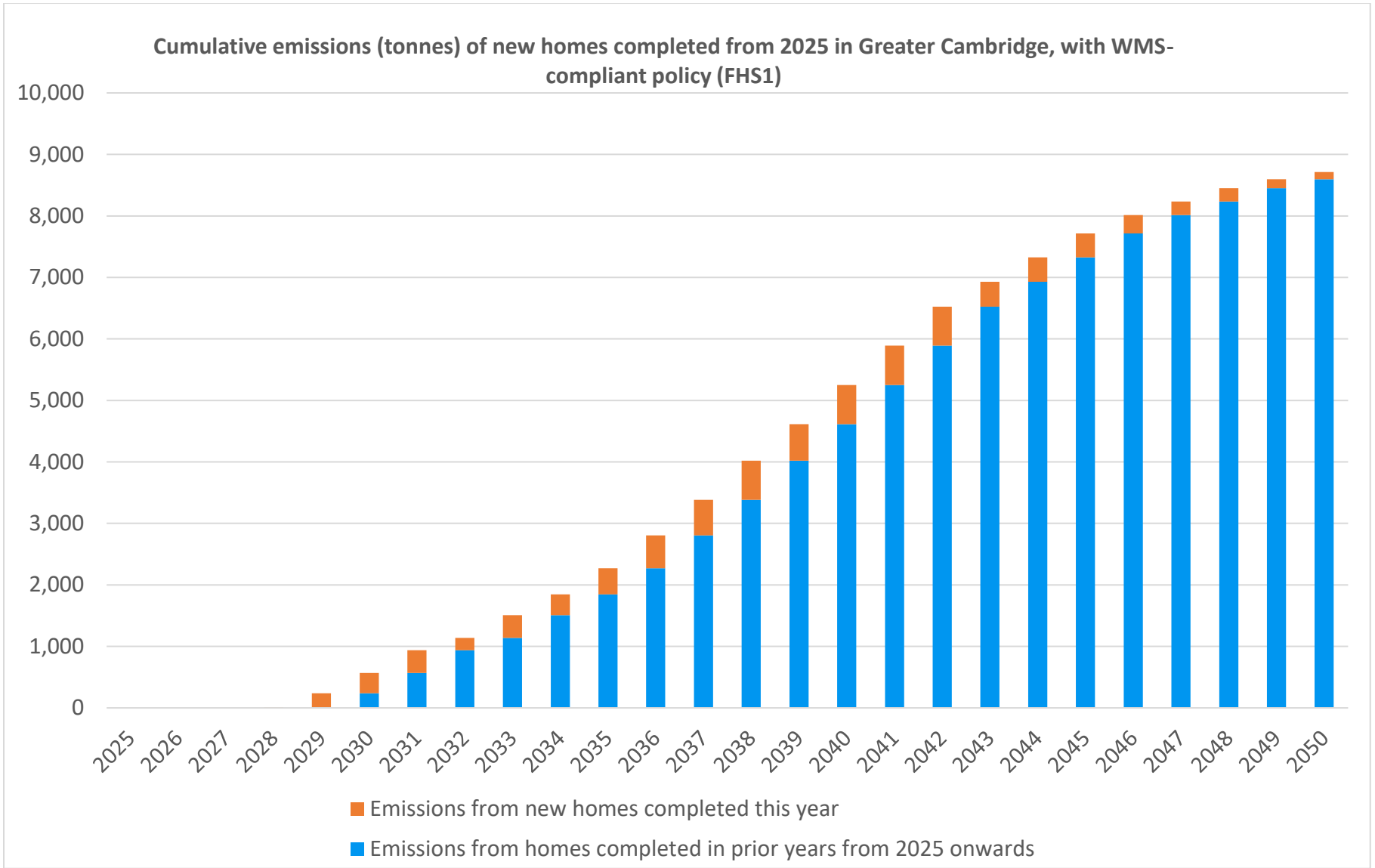


Figure 5: Cumulative emissions to date for each year, from all homes that would be completed from 2025 onward (cumulative homes; annual emissions) with the assumed WMS-compliant policy option (FHS1).

However, if the 'end date' for the study were 2030 to reflect the aforementioned aspiration set by Cambridge to reach net zero, the amount of carbon emitted by the new housing would be quite small (yet not zero) because the Greater Cambridge housing growth trajectory (for new housing that would be subject to these policies) shows the first completions occurring only in 2028 and growing quite slowly for the first few years.

In the following section, these cumulative emissions from new housing are compared against the available carbon budget that can reasonably be assigned for new housing in Greater Cambridge, as a share of national carbon budgets (and eventual net zero 2050 goal) that are set within the Climate Change Act 2008. The same is done with an alternative assumed carbon budget period that would apply if the net zero end date were 2030 as per the local aspiration.

2. Setting a carbon budget for Greater Cambridge

Importance of setting a carbon budget

The exercises in this section are crucial to determine whether Policy CC/NZ is necessary for Greater Cambridge to meet a local net zero target date of 2030 and sufficiently contribute to the national net zero target of 2050. These are considered the only rational tests for whether the plan will sufficiently fulfil its legal duty to mitigate climate change (set by the Planning & Compulsory Purchase Act 2004) to the extent required by the NPPF 2024 i.e. proactively and in line with the Climate Change Act 2008, as that 2008 Act includes the national carbon budgets.

To address the impact of complying with the 2023 WMS' stipulated metric of TER and also to fulfil its expectation to demonstrate local circumstances to justify the policy, the estimated emissions of two policy scenarios (identified in Section 1) can be compared to what carbon budget is available for the operational emissions of new build housing in Greater Cambridge, as set by the carbon budget in this section, to align with local and national net zero targets.

By testing these policy scenarios against the available carbon budget, it can be determined whether Policy CC/NZ is justified and required for the new build housing sector to sufficiently contribute to mitigation of climate change. If it is found that CC/NZ remains in line with the carbon budget, while the WMS-compliant alternative (FHS1) does not, this would demonstrate clear local circumstances to justify divergence from the WMS and retain Policy CC/NZ.

Net zero context for Greater Cambridge

The local councils of both Cambridge and South Cambridgeshire each declared a climate emergency in 2019. Cambridge Council has expressed[vii] a 'vision' for the area to achieve net zero by 2030, while South Cambridgeshire's stated[viii] target for 2030 is to halve their area's emissions from their 2018 baseline, and then net zero by 2050. For the specific scope of our study (net zero operational carbon in new build homes[12]), it therefore is important to consider what policy requirements are aligned achieving net zero by 2030 (see endnote i), as well as with the national carbon budgets on the way to the national goal of net zero by 2050.

The Balanced Pathway to Net Zero (set out in the 6th Carbon Budget, which is one of the series of legally binding national carbon budgets passed into law under the aegis of the Climate Change Act 2008 that also sets the UK's 2050 net zero target), clearly states that all new build housing must be net zero from no later than 2025[ix] and prior analysis[x] had shown that this will need to include that new homes achieve a space heating demand of no more than 15-20 kWh/m^2/yr. GCLP draft Policy CC/NZ would require that all new housing achieves exactly these two requirements, and is therefore aligned with national legislated carbon goals and the local net zero 2030 aspiration.

Although the 2030 net zero local aspiration is not legally binding, it is crucial that local plans fulfil their mandate to contribute to the national legislated Climate Change Act target of 2050 (and legislated carbon budgets). As per the NPPF (cited above), it is the responsibility of local authorities to ensure their plan proactively plays its fair role in this. In local areas that have the physical ability and the viability margin to carry the cost uplift of higher build standards, this would logically mean maximising policy ambitions to balance out for less progressive policies in other areas of the UK that may not be able to meet optimal standards due to local constraints on viability, supply chain or type of development that can be physically accommodated. Testing policies against the national legislated carbon budgets and net zero goal will determine whether the policy is sufficient to proactively mitigate climate change.

Carbon budget methodology

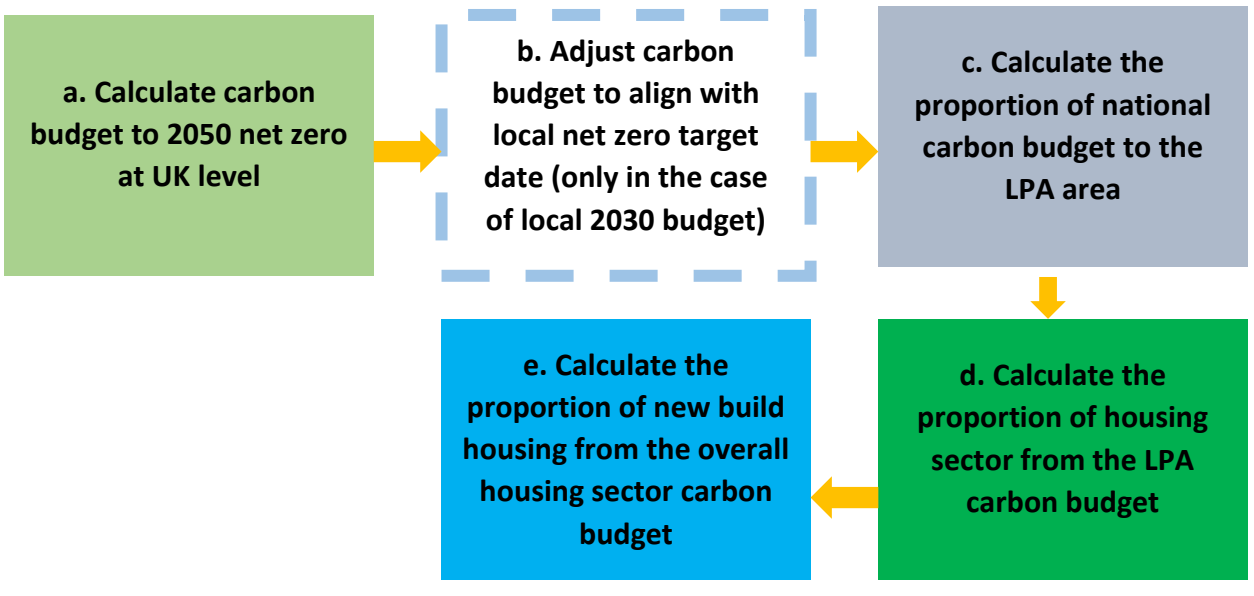
The first step in determining whether each policy scenario (GCLP policy CC/NZ or a WMS-compliant policy) would make new build homes compatible with local or national carbon goals is to rationally establish a carbon budget for new build homes in Greater Cambridge.

Two carbon budgets will be established: one reflecting the local 2030 net zero goal; the other reflecting the national net zero 2050 goal. The policy scenarios will be compared against each.

These local carbon budgets themselves do not assume any level of plan policy ambition. Rather, they represent the maximum allowable emissions to align with either the local 2030 net zero aspiration, or the local share of legislated national carbon budgets to net zero 2050.

As the WMS23 has a specific scope that does not include embodied carbon, existing buildings nor non-residential buildings, we here derive local carbon budgets that represent only the maximum allowable emissions from to energy use of *new build housing* in Greater Cambridge.

[12] The 2023 WMS only applies to energy efficiency standards in new build housing (asking that this be expressed in terms of TER, which is operational carbon from regulated energy only) and does not apply to policies on embodied carbon, on-site renewable energy, existing buildings or non-residential buildings. Operational carbon is any carbon emitted during the occupancy of a building. Energy efficiency is using less energy to achieve the desired result (in this case, the desired result is homes that function for their occupants including remaining a comfortable temperature year-round).



a. Calculating remaining carbon budget to 2050 net zero at UK level

Our first step is to determine the remaining carbon budget through to the end date of net zero by 2050 at a national level. We here take the carbon budget values from Climate Change Committee reports (that devise national carbon budgets and identify the 'Balanced Pathway to Net Zero'[xi],[xii]). Those values are as follows, in megatonnes of emissions:

Period	Budget source	Carbon budget ($MtCO_2e$)	Average/yr ($MtCO_2e$/yr)
2025–2027	4th Carbon Budget (legally binding; 2023 to 2027 total = 1,950$MtCO_2e$). Our study period covers only the last 3 years of that period (2025+2026+2027). 3/5 of 1,950 = **1,170**	1,170	390
2028–2032	5th Carbon Budget (legally binding)	1,725	345
2033–2037	6th Carbon Budget (legally binding)	965	193
2038–2042	CCC's 7th Budget recommendation (2025)	535	107
2043–2050	Not officially budgeted; CCC Balanced Pathway shown in most recent carbon budget charts & data download [xii] implies annual emissions fall from ~65 $MtCO_2e$ to ~-1 $MtCO_2e$. Estimate[13] total of all years in this period: **256.2** $MtCO_2e$.	256.2	32
Total		**4,651.2**	

Please note that the actual budget for the 2043-2050 period has not been defined by the CCC and won't be until the 8th Carbon Budget report in a few years. The 256.2 figure assumed here for 2043-2050 is indicatively derived from the Balanced Pathway trajectory (see Appendix 3).

The estimated overall carbon budget value (between 2025 to the UK's end date of net zero in 2050) is therefore **4,651.2 $MtCO_2e$**.

b. Aligning budget to timescale of the local net zero aspired date (2030)

This stage is not relevant for the national 2050 carbon budget value, only the local aspirational 'vision' of reaching net zero by 2030 as previously cited.

The carbon budget for an aspired end date of net zero 2030 starts with applying a linear trajectory from the current year's national carbon budget amount (390 $MtCO_2e$/yr in 2025) to 0 $MtCO_2e$/yr in 2030. This trajectory is shown in the table below. At this point in the process, national emissions values are still being used as the starting point to establish the trajectory, before portioning-off the local share of that trajectory value later in this methodology.

[13] See Appendix 3.

Emissions at national and global scale will not reach absolute 0, due to residual emissions from unabated sectors which will be balanced by carbon removals (thus 'net' zero). However, in the national Balanced Pathway, residential buildings are not one of the sectors expected to still have significant residual emissions by the time the net zero goal is reached (see Figure 2 previously provided). As we are working towards deriving a carbon budget specific to new build housing, it is here assumed that a final absolute emissions value of 0 is achieved in this sector, as the built environment is expected to achieve net zero with little or no use of carbon offsetting/removals in the national Balanced Pathway.

Year	Annual emissions ($MtCO_2e$)	% reduction vs 2025
2025	390	0% (baseline)
2026	312	−20%
2027	234	−40%
2028	156	−60%
2029	78	−80%
2030	0	−100%
Total to local let zero 2030 goal	**1,170 $MtCO_2e$**	

As shown above, if we start with the current legislated carbon budget's annual emissions value for the current year (which is the first year in our study), and proceed on a linear pathway to reach net zero in 2030 as per the aforementioned local aspiration, this would mean the national-scale carbon budget would be 1,170 $MtCO_2e$.

The next steps in our methodology explain how the local area's share of those national carbon budgets (whether 4651.2$MtCO_2e$ to 2050, or 1170 $MtCO_2e$ to 2030) can be logically derived.

c. Deriving Greater Cambridge's share of the total national carbon budget

This next step takes the national carbon budget value and tailors it to an equivalent reduced value for Greater Cambridge. A reasonable principle is to assume that each local area's respective share of current national emissions will continue into the future[14].

Therefore it is necessary to identify what % Greater Cambridge's current emissions contribute to current national emissions, using the DESNZ UK Local Authority GHG Emissions dataset (2025 release whose latest emissions values are for year 2023).

For Greater Cambridge, this calculation is 1,780.5 $ktCO_2e$ (Greater Cambridge annual emissions total) / 356,094.1 $ktCO_2e$ (UK annual emissions total) = **0.50%.**

0.50% is therefore applied to the previous carbon budget value stage, to derive the specific carbon budget for Greater Cambridge. This results in the following local carbon budget:

- Carbon budget to net zero 2030 local goal: **5.85 $MtCO_2e$** (0.50% of 1,170 $MtCO_2e$)
- Carbon budget to net zero 2050 national goal: **23.26 $MtCO_2e$** (0.50% of 4651.2 $MtCO_2e$)

d. Deriving the housing sector's share of the total local carbon budgets

This step apportions the Greater Cambridge housing sector a share of the aforementioned total Greater Cambridge carbon budget. As per the previous stage, here the housing sector is apportioned a share that reflects the housing sector's existing share of existing total Greater Cambridge emissions, based on DESNZ UK Local Authority GHG Emissions dataset as previously cited.

To determine the contribution from the housing sector in Greater Cambridge, an average of emissions from the housing (domestic) sector over the last 10 years is taken, which is representative of the housing sector's contribution to Greater Cambridge's total emissions over a recent period.

In Greater Cambridge, the average annual housing emissions in the last 10 years of available data (2014-2023) were 422.2 $ktCO_2e$, whilst the average annual total emissions were 1995.9 $ktCO_2e$. Thus the housing sector contributes 21.2% to Greater Cambridge's total emissions.

This 21.2% value is therefore applied to the local carbon budget value from the previous step.

[14] This is a principle used by other local carbon budget expert analysis such as that of the Tyndall Centre, termed 'grandfathering'. It more fairly apportions emissions than alternative ways such as by population or financial indicators, because grandfathering automatically takes account of the sectors that make up the economy of each local area. For example, a location with a heavy dependence on employment in manufacturing would struggle to transition to low-carbon as rapidly as a service-based economy, while maintaining employment. Grandfathering automatically factors-in the current economic base of each area by reflecting the existing emissions profile of the area.

- 5.85 $MtCO_2e$ total local carbon budget vale with net zero *2030* local goal
    - times 21.2% = local carbon budget for housing to *2030* is **1,237 $ktCO_2e$**.
- 23.26 $MtCO_2e$ total local share of national carbon budget value to net zero *2050*
    - times 21.2% = local carbon budget for housing to *2050* is **4,919 $ktCO_2e$**.

e. Deriving new builds' share of the overall housing sector carbon budget

The previous step separated the housing sector from the overall local carbon budget value. The final step to set the local and national carbon budget values for the operational carbon of new build housing is to separate new build housing emissions from existing housing.

Firstly, the expected emissions from existing homes and new-build homes throughout the two possible carbon budget periods (2025-2030 or 2025-2050) are calculated.

The % split between the expected emissions of existing homes and new-build homes from 2025 to the net zero target date will provide a % split that will be applied to the previous stage's housing sector total carbon budget value. By applying this % split, the value apportioned to new build homes (based on the expected emissions from new homes) forms the final carbon budget value against which to assess local plan policy scenarios.

Existing housing

To calculate the expected emissions from existing homes within the carbon budget periods, data from the latest year value for gas and electricity data is used, which is available at local authority area level (published in national DESNZ datasets on local authority area energy use).

Those national figures were last published in December 2024 and reflect the 2023 data year. In Greater Cambridge, those nationally published figures on energy consumption show that:

- For gas: The existing annual domestic gas consumption (across all existing homes in Greater Cambridge) is 1161.4GWh (1,161,432,031kWh). This translates to 11,684.3kWh per existing domestic gas meter, (99.4 thousand domestic gas meters).
- For electricity consumption, this figure is 452.6GWh (452,557,187kWh). This translates to 3258.1kWh per domestic electricity meter (across 128,271 domestic electricity meters[15]).

For all years in the carbon budget assessment period (2025-2050 or 2025-2030), a future projected decrease in per-household electricity and gas use (reflecting average year-on-year change in the past 10 years of DESNZ data) is applied in combination with data about the estimated number of existing homes and the estimated number of new homes in the Greater Cambridge housing trajectory that already have full planning permission and thus won't be subject to the new GCLP policy (thus becoming part of the "existing homes" carbon burden, as distinct from our "new homes" which we define as those that would be subject to the new GCLP policy). See Appendix 4 for details of the data source and calculations to estimate number of 'existing' homes (current and future) and resulting gas and electricity use from those homes.

Those resulting total annual kWh figures for electricity and for gas are multiplied by the respective amount of carbon per kWh, using UK Government endorsed carbon factors for electricity (Table 1; Grid average, consumption, domestic; projected through to 2050 including grid decarbonisation) and gas (Fuels tab; natural gas; gross CV; not subject to significant change over time as there is no such future national decarbonisation trajectory for gas as there is for electricity).

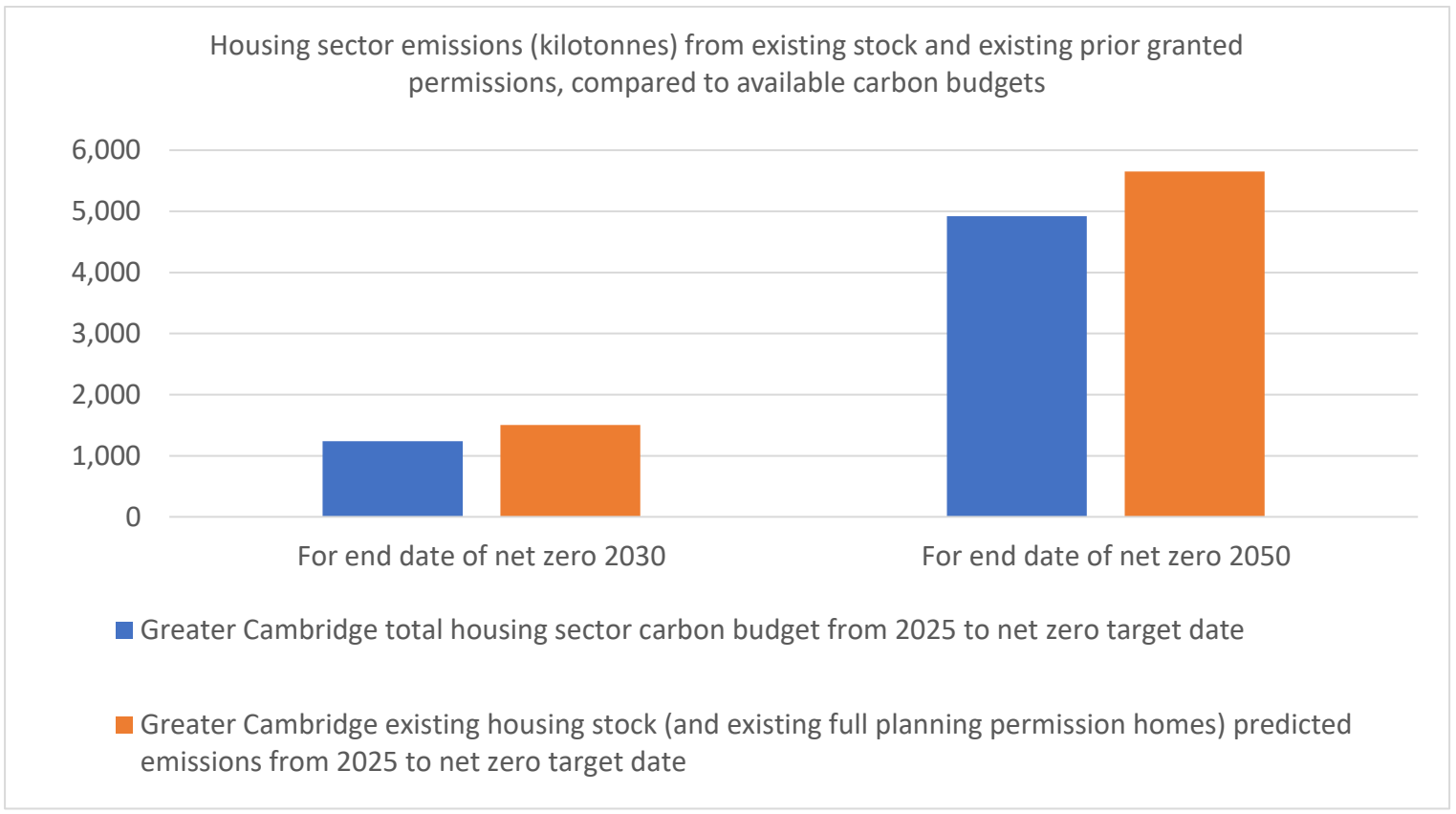
The following cumulative emissions for Greater Cambridge's existing homes (including existing stock and imminently-built additional homes that won't be subject to the GCLP policy due to prior full planning permission) are:

- Within local carbon budget period (2025-2030): 1,505.81 $ktCO_2e$)
- Within national carbon budget period (2025-2050): 5,652.18 $ktCO_2e$)

Crucially, this reveals that the predicted **emissions from existing housing[16] already exceed the available Greater Cambridge housing sector carbon budget** previously identified, by 15-22%:

[15] These DESNZ energy consumption figures also provide an estimated "per household" electricity figure, but that is based on ONS household number projections that were last updated in 2020 on the basis of 2018 household counts. Those ONS projections show a number of households for Greater Cambridge that is 14-17% lower than other data sources e.g. the Valuation Office Agency (national office that administers council tax, updated annually) and the Cambridgeshire Insight tool that both GCLP Councils use to understand their communities. Therefore we do not use the DESNZ 'per household' figure, but rather we take the DESNZ 2023 'number of domestic electricity meters' figure as a proxy for homes (128,271) which is very close to the figure stated in GCLP Councils' respective "State of the City / State of the District" reports relating to the 2023 data year, which in turn were drawn from the Cambridgeshire Insight tool mentioned above, which in turn is stated to draw on the VOA.

[16] As previously explained – this includes the pre-existing housing stock of 128,271 homes, plus the delivery of homes that already have full planning permission and are due to be delivered incrementally according to the Greater Cambridge housing trajectory figures received from GCSPS. That trajectory predicts delivery of 8376 of these 'prior full permission' homes by 2030, and the remainder all by the end of 2035. Our carbon emissions figures here only include those relevant to the respective carbon budget, whether to 2030 or 2050, and take into account when each batch of homes is stated to be delivered in that housing trajectory data (thus when they begin consuming energy and thus causing associated carbon emissions).



Taken at face value, this would imply that there is no room in the carbon budget for any new homes. However, these figures only include quite conservative improvements in energy use of existing homes, representing incremental year-on-year per-home usage reductions reflecting the past 10 year trajectory; see Appendix 4 for details). If there were a much greater step change in the energy use or carbon intensity of the fuels used in those "existing" homes, e.g. energy efficiency retrofit or switching from gas to electric heating, then these "existing" homes' carbon emissions would be lower. In fact the achievement of the UK's legislated carbon budgets does depend on dramatically accelerated rollout of deep energy retrofit and heat pumps to replace gas boilers, as described in the 6th and 7th Carbon Budgets published by the Committee on Climate Change previously cited.

Therefore, the next step in our methodology allocates a share of carbon budget to *new* homes by dividing the available housing sector carbon budget between existing and new homes in proportion to the emissions that would be predicted in the absence of those improvements – effectively assuming that they together *will* fit within the housing sector carbon budget. This has the effect of assuming that both the pre-2025 and post-2025 homes will undergo some degree of future improvement, especially in pre-2025 existing housing to make room in the budget for the emissions of new homes.

New build housing

To determine the cumulative expected emissions of all new build homes, FHS Option 1 specification (as explored in the previous section) is assumed as the standard that new homes will be built to as a business-as-usual-scenario. It is also assumed that the emissions from a semi-detached house are reflective of an average new build home in Greater Cambridge over the carbon budget periods. As previously described, based on the GCLP housing trajectory delivery rate in each year from 2025, the following cumulative emissions for all *new build* homes (that do not already have prior permission) in Greater Cambridge are calculated as:

- Within carbon budget period to local net zero target date (2025-2030): 0.148 $ktCO_2e$
- Within carbon budget to national net zero target date (2025-2050): 4.75 $ktCO_2e$

Balance between existing and new build homes

Adding together the aforementioned *existing homes cumulative emissions* over the respective carbon budget period to that of new homes, this gives a total of:

- Within carbon budget period to locally aspired net zero target date (2025-2030):
  - 1,505.8 $ktCO_2e$ (existing homes) + 0.148 $ktCO_2e$ (new homes) = 1,505.96 $ktCO_2e$
- Within carbon budget to national net zero target date (2025-2050):
  - 5,652.18 $ktCO_2e$ (existing homes) + 4.75 $ktCO_2e$ (new homes) = 5,656.93 $ktCO_2e$

Based on the cumulative emission calculations for new build and existing homes for both carbon budget periods, the % contribution from **new build** housing (excluding existing permissions as previously explained) to overall expected housing sector emissions are:

- Local carbon budget period (2025-2030): 0.148 / 1,505.96 = 0.01%
- National carbon budget period (2025-2050): 4.75 / 5,656.93 = 0.08%

As previously mentioned, the assumption is made that room must be made in the carbon budget to allow for the new housing growth (i.e. that existing housing in Greater Cambridge will not be allowed to exceed the available local housing sector carbon budget and therefore will undergo some sort of carbon performance improvement in future years). We allocate that room for new housing based on new homes' % of actual predicted emissions, as above.

Applying this % contribution to the previously identified housing sector carbon budget values therefore results in final carbon budgets for new housing as follows:

- **Within carbon budget period to local net zero target date (2025-2030):**
  - 1237.3 $ktCO_2e$ (total Greater Cambridge housing sector) x 0.01% = **0.12 $ktCO_2e$**
- **Within carbon budget to national net zero target date (2025-2050):**
  - 4919.1 $ktCO_2e$ (total Greater Cambridge housing sector) x 0.08% = **4.13 $ktCO_2e$**.

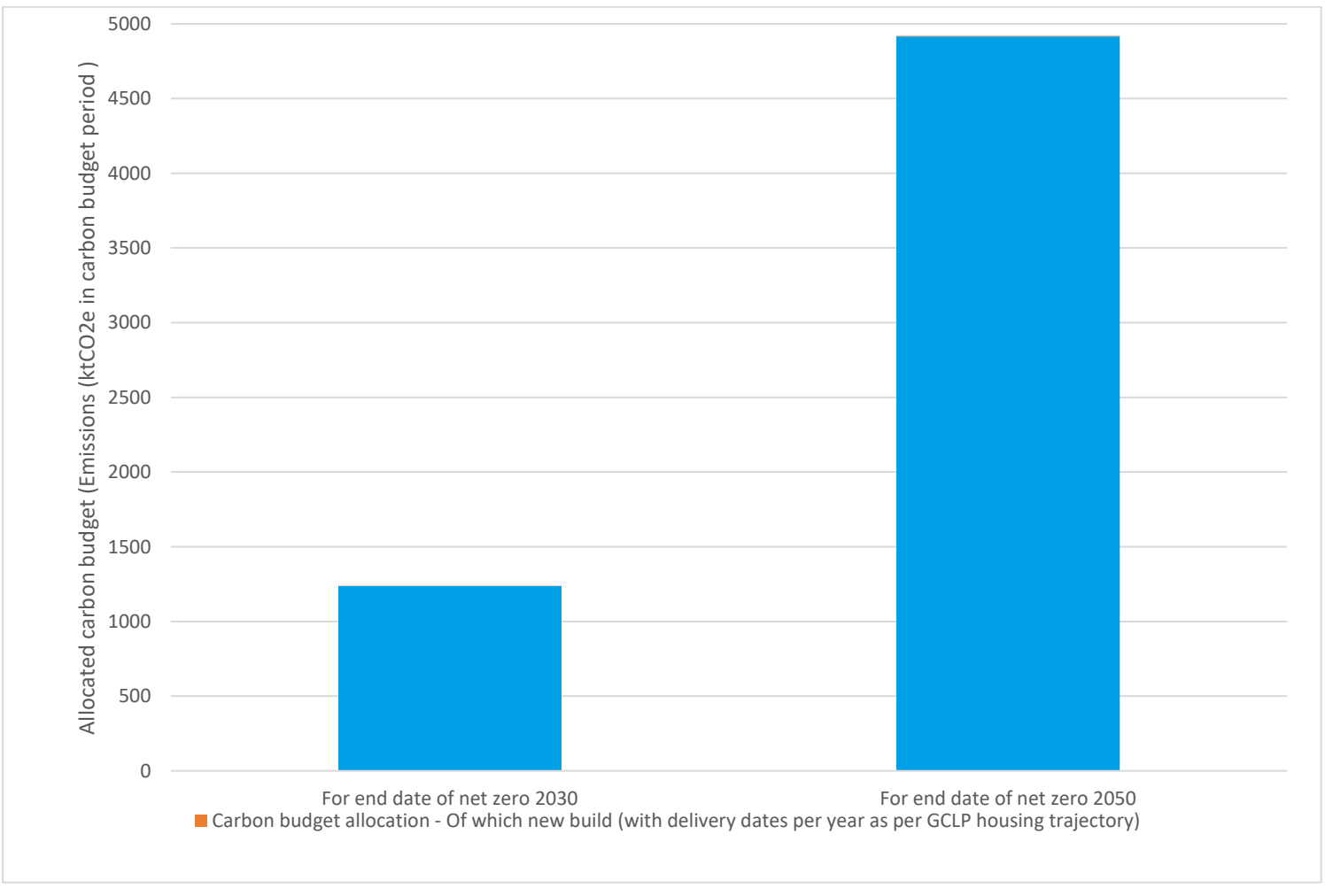


Figure 6: Available carbon budget for housing sector operational emissions from 2025 to either 2030 or 2050, derived from national carbon budgets as previously described.

3. Conclusion to determine alignment with net zero targets

The aim of this conclusion is to determine which of the two policy approaches, GCLP draft Local Plan Policy CC/NZ or a WMS-compliant FHS policy, will keep new homes within the remaining carbon budget for new build housing in Greater Cambridge:

- The figures for the 2050 end date are crucial to the question of whether each policy scenario will ensure that housing development in Greater Cambridge will "contribute to the mitigation of climate change" as per local plan's legal duty, to the extent of being consistent with the national policy instruction to do so "proactively … in line with the Climate Change Act" and "support the transition to net zero by 2050".
- The figures for the local ambition of net zero by 2030 provide a further illustration of local circumstances that further justify policy going beyond Building Regulations.
- In both scenarios, **the modelled WMS2023-compliant policy scenario** (which is similar to a 'no policy' scenario as it aligns with the Future Homes Standard) **exceeds the available local new build carbon budget** as a share of national carbon budgets.

Carbon budget period	Available carbon budget	FHS1 (WMS 2023 compliant policy)	Policy CC/NZ (Emerging GCLP 'true net zero' policy)
Total operational carbon emissions from new housing (2025-2030) ($ktCO_2e$)	**0.12**	**0.148**	**0**
Total operational carbon emissions from new housing (2025-2050) ($ktCO_2e$)	**4.13**	**4.75**	**0**

As previously noted, GCLP emerging Policy CC/NZ has zero total carbon emissions from new housing, as the policy would represent true zero carbon development and therefore is aligned to both carbon budget scenarios. The policy achieves this by ensuring that a home is extremely energy efficient to the point that its *total* annual energy use is equalled by annual on-site renewable electricity generation. Key elements of this policy are energy efficiency metrics that cover the home's *total* energy use (not just the regulated energy use[17]) and that are demonstrated using accurate energy use prediction methods (PHPP, CIBSE TM54 or similar[18]). These key elements for success are precisely what diverges from the Written Ministerial Statement 2023, previously outlined.

[17] This is in contrast to the TER metric stipulated by the Written Ministerial Statement 2023 previously noted. The TER metric by definition can only account for regulated energy uses, which make up only approximately 25-75% of a building's total energy use,.
[18] Again, this is in contrast to the WMS' preferred metric of TER calculated using Building Regulations SAP methodology, which is highly inaccurate in predicting actual energy performance (see separate full evidence report for the extent of SAP's inaccuracy).

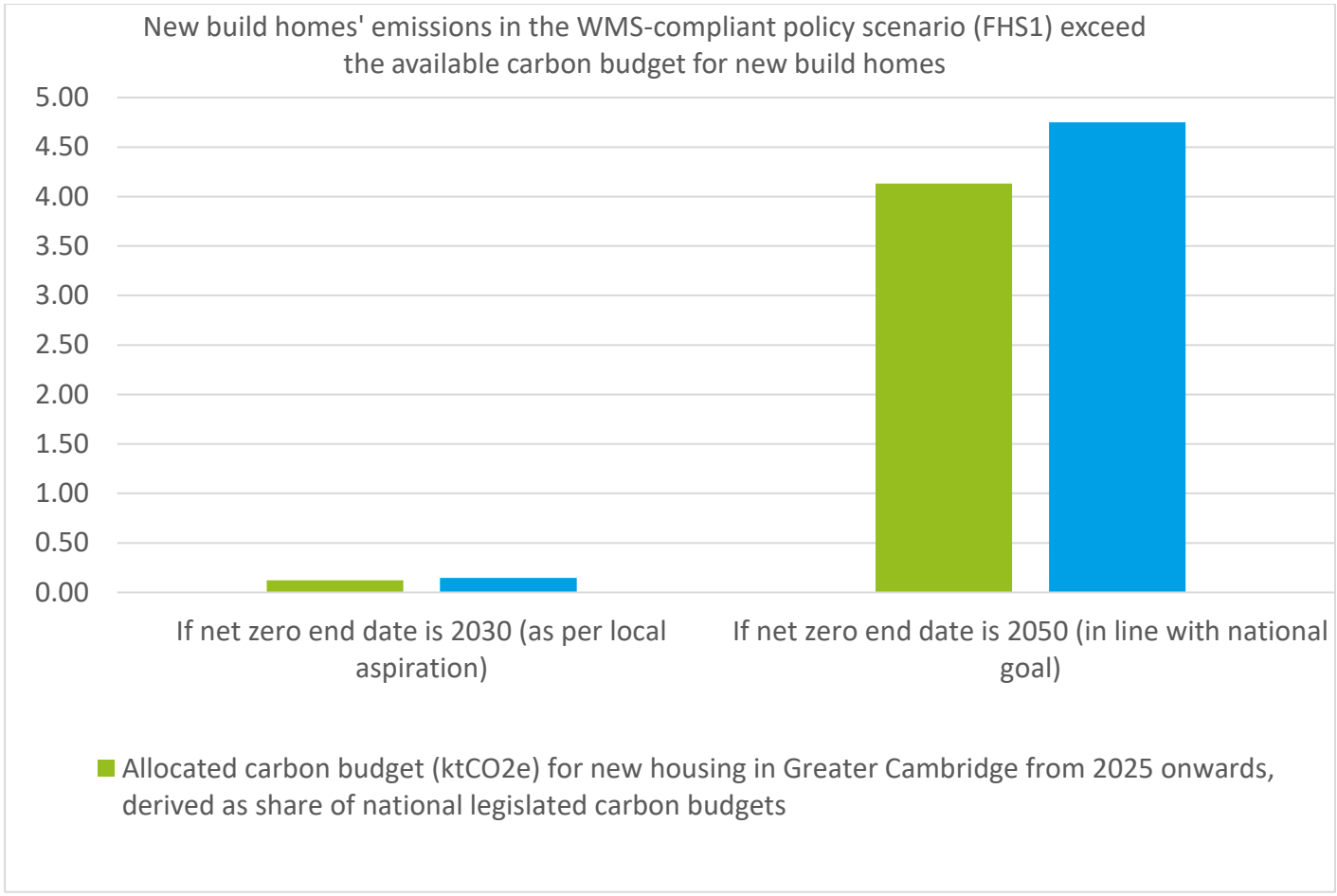


Figure 7: Chart showing the available carbon budget for new housing operational emissions in Greater Cambridge (derived as share of national carbon budgets as previously described), compared to actual predicted emissions of new homes with a WMS-compliant policy (FHS1 policy scenario previously described).

This WMS-compliant policy (FHS1) is therefore not an appropriate policy approach to fulfil the local plan mandate to proactively mitigate climate change in line with the Climate Change Act. The proposed GCLP policy CC/NZ, including its divergence from the WMS2023, is therefore justified in light of the climate change mitigation mandate in law and policy.

Discussion

Clearly, this study has not attempted to test every possible formulation of 2023 WMS-compliant policy scenario. It may be possible to design a WMS-compliant policy that could make a somewhat greater carbon saving than assumed here. However, the WMS stipulates the use of a metric (TER, calculated by SAP methodology) that by definition does not cover the total energy use of a home and does not accurately reflect homes' actual energy performance.

Therefore any WMS-compliant policy cannot ensure that homes' energy use is kept low enough that it can be met with on-site renewable energy in actual operation and therefore achieve the actual net zero carbon homes that are necessary for the achievement of national carbon budgets - at least without needing to specify excessive amounts of onsite solar PV provision to counteract SAP's dramatic underestimation of energy use, which could make housing delivery unviable and might not be compatible with electricity grid constraints in some areas. By contrast, Greater Cambridge's draft policy CC/NZ (true net zero carbon) would keep energy use so low that only small amounts of solar panels on site are needed to match the home's annual energy use, therefore not bringing excessive construction costs and minimising the burden that these new homes will place on the electrical grid.

Additionally, we reiterate that **the carbon budget assumed 'available' to new homes in this study depends on significant reductions in the emissions of existing homes, beyond what will be delivered by electricity grid decarbonisation.** It is important to focus on the fact that the expected emissions from existing homes significantly exceed the overall housing (existing and new build) carbon budget values in Greater Cambridge, even with grid decarbonisation.

- The necessary further carbon reductions in existing homes will need to be delivered by significant rollout of energy efficiency improvements and electric heating (ideally heat pumps) to replace existing homes' gas boilers, faster than ever seen to date.
- The delivery of this necessary change in existing housing is in fact a very uncertain prospect, with the recent national progress reports showing that the rollout of insulation and clean heating to existing buildings is far behind where it needs to be for the achievement of nationally legislated carbon targets under the Climate Change Act.
- **If that rollout of improvements to existing housing in Greater Cambridge remains too slow**, there will be no available carbon budget for new homes within the housing sector carbon budget, and in fact that housing sector carbon budget will be exceeded even just by the emissions of existing homes[19], as follows:
  - If carbon budget is to 2030: Total housing local carbon budget of 1,505.96 $ktCO_2e$, which would be exceeded by 268 $ktCO_2e$ just by existing housing stock emissions

[19] As before, where we say "existing homes" this refers to the 128,271 homes existent in 2023 plus the further homes that the housing trajectory figures (received from GCSPS) show already have full permission to be built and therefore wouldn't be subject the emerging GCLP policy.

- If carbon budget is to 2050: Total housing local carbon budget of 5,656.93 $ktCO_2e$ will be exceeded by 733 $ktCO_2e$.

To reiterate: As these housing sector carbon budgets are derived directly from the legislated national carbon budgets via a logical series of steps as described in sections 2.a – 2.e, this is untenable. While changes to existing buildings cannot be ensured by the local plan (which only exerts power where permission is needed, and cannot initiate change to existing buildings), it is the responsibility of the local plan to proactively take the mitigation actions that are within its power to reduce the likelihood of these carbon budgets being breached.

Given that Greater Cambridge's existing housing emissions likely to exceed the available carbon budget for the entire Greater Cambridge housing sector, it is essential that new homes do not further add to the burden of remaining within the budget. It is arguable that a carbon budget of zero should be apportioned to new homes, since the existing housing subsector is already expected to need more than the whole housing sector local carbon budget.

Local plan policy must therefore require robust targets and metrics that truly result in zero carbon development, as GCLP existing draft Policy CC/NZ would do. By contrast, that would not be achievable under a 2023 WMS-compliant policy, such as one reflecting the FHS, because the Target Emissions Rate in the Standard Assessment Procedure, (the metric stipulated by the WMS) does not cover unregulated energy which can account for 20-75% of new builds' operational carbon emissions . The modelling found that Future Homes Standard Option 1[20] results in emissions from new build housing amounting to a 15-22% exceedance of the available carbon budget for new housing, whilst GCLP's draft Policy CC/NZ means new build housing would have zero emissions and thus would not exceed that budget.

It is therefore explicitly apparent that new build housing must be subject to stringent policy that genuinely achieves zero carbon development. Expressing a policy in the way that the WMS2023 stipulates – i.e. as a percentage reduction on the TER metric calculated using SAP methodology – would make the policy subject to the inadequacies and inaccuracies associated with Building Regulations metrics and modelling tools (see separate previous evidence reports for GCLP). This clearly cannot be risked in light of the carbon budget analysis presented here. This study has clearly shown that the modelled WMS-compliant policy (FHS1) is not an appropriate policy for Greater Cambridge's local net zero target nor the UK's legally binding target. Even if some carbon budget were made available to the new build housing subsector, it is only a true net zero policy such as Policy CC/NZ that should be considered appropriate as a proactive mitigation step in line with the net zero targets. Therefore, this study has clearly shown that local circumstances exist to justify a departure from national policy, i.e. the 2023 WMS, as Greater Cambridge would exceed its remaining carbon budget for new build housing if a policy aligned to the 2023 WMS was implemented, whereas draft GCLP Policy CC/NZ would help to remain within wider carbon budget efforts across all sectors.

[20] It is also important to note that Future Homes Standard Option 1 was the more stringent of the two most recent FHS options consulted upon by government (2023); the actual FHS that eventually forms the new Building Regulations Part L could even have worse performance.

Appendix 1
Building specifications assumed in each of the two policy scenarios

These building specifications are taken from the aforementioned primary source of energy data (South & Vale emerging joint local plan evidence base, as previously cited).

These were provided here illustratively because the emerging South Oxfordshire & Vale of White Horse emerging policy on 'net zero carbon homes' has the same energy efficiency targets as those of Greater Cambridge emerging local plan policy CC/NZ. As an area relatively central to the UK and not coastal, Greater Cambridge's climate is likely to be sufficiently similar to that of South & Vale and thus it is unlikely to make any significant difference in the specification that would be needed to achieve these identical energy targets.

These inputs represent different specifications set for different policy scenarios, which are the key factors that influence space heating demand, energy consumption and carbon emissions of buildings. FHS1 inputs are the exact specifications set out in the FHS 2023 consultation document (see also South & Vale local circumstances addendum which provided the accurately modelled energy use results of this specification), whilst the 'true net zero' inputs were set as part of Task 3 of the South & Vale local plan evidence feasibility exercise, which identified exactly what specifications would be needed to achieve the selected energy performance targets in the policy for homes.

Envelope performance

Building element	FHS Option 1	GCLP draft Policy CC/NZ	
		Apartment	Semi-detached
Roof U-value (W/(m^2.K))	0.11	0.10	0.11
External wall U-value (W/(m^2.K))	0.18	0.10	0.15
Floor U-value (W/(m^2.K))	0.13	0.10	0.11
Door U-value (W/(m^2.K))	1.00	1.00	0.80
Glazing U-value (W/(m^2.K))	1.20	0.80	0.80
Air permeability (m3/(h.m2) @ 50Pa)	4	0.60	0.60

Building services

	FHS Option 1	GCLP draft Policy CC/NZ
Wastewater heat recovery	Yes	Yes
Heat source	Air source heat pump	
Ventilation	Decentralised mechanical vent (dMEV)	Mechanical ventilation with heat recovery (MVHR)
Renewable energy	Apartment block: 38 kWp Semi-detached: 4 kWp	Apartment block: 47 kWp Semi-detached: 3 kWp

Appendix 2
Electricity carbon factor change over time

Electricity carbon factors were taken from national projections that are released within the UK Government DESNZ dataset "Green Book Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal"[xiii], data tables 1-19. The relevant table is "Table 1: Electricity emissions factors to 2100, kgCO_2e/kWh".

This is the national estimate of the amount of greenhouse gas emissions that will occur due to each kilowatt-hour of grid electricity use. It reduces over time because national government assumes that more and more renewable energy generation will be connected to the grid to replace fossil fuels, and some extent of hydrogen use and/or carbon capture being deployed at any remaining power stations that run on fossil gas or other combustible fuels.

The Green Book dataset is updated periodically. This analysis was conducted in Spring-Summer 2025, at which time the most recent version was released in November 2023.

The Green Book provides the Table 1 data in 2 forms:

- "Long run marginal" and
- "Grid average".

These two forms are further differentiated into:

- generation-based factors
- consumption-based factors, which are further differentiated by:
    - residential,
    - industrial,
    - commercial/public sector.

The guidance within that Green Book data table download confirms that "Analysts should use consumption-based emissions factors for measuring GHG emissions per unit of final energy demand. These emissions factors include transmission and distribution losses, including significant losses due to power station inefficiency. Long-run marginal emissions factors should be used for measuring small changes in consumption or generation [whereas by contrast,] Grid average emissions factors are used for footprinting."

Therefore, as we are looking to find the carbon footprint of new housing in Greater Cambridge, for our exercise the **appropriate category is 'grid average, consumption-based, domestic'**.

We therefore here reproduce the relevant part of Green Book Table 1 that we used.

Year	$kgCO_2e$ per kWh Electricity use (Grid average, consumption-based, domestic)
2025	0.131
2026	0.098
2027	0.073
2028	0.063
2029	0.054
2030	0.049
2031	0.042
2032	0.033
2033	0.026
2034	0.021
2035	0.020
2036	0.020
2037	0.018
2038	0.018
2039	0.017
2040	0.016
2041	0.015
2042	0.015
2043	0.009
2044	0.008
2045	0.008
2046	0.008
2047	0.005
2048	0.005
2049	0.003
2050	0.003

Table 1: Relevant grid electricity carbon factors extracted from national Green Book dataset.

Appendix 3
Forecasting an estimated carbon budget amount for years beyond the legislated and CCC-recommended budgets to date

The ultimate carbon budget for Greater Cambridge needed to be derived from national carbon budgets. National carbon budgets are devised by the Climate Change Committee CCC) before being passed into law by parliament under the aegis of the Climate Change Act.

So far national carbon budgets have only been legislated up to year 2037 (the Sixth Carbon Budget), and the next carbon budget (period 2038-2042) has been devised by the CCC and is now waiting to be passed into law (it is here assumed that this will form the next legislated budget, as prior carbon budgets have followed the CCC's recommendation).

Because the NPPF 2024 instructs local plans to support the *transition to net zero* for which the date is 2050, the carbon budget in this exercise needs to cover the full period to 2050. Therefore for years from 2043 to 2050, it is necessary to make a reasonable assumption about what the carbon budget is likely to be in that period.

The last few CCC recommended budgets (which became law) closely follow what the CCC terms the "Balanced Pathway to Net Zero", which represents the most reasonable balance between ambition and feasibility.

The CCC *does* provide projections of this Balanced Pathway all the way through to the legislated net zero target date of 2050, including beyond the period for which national carbon budgets have been devised so far. The latest available version of this, from the CCC's 7th Carbon Budget Report, is as follows:

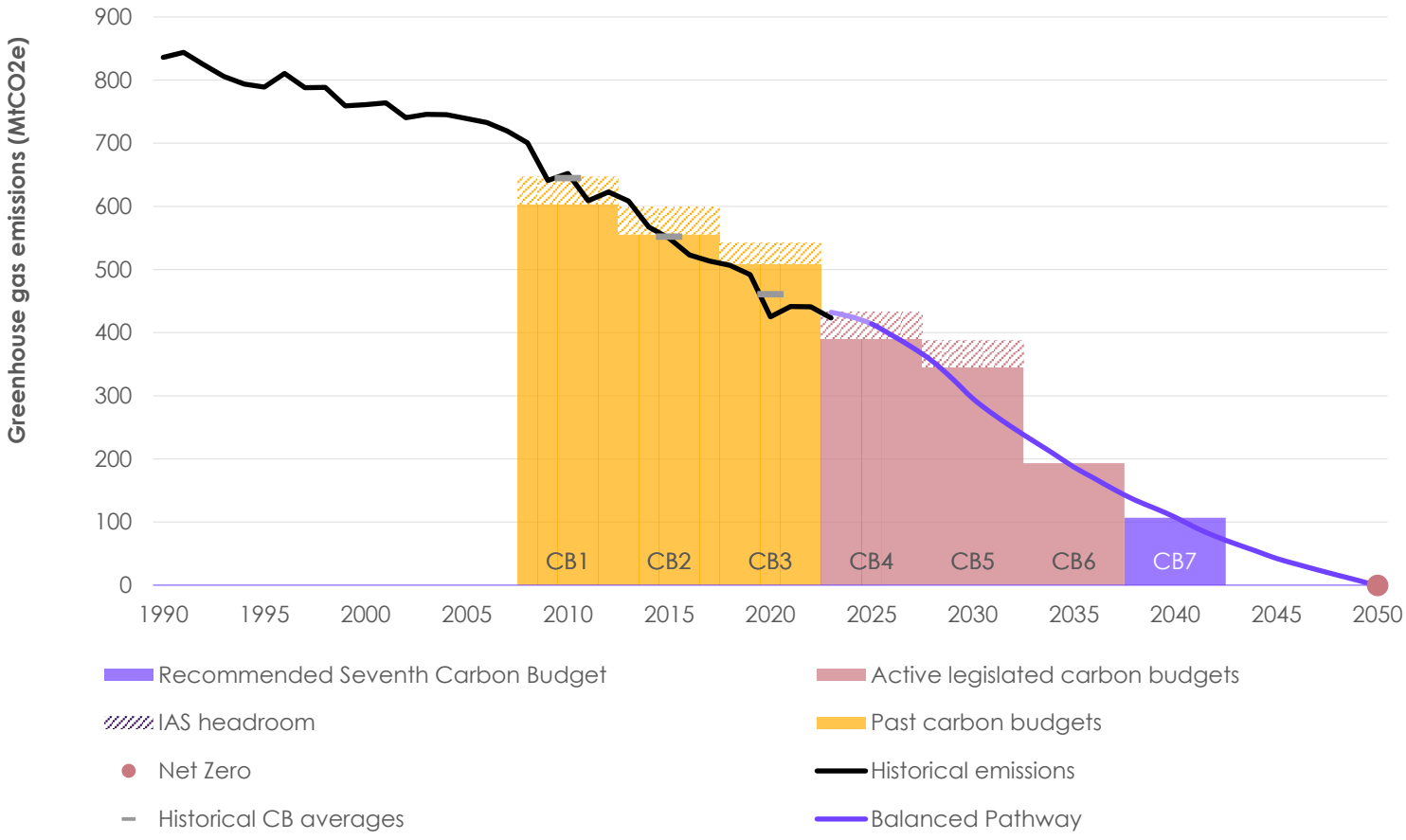


Figure 8: Legislated carbon budgets, soon-to-be-legislated 7th carbon budget, and 'balanced pathway to net zero'. "CB" = Carbon Budget. IAS = International aviation & shipping. Climate Change Committee 7th Carbon Budget, 2025

The CCC's carbon budget reports also come with downloadable spreadsheets of the data that generates these charts. From that download, we can see that the exact emissions in the Balanced Pathway in the years beyond the 7th carbon budget are, in megatonnes CO_2e:

2043	2044	2045	2046	2047	2048	2049	2050
65.29	54.07	42.47	33.33	24.58	16.09	7.90	-1.11

The sum of these is **242.61 $MtCO_2e$**.

We could make an assumption that this will be the legislated carbon budget in those years.

However, the CCC's data also show the balanced pathway for previous years and the actual legislated carbon budgets (and soon-to-be-legislated 7th carbon budget). In fact, these do not precisely equal the sum of the 'balanced pathway' annual emissions for the respective years in the period. As a whole, the sum of all actual carbon budgets from today onwards is 6% higher than the sum of all 'balanced pathway' annual emissions figures in the same period:

-	Total $MtCO_2e$, 2025 to 2042
Sum of all "Balanced Pathway" annual emissions:	4,161.9
Sum of all actual national carbon budgets: *(including the 7th carbon budget and minus a deduction from the 4th carbon budget to exclude 2023 & 2024)*	**4,395.0**
Actual national carbon budgets total as a % of 'Balanced Pathway' total	**106%**

Therefore, a more accurate prediction of actual carbon budgets from 2043-2050 can be made by applying this difference to the Balanced Pathway figure for that period as noted above:

- **242.61 $MtCO_2e$** x **106%** = **256.2 $MtCO_2e$**.

This figure of **246.2 $MtCO_2e$** is therefore the figure we use in our assumptions of the total national carbon budget through to the final net zero legislated date of 2050:

- **4395** (budget 2025 to 2042) + **256.2** (budget 2043 to 2050) = **4651.2 $MtCO_2e$**.

All of our local and sectoral carbon budgets are subsequently derive from this national figure.

Appendix 4

Estimating existing number of homes and associated future energy use and carbon emissions

To estimate the energy use of the existing Greater Cambridge building stock across the entire carbon budget period of 2025-2050, it is necessary to estimate two things:

- Number of existing homes
- Annual electricity consumption per existing home (and future grid decarbonisation)
- Annual gas consumption per home.

There are various sources of estimates of existing housing stock numbers, including:

- ONS household projections, last updated in 2020 based on 2018 home counts
- 'State of the City' / 'State of the District' reports published by the respective Cambridge and South Cambridgeshire Councils, which were published in 2023 (for 2022 data year) and updated in 2024 (for 2023 data year).
    - These in turn draw on 'Cambridgeshire Insight' online tool which both GCLP Councils use to understand their communities
        - That tool states that it draws on the annual dataset from the Valuation Office Agency (VOA; the national office that administers council tax, updated annually, most recently in late 2024 including prior data years).

The latest data year that is available across all three of these sources is 2023 (as the "State of the City / District" reports will only add 2024 data in the 2025 report which is not yet available). Across the 2023 data year, the ONS figure is 14% lower than the "State of the city/district" figure, or 17% lower than the VOA figure. (The Cambridgeshire Insight tool no longer shows 2023 data therefore is not comparable).

Because the "State of" reports and VOA figure are relatively close to each other and were more recently updated, we consider the ONS figure to most likely be inaccurate and an underestimation of the actual number of homes in Greater Cambridge.

In addition to these existing stock, housing trajectory figures received from GCLP show there will also be 36,242 further new builds that already have planning permission (full or outline), which can be assumed therefore not subject to the emerging GCLP policy. The trajectory figures show that within those, 10,388 have full planning permission, which can be assumed not to be subject to the Future Homes Standard either but rather the current Building Regulations (Part L 2021) therefore mostly have gas heating. In the GCLP trajectory figures, these homes with prior full permission are delivered gradually through to 2035. In order to avoid overestimating the amount of carbon budget available for new homes to which the new GCLP policy *will* apply, it is therefore necessary to account for the emissions of these as part of the calculation of the allocated carbon budget allowance for 'existing homes'.

Regarding estimating the energy use of existing Greater Cambridge housing stock that has already been built: As previously noted in the main body report, we start with national annually published data from DESNZ[21] regarding local area gas and electricity use.

In the DESNZ downloadable spreadsheet, whose most recent data year is 2023, this is presented in several forms:

- **The domestic gas dataset provides:**
    - Total domestic gas use in GWh (gigawatt-hours; equivalent to 1 million kWh)
    - Mean average gas use per domestic gas meter
    - Median average gas use per domestic gas meter.
    - Number of domestic gas meters.
    - No estimate of per-household gas use, in contrast to the electricity dataset.

- **The domestic electricity dataset provides:**
    - Total domestic gas use in GWh
    - Mean average use per domestic electricity meter
    - Median average use per domestic electricity meter
    - Count of domestic electricity meters
    - All of the above are also presented according to type of meter:
        - Domestic standard electricity meter
        - Domestic E7 electricity meter
        - Domestic electricity meter, all types.
    - An estimated per-household mean domestic consumption figure.

To estimate the current and future electricity use (from existing housing already built before 2025, plus the imminent new housing that already has full permission and therefore won't be subject to the new GCLP policy), one calculation option considered was to multiply the number of homes in each year of the carbon budget period by the DESNZ stated 'per household' electricity use figure. However, that DESNZ per- figure is based on ONS household number projections that we consider a 14-17% underestimation as noted above. which would result in a corresponding *overestimation* of the per-household figure, when dividing the total electricity use by too few households. Utilising the

[21] HM Government Department for Energy Security & Net Zero

DESNZ per-household figure would therefore result in overestimations of future electricity use when multiplied by the future housing numbers when including the 'prior full permission' new homes not subject to the GCLP policy as explained above.

Therefore, instead:

- We start with the DESNZ 2023 'number of domestic electricity meters' figure as a proxy for homes (128,271).
    - This is validated by being very close to the figures relating to the 2023 data year:
        - GCLP Councils' respective "State of the City / State of the District" reports relating to the 2023 data year (127,103 homes total; only 0.9% less than the DESNZ number of domestic electricity meters noted above), which were drawn from the Cambridgeshire Insight tool mentioned above,
        - VOA (whose data indicate 131,720 homes total in 2023; only 2.7% more than the DESNZ number of domestic electricity meters as above)[22].
        - All of the above are the sum of 'Cambridge' and 'South Cambridgeshire'.
- For all years after 2023, we add the GCLP housing trajectory stated number of housing delivery per year that is associated with sites that already have full planning permission. This dataset which itemised housing growth by existing permissions by full or outline permission (or resolution to grant), existing local plan allocations that don't yet have permission, and existing local plan windfall assumptions. The dataset itemises these by delivery year, as financial years. Years were only itemised up to 2044/45 and the remainder are in a single "post-2045" category, but all of the "existing full/reserved matters" permissions were shown to be delivered by 2035. Therefore:

Year	'Prior full permission' homes delivery	Rolling total homes exempt from policy
2023	n/a	128,271 [but not part of carbon budget]
2024/25	991	129,262 [but not part of carbon budget]
2025/26	2099	131,361
2026/27	1682	133,043
2027/28	1459	134,502
2028/29	1221	135,723
2029/30	924	136,647
2030/31	571	137,218
2031/32	434	137,652
2032/33	422	138,074
2033/34	300	138,374
2034/35	237	138,611
2035/36	48	138,659
2036/37 onwards	0	138,659

These numbers of homes were then used with the annua energy use figures described next.

To calculate the electricity use per home for each year of the carbon budget period: The DESNZ data stated 'Domestic GWh consumption' divided by the 'number of domestic electricity meters' does accurately result in the DESNZ stated 'mean average consumption per domestic electricity meter'. This (3258.1kWh/home) is therefore considered a reasonably accurate assumption for the latest data year, i.e. 2023.

Acknowledging that efficiency gains have been occurring over time and may continue in future, whereas the DESNZ energy use is only currently available up to 2023, we apply an electricity use year-on-year reduction to all future years (2024 onwards, of which 2025-2050 falling within the carbon budget analysis period). This future year-on-year trajectory is based on the average change in electricity use per domestic electricity meter in the most recent 10 years of data, after excluding the anomalous years of:

- 2020 (a dramatic increase due to time spent at home during the pandemic),
- 2021 (a dramatic decrease due to bounceback from the pandemic)
- 2022 (an anomalous decrease due to a combination of ongoing pandemic bounceback and consumer reactions to the anomalous energy price crisis in that year, which was due to the electricity price being pinned to gas prices and therefore becomes less likely in

[22] It is possible that the 2.7% difference in the VOA might be explained by empty homes which therefore don't show up as active electricity meters in the DESNZ data. For the purpose of this carbon budget analysis, the object is energy use, therefore the DESNZ 'number of domestic meters' is considered the most relevant count of existing homes in Greater Cambridge.

future the more the electricity grid is transitioned to renewable energy instead of gas, as is an integral component of the UK's future carbon budgets explained earlier in this report).

That average year-on-year decrease in per-meter domestic electricity use was 1.1%. This was applied to all future years from 2024, to reasonably project future domestic efficiency gains:

Year	Elec. per home	YOY reduction	Number homes	GC homes total elec. use
2023	3258.1kWh	[n/a; baseline]	128,271	[not in carbon budget period]
2024	3487.7 kWh	-1.1%	129,262	[not in carbon budget period]
2025	3447.7 kWh	-1.1	131,361	452,894,075 kWh
2026	3408.2 kWh	-1.1%	133,043	453,434,777 kWh
2027	3369.1 kWh	-1.1%	134,502	453,152,252 kWh
2028	3330.5 kWh	-1.1%	135,723	452,023,959 kWh
2029	3292.3 kWh	-1.1%	136,647	449,884,167 kWh
2030	3254.6 kWh	-1.1%	137,218	446,585,169 kWh
2031	3217.3 kWh	-1.1%	137,652	442,861,922 kWh
2032	3180.4 kWh	-1.1%	138,074	439,127,186 kWh
2033	3143.9 kWh	-1.1%	138,374	435,036,320 kWh
2034	3107.9 kWh	-1.1%	138,611	430,785,743 kWh
2035	3072.2 kWh	-1.1%	138,659	425,994,794 kWh
[For all future years to 2050, continue deducting 1.1% kWh per home each year but number of homes remains static because no further 'prior full permission' homes are due for delivery]				

Those annual kWh electricity use figures are then multiplied by future grid carbon for each respective year (see Appendix 2).

For gas use, further adjustments are necessary because the data make it evident that not all existing homes have gas and therefore the 'per meter' figure cannot be assumed to be a 'per home' figure. The DESNZ most recent data year (2023 as previously noted) shows a count of only 99,401 domestic gas meters in Greater Cambridge, compared to the aforementioned count of 128,271 domestic electricity meters. The proportion of homes with gas is therefore estimated at 77.5% in 2023. In the past 10 years this ranged from 77.3% to 79.1%. The 10-year average would be 78.2%, but it is more reasonable to use the most recent year ratio (77.5%) as it is unlikely that the ratio will increase from today.

Therefore, the aforementioned total number of homes in each year is multiplied by the ratio of gas meters shown above, as follows:

Year	Total number of homes	Assumed ratio, homes with gas	Resulting number of homes with gas
2024	129,262	.775	100,169 [but not in carbon budget period]
2025	131,361	.775	101,796
2026	133,043	.775	103,099
2027	134,502	.775	104,230
2028	135,723	.775	105,176
[continue as above for all years through to 2050].			

As the DESNZ gas use figures do include a figure for gas use per domestic meter (and this does correctly equate to the DENSZ stated total domestic gas use divided by stated total number of domestic gas meters), that figure is a reasonable estimate for the data year of 2023. To estimate change in gas use per household into the future, we apply a year-on-year change that reflects the average year-on-year change in the past 10 years of available data[23]. That year-on-year average change is -0.76%.

[23] Please note that whereas we excluded anomalous data years of 2020, 2021 and 2022 from the electricity year-on-year 10-year average as these were heavily influenced by the pandemic and the 2022 price spike and not expected to continue in future, our equivalent calculation for gas only excludes the 2022 price spike but have kept in the pandemic years. This is because the per-household gas use increase in the 2020 pandemic (+1.7%) was not dramatically anomalous compared to the gas use change in the prior years (which range from -3% to +1.3%), whereas the electricity increase in 2020 was +6.4% followed by a -6.5% in the 2021 post-pandemic bounceback, while prior years in that 10-year period were only -0.1% to -3.1%. As we did not exclude the 2020 gas increase during the pandemic, it was congruent to also not exclude the 2021 post-pandemic bounceback.

Applying that 0.76% year-on-year decrease to per-home gas use in all future years, along with the change in number of homes and constant ratio of homes with gas as above, then multiplying annual use per home by aforementioned number of homes that have gas, we get:

Year	Gas per home	YOY reduction	Homes with gas	GC homes total gas use
2023	11,684.3 kWh	[baseline]		[n/a out of carbon budget]
2024	11,467.8 kWh	-0.76%	100,169	[n/a out of carbon budget]
2025	11,255.2 kWh	-0.76%	101,796	1,171,296,031 kWh
2026	11,046.6 kWh	-0.76%	103,099	1,177,225,629 kWh
2027	10,841.9 kWh	-0.76%	104,230	1,181,038,010 kWh
2028	10,641.0 kWh	-0.76%	105,176	1,182,649,458 kWh
2029	10,443.8 kWh	-0.76%	105,892	1,181,599,072 kWh
2030	10,250.2 kWh	-0.76%	106,334	1,177,466,550 kWh
2031	10,060.3 kWh	-0.76%	106,671	1,172,161,554 kWh
2032	9,873.8 kWh	-0.76%	106,998	1,166,767,456 kWh
2033	9,690.8 kWh	-0.76%	107,230	1,160,364,275 kWh
2034	9,511.2 kWh	-0.76%	107,414	1,153,466,549 kWh
2035	9,335.0 kWh	-0.76%	107,451	1,145,045,712 kWh

[For all future years to 2050, continue deducting 0.76% kWh per home each year but number of homes remains static because no further 'prior full permission' homes are due for delivery]

The total homes gas use across Greater Cambridge for each year then can be multiplied by the latest available national greenhouse gas factor for natural gas, This can then be added to the electricity-related emissions of these homes previously described, to get the total carbon emissions from Greater Cambridge homes not subject to the emerging GCLP policy.

Caveat on exclusions:

This exercise in modelling emissions that won't be affected by the emerging GCLP policy does not include the following further homes that the Greater Cambridge housing growth trajectory dataset shows to have existing *outline* planning permission only (therefore may not be subject to the new GCLP policy, but likely to be subject to some future iteration of Building Regulations not the current Part L 2021). That is a significant number of exclusions (net outline permissions: 192 homes in 2024/25, and a further 20,776 spread throughout the subsequent years to 2050 (the end of the carbon budget period). They are here excluded because it is not certain what energy performance standards they will be subject to. If added in, these would have the effect of even further reducing the available carbon budget for new homes and further justifying the GCLP policy. This exclusion, however, may mitigate the lack of assumption about any energy efficiency retrofit to existing housing stock beyond the aforementioned -1.1% and -0.76% yearly change in per-household electricity and gas use.

References & endnotes

[i] Cambridge City Council (no publication date provided), *Climate Change Strategy*. https://www.cambridge.gov.uk/media/9581/climate-change-strategy-2021-2026.pdf .

This document expressed a "vision", albeit not a fixed commitment, for the Cambridge geographical area to reach net zero by 2030, the same date that the Council has committed to for its own activities. Please note that this target is not shared by South Cambridgeshire, the other relevant local authority area covered by the emerging Greater Cambridge Local Plan. South Cambridgeshire has instead set a district-wide net zero target date of 2050 in line with the national goal, but with an interim 2030 target for the area to reduce its emissions by 50% from a 2018 baseline (https://www.scambs.gov.uk/media/dmlf5kfc/scdc-zero-carbon-strategy-web.pdf). However, in the methodology used in the current carbon budget exercise, the local carbon budget depends on drawing a linear carbon reduction trajectory through to a given net zero carbon end date (unless matching the national 2050 net zero target in which case the reduction trajectory proceeds proportionally to the nationally legislated carbon budgets). For consistency, this linear trajectory is also used in the assumptions about existing emissions (which in turn affects the local carbon budget for new builds). Therefore in this methodology, it is not possible to set a carbon budget within which there are two different net zero dates for Cambridge City versus South Cambridgeshire District. Therefore in the "2030 net zero" scenario throughout this document, we apply that 2030 net zero date to the entire Greater Cambridge Local Plan area.

This does mean applying the City's 2030 target beyond the bounds of the local authority that made it. However, this is not unreasonable for the purpose of testing that scenario, given that the City is entirely surrounded by the District and therefore subject to a high proportion of transport and energy flows from the District, making it difficult to envision a way that the City could meaningfully reach net zero by 2030 without the District achieving the same or similar. This is because all local area carbon accounting methodologies only allow a local area's 'net zero' status to be achieved through equal carbon removals to carbon emissions, and not by purchasing offsets from outside the area (which must instead be reported separately; see 2020-21 GCLP report "Defining net zero"). Carbon removals can currently only be achieved by nature-based sequestration (trees and forests) which currently sequester only a negligible proportion of the City's current emissions (see emissions graph in 2025 report to GCLP "National policy changes since 2020"). The City's constrained land area and largely built-up character does not offer capacity to increase this sequestration by much. For as long as any significant proportion of fossil fuelled transport enters the City (necessarily passing through the District), it is highly unlikely that the City would have the capacity for sufficient carbon removal activities to balance those emissions to zero. This could change in future if carbon removal technologies are developed in a form that is cost-effective, energy-efficient and suitably quiet and space-efficient to be significantly rolled out in a city like Cambridge which is subject to large areas of historical conservation protections as well as the usual urban constraints of residential amenity and other noise-sensitive uses such as education. As no such technology is yet existent or imminent, Cambridge's carbon removal capacity is likely to remain low.

For our "2030 net zero target date" carbon budget scenario reflecting local commitments therefore, it is reasonable to apply that same date to the entire GCLP area because it is most realistic to assume that the meaningful achievement of Cambridge City's 2030 net zero aspiration would depend on South Cambridgeshire also becoming net zero or near.

[ii] https://www.theccc.org.uk/wp-content/uploads/2025/02/The-Seventh-Carbon-Budget.pdf. For a view of the past, current legislated and soon-to-be-legislated carbon budgets, see figure 3.2 on page 64. For a view of the steep reductions pathway in each sector, see figure 3.6 on page 72.

[iii] We note that the previous work for Greater Cambridge in 2020-21 did include a similar energy modelling study (https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-08/NetZeroTechnicalFeasibility_GCLP_210831.pdf). That explored the feasibility of meeting the GCLP Policy CC/NZ requirements and compared these against the then-current Building Regulations which was Part L 2013. However, the baseline of Part L 2013 is no longer relevant today as it has not only been superseded by Part L 2021, but is also about to be replaced by Part L 2025 (the Future Homes Standard which will be in place before the new Greater Cambridge Local Plan comes into force). The Future Homes Standard also forms our assumed standard for our 'WMS-compliant' policy scenario for our current carbon budget study. Therefore we need to be able to use the energy performance figures for the latest available Future Homes Standard (FHS), which was published in late 2023 therefore was not part of the Greater Cambridge 2020-21 study. Our current appointment for Greater Cambridge includes updates to costs, but not to energy performance figures. This is the reason why our current study uses the energy performance figures from the South & Vale reports in place of those from the 2020-21 Greater Cambridge work.

This does not result in any distortion of carbon outcomes of the GCLP CC/NZ policy compared to with the South & Vale equivalent 'true net zero' policy, because both of those would result in zero carbon emissions. Instead, the subject of the current study is to scrutinise the emissions in the Future Homes Standard/WMS-compliant policy scenario, which are currently only available within the South & Vale study. These South & Vale figures are reasonably representative of the emissions that would occur in FHS Greater Cambridge new builds, given the very similar climate and similar types of houses and apartments likely to come forward in areas sharing so many similar characteristics, being affluent surrounds of major regional university cities and containing a similar mix of urban/suburban/rural areas. Our study uses the South & Vale emissions per new build home, but does still adjust the assumed mix of housing to reflect that of Greater Cambridge, as explained in the current report section "Scaling up the per-home results to reflect Greater Cambridge's total new housing delivery".

[iv] Electricity grid carbon intensity national projections through to 2100 found in HM Government Department for Energy Security and Net Zero (2023*), Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*, Data table 1.

https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

[v] As demonstrated specifically for Greater Cambridge in the 2020-21 suite of reports, specifically the report "Task D – Technical feasibility". https://consultations.greatercambridgeplanning.org/sites/gcp/files/2021-08/NetZeroTechnicalFeasibility_GCLP_210831.pdf#page=22

[vi] Greater Cambridge Shared Planning Service (2025), *Greater Cambridge Housing Trajectory and Housing Land Supply Report Published April 2025*. https://www.greatercambridgeplanning.org/media/oqrjwolk/gc_ht__hls_final_april_2025.pdf

[vii] Cambridge City Council (no publication date provided), *Climate Change Strategy 2021-2026*. https://www.cambridge.gov.uk/media/9581/climate-change-strategy-2021-2026.pdf

[viii] South Cambridgeshire District Council (2020), *Zero Carbon Strategy*. https://www.scambs.gov.uk/media/dmlf5kfc/scdc-zero-carbon-strategy-web.pdf

[ix] Climate Change Committee (2020), *The Sixth Carbon Budget: The UK's path to Net Zero.* See table 3.2.c https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

[x] Climate Change Committee (2019) UK Housing: Fit for the future*?*. *https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/*

[xi] Climate Change Committee (2020), *The Sixth Carbon Budget: The UK's path to Net Zero.* See "Supporting information, charts and data" for excel downloads of carbon budgets and balanced pathway. https://www.theccc.org.uk/publication/sixth-carbon-budget/

[xii] Committee on Climate Change (2025), *The Seventh Carbon Budget*. See "Supporting information, charts and data" for excel downloads of carbon budgets and balanced pathway. https://www.theccc.org.uk/publication/the-seventh-carbon-budget/

[xiii] HM Government Department for Energy Security and Net Zero, *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*. https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal