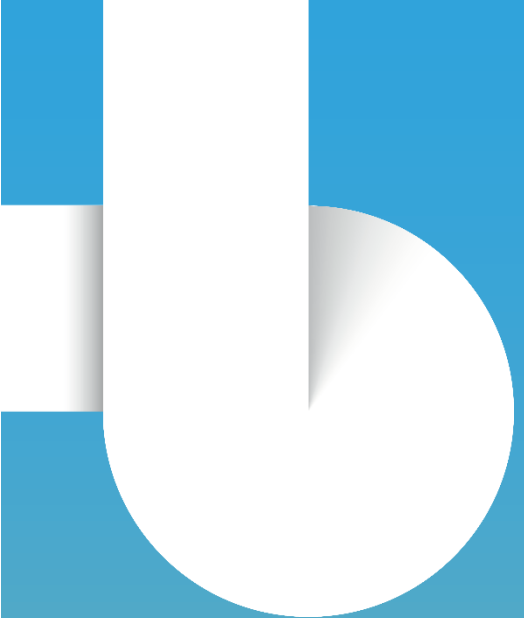




Gloucestershire net zero carbon local plan policy support

Evidence base:
Carbon budget assessment

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Final Draft

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Executive Summary

Bioregional (in partnership with Etude) was appointed by Climate Leadership Gloucestershire on behalf of the relevant local districts (Cheltenham, Gloucester, Forest of Dean, Stroud, Tewkesbury) to provide an assessment of options available within the local planning system to address climate change in Gloucestershire. This carbon budget assessment tests whether a ‘True Net Zero’ operational energy performance standard for *new-build housing* can be demonstrated as necessary for Gloucestershire (covering Cotswolds, Cheltenham, Gloucester, Forest of Dean, Stroud, Tewkesbury) to remain aligned with the UK’s legislated carbon budgets, the local net zero ambition of 2045, and the national net zero target of 2050.

Purpose of the report

The assessment evaluates the operational energy performance of typical new homes against a **local carbon budget** (for the operational emissions of new-build housing) that is logically derived from national carbon budgets. For the share of the new housing growth trajectory that new local plan policies would affect, two policy approaches are compared:

- a **TER / Building Regulations-aligned approach**, represented here using **Future Homes Standard (FHS)** as the baseline scenario; and
- a **“True Net Zero EUI” approach**. This approach uses absolute energy metrics (Energy Use Intensity and Space Heat Demand) and requires on-site renewable generation to match annual energy use, thus achieving net zero operational emissions from the year of adoption.

The modelling also accounts for new homes that would already have planning permission before new local plans are adopted and therefore would not be affected by any new policy. These homes follow Building Regulations (Part L 2021 or FHS) in both policy approaches.

The goal is to explore whether each of these possible policy approaches would be effective in ensuring the new housing growth stays within its reasonable share of national legislated carbon budgets, thus ‘mitigating climate change ... in line with the objectives and provisions of the Climate Change Act’ as local plans are instructed to do by both NPPF 2024 and 2026.

Key modelling assumptions

- Energy performance is drawn from PHPP-based modelling for four archetypes: low-rise block of flats, bungalow houses, semi-detached houses, detached houses, weighted using 81% houses / 19% flats split assumed based on the latest EPC [data](#) for new dwellings by housing type (detailed later in the report).
- To maintain consistency and comparability across scenarios, PHPP outputs are used to represent energy performance of new homes in both scenarios, recognising that SAP is a compliance tool and may not reflect real-world energy use accurately.
- According to the combined housing trajectory derived from housing trajectories provided by individual authorities, comprises 96,974 new dwellings in the remaining years to the local net zero target year of 2045, and 120,374 new dwellings over the 2026–2050 carbon budget period (see Appendix 4).

- Homes completed in years up to and including 2027 are assumed to follow Part L 2021 (with gas heating). Thereafter, homes completed from 2028 assumed to be all-electric under both policy scenarios, given the FHS transition period which ends in March 2028.
- Acknowledging that the relevant Local Plans may come into force at different times, we assume for modelling purposes that all will be in place from 2028, aligning with the end of the Future Homes Standard transition period.

Results

The report derives a local carbon budget for Gloucestershire area from national carbon budgets to 2045 and 2050, then apportions a share of this to the housing sector, and then a share of that to the new homes that would be built during the carbon budget period.

Some homes that would be completed during the carbon-budget period would already have secured planning permission before local plans come into force in their local area. Since new local plan policies cannot influence the energy performance of these already-permitted homes, they should not be included in the carbon budget used to compare the different policy approaches. The report therefore first identifies the carbon budget available for all new homes built during carbon budget periods, and then allocates a specific share of those budgets to the homes that local plans *can* influence: namely, homes that would receive planning permission after local plans come into force.

In this approach, **the available carbon budget for operational emissions of housing built during carbon budget periods, of which the new policy can affect, are 1.43 ktCO₂e for 2026–2045 and 1.62 ktCO₂e for 2026–2050**. Correspondingly, the available carbon budget for new-build homes that the policy *cannot* affect are 268.73 kt CO₂e and 325.12 kt CO₂e for local and national carbon budget periods respectively. The resulting total new-build budgets is 270.16 kt CO₂e and 326.73 kt CO₂e respectively.

At a per-home level (weighted average), there is a large change between the approaches:

		Weighted average per new-build home in Gloucestershire reflecting local split of 19% flats vs 81% houses		
Metric	Unit	Part L 2021 (today)	Baseline	True Net Zero EUI
Net annual carbon per home in 2026	Kg CO ₂ e/yr	1,478	15	-148

When scaled across cumulative delivery to 2050, reflecting the anticipated housing delivery trajectory in Gloucestershire and assessed against the carbon budget, the results show:

- **Baseline (Part L 2021 until 2027, FHS from 2028)**: Emissions of the policy-affectable homes would be 2.18 ktCO₂e (and emissions from new homes unaffected by the policy due to prior permission would be 437.88ktCO₂e)
- **True Net Zero EUI: Delivers a significant net negative contribution from the policy-affectable homes**, totalling -21.77 ktCO₂e. The emissions from new homes unaffected by the policy would remain 437.88ktCO₂e. Thus the policy-affected homes would offset 5.0% of the emissions of the unavoidable new homes. The net emissions from all new homes built in this period would therefore be 416.28 ktCO₂e.

The core conclusion is that [a Building Regulations / FHS-led baseline pathway would continue to add to Gloucestershire's new-build housing operational emissions](#), indicating clear local circumstances for adopting a more effective approach to increase the likelihood of staying within the available carbon budget. The True Net Zero EUI approach is shown to be the most robust and “proactive” policy approach, because it is the most effective scenario in counterbalancing unavoidable near-term emissions associated with the pre-policy period.

Introduction & overview

Bioregional (in partnership with Etude) was appointed by Climate Leadership Gloucestershire on behalf of the relevant local districts (Cheltenham, Gloucester, Forest of Dean, Stroud, Tewkesbury) to provide an assessment of options available within the local planning system to address climate mitigation in Gloucestershire. This report's purpose is to explore, through reasoned analysis, what local standards for new buildings' energy performance can be demonstrated necessary in order for Gloucestershire area to remain aligned with the UK's legislated carbon budgets, the local net zero ambition of 2045, and the national net zero target of 2050.

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

- 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; NPPF 2026, paragraph 18).

The Climate Change Act includes the net zero goal and the legislated carbon budgets for the UK (limits on the permissible amount of emissions in each 5 years; see Figure 1).

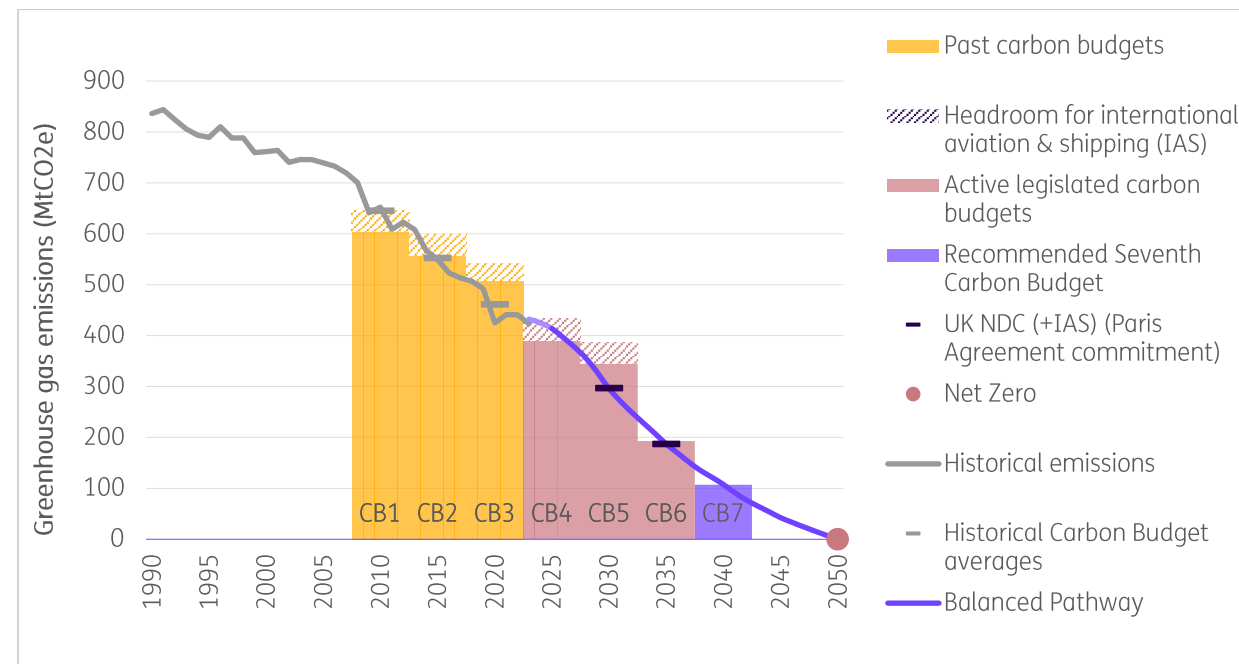


Figure 1: The UK's legislated carbon budgets (past, present and future) within the Climate Change Act. Adapted from: Climate Change Committee, *7th Carbon Budget report, 2025*.

¹ As endorsed by all major standard-setting professional bodies in the UK construction sector, by their co-creation of the UK Net Zero Carbon Buildings Standard which uses the metrics of EUI, SHD and renewable energy provision

This report assesses the carbon impact of two broad types of policy approach:

1. An approach that reflects the Future Homes Standard (FHS), utilising the Building Regulations Target Emission Rate (TER) metric, expressed as a % reduction against the TER baseline of today's Building Regulations Part L 2021, according to the approved national calculation methodology (currently Part L SAP10.2 methodology). This would provide a route for Gloucestershire local authorities to work towards as they develop their emerging local plan policies, by reflecting the FHS while retaining scope for a locally evidenced uplift over the Part L 2021 baseline.
2. An approach that is based on the energy efficiency metrics of total Energy Use Intensity (EUI) and space heat demand (SHD) calculated using a more accurate energy modelling methodology, plus renewable energy provision on site sufficient to at least match total energy use thus reaching 'true net zero' in operation.

The impetus for this analysis is that Policy PM13 of the NPPF 2026 now supersedes the approach previously set out in the Written Ministerial Statement of 13 December 2023 (WMS2023), purporting to require that any local plan energy efficiency standard exceeding Building Regulations should be expressed as a percentage uplift of a dwelling's Target Emissions Rate (TER), calculated using a specified version of SAP. However, industry best practice¹ is to use metrics other than TER; specifically EUI and SHD, using a more accurate methodology than SAP. It is legally established² that local plans can diverge from national policy if there are local or exceptional circumstances to justify this. This report explores whether such circumstances are extant in light of the effectiveness of TER-based vs EUI-based standards in keeping Gloucestershire within its proportionate share of national carbon budgets, thus meeting the mandate to 'mitigate climate change in line with the Climate Change Act'².

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 Gloucestershire (derived from the national legislated carbon budgets). This study then models new homes' operational emissions in 2026-2050 in two policy scenarios:

- Future Homes Standard (FHS), which is Building Regulations Part L 2026 expected to take effect on 24th March 2027, and thus represents the **baseline scenario**. This standard is compliant with the NPPF 2026;
- **'True Net Zero EUI' policy scenario** (which represents an approach that diverges from NPPF 2026 by using more effective metrics for energy efficiency).

The carbon emissions of these two scenarios draw on prior energy modelling of the performance that would be achieved by typical Gloucestershire new homes in those policy scenarios. The number of homes modelled reflects the estimated Gloucestershire housing

² This local plan is expected to be examined to the NPPF 2024. However, this reference to the Climate Change Act is also present within the emerging new NPPF (2025/26 consultation). Thus this analysis would also support divergence from the less supportive parts of that emerging new NPPF if that becomes relevant.

growth target (to 2045 and 2050; see Section 1. The energy performance figures in each scenario are translated into carbon emissions through to the UK's legislated net zero goal date of 2050, reflecting national datasets for conversion of gas and electricity to emissions including future electrical grid decarbonisation.

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 Climate Change Act goals (and therefore the climate mitigation mandate in law and policy as above). While the Climate Change Act does not legislate emissions limits on individual sectors, the legislated national carbon budgets rely on steep falls in all sectors' emissionsⁱⁱ (see Figure 2), 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 most effective to pursue indicative sectoral carbon budgets to keep the national legislated mitigation target feasible. Therefore, logically, all sectors in Gloucestershire 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. This is therefore an appropriate and logical test to apply when determining what policies are appropriate for local plans' climate mitigation mandate.

The 'True Net Zero EUI' policy scenario requires net zero operational emissions for new buildings, using absolute energy metrics, which diverge from the stipulations of the WMS2023 as previously outlined above. This study concludes that there are demonstrated local circumstances to justify divergence from the NPPF 2026, as the approach set out in 'True Net Zero EUI' policy scenario is necessary for Gloucestershire to align as closely as possible 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 local plans to pursue).

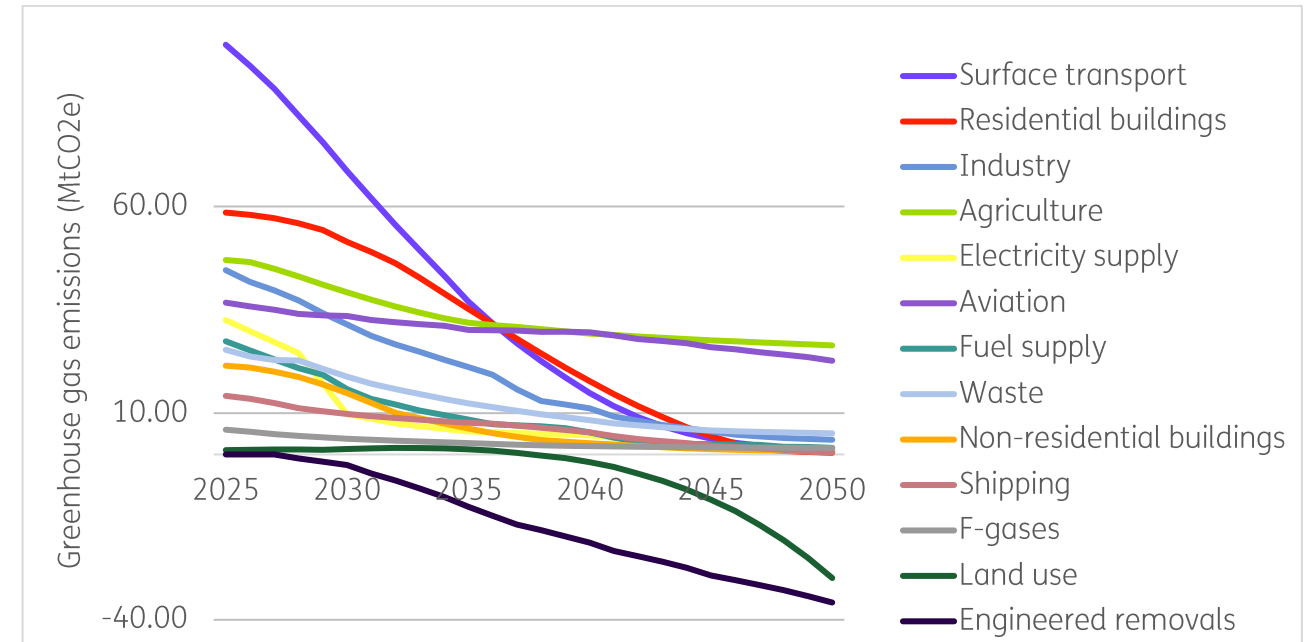


Figure 2: Chart showing how each sector's emissions must fall in the 'balanced' pathway to net zero in 2050. Adapted from: Climate Change Committee, *7th Carbon Budget report, 2025*.

1. Comparison of policy scenarios

Scenarios tested

The first step of this study was to identify energy use data to reflect a ‘True Net Zero EUI’ policy scenario, versus the baseline scenario. 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 Gloucestershire’s local net zero target of 2045.

To represent the emissions of the baseline scenario, Building Regulations Part L 2021 is assumed to apply until 2027, after which the Future Homes Standard is assumed to take effect. The Future Homes Standard is the new Building Regulations Part L, which was due to have been introduced in 2025 but was only recently published on 24 March 2026. The [published document](#) indicated the FHS standard to go into effect on 24th March 2027, with the transition period lasting until 24th March 2028. This Future Homes Standard includes a heat pump, and some on-site solar PV in most cases, but negligible fabric improvement compared to today’s building regulations (Part L 2021).

Secondly, the ‘True Net Zero EUI’ policy scenario was tested. This ‘True Net Zero EUI’ policy scenario 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 and that all of the above are calculated using accurate energy use modelling methods. This policy scenario does not wholly align with the requirements of the NPPF 2026 or 2023 WMS because it does not use the Target Emissions Rate metric but would more effectively optimise energy performance and thus assist fulfilling Gloucestershire’s contribution to the UK’s legislated carbon budgets and national net zero target of 2050. 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 and/or TER-based policy option	True Net Zero EUI
- Target Emissions Rate metric based on % improvement, not absolute values, which makes comparison difficult due to different baselines used - Only considers regulated energy uses (heating, cooling and lighting), not unregulated ones (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 - May not ensure all buildings are net-zero-carbon until the energy grid is fully decarbonised (via future development of extensive standalone renewables).	- Uses absolute energy-based targets that directly limit energy consumption, which are verifiable in-use by the occupier at the meter - EUI accounts for regulated and unregulated energy use - Uses a predictive energy modelling tool (e.g. Passivhaus Planning Package) that is proven to accurately predict energy use, thus reflects real-life performance - Industry-evidenced best-practice 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.

	FHS (no policy)	True Net Zero EUI
Metrics used	Target Emissions Rate (approximately 63% reduction on today’s Part L 2021 TER)	Energy Use Intensity (EUI) and space heating demand, via an accurate method
	Calculate TER and TFEE with SAP or HEM ³	
Renewable energy on site (solar PV)	PV area = ~40% of ground floor ⁴	Match total energy consumption on an annual basis
Net zero building?	Not until grid is fully zero carbon	Yes, from year 1
Aligned to WMS2023?	Yes	No

³ SAP will be nationally replaced by the Home Energy Model (HEM) approximately 15 months after the Future Homes Standard is in force: Government [statements](#) in March 2026 indicate that HEM will “become an approved calculation methodology no earlier than 3 months after this consultation response is published” (thus, late June 2026 or later) and that it will remain acceptable to use either SAP 10.3 or HEM for at least 24 months after that (therefore at least until late June 2028, which is 15 months after the FHS first enters force). It is also confirmed that HEM will continue to use the TER and TFEE metrics, and [previous consultations](#) have indicated that it may also offer other metric outputs.

⁴ Please note that the amount of PV in the FHS notional building is in fact not a fixed amount but instead will reflect the amount of PV that the actual proposed building has, up to this figure of 40% of floor area. However, the published FHS also contains a new ‘functional requirement’ for a ‘reasonable output’ of renewable energy to be produced on the building or within its curtilage. While the FHS allows variance in what is a ‘reasonable amount’ between different buildings and their situations, it is stated that this benchmark figure of 40% of floor area would be deemed to fulfil the ‘reasonable’ amount.

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 uses energy specifications used to conduct energy modelling and cost analysis, which forms an earlier part of this evidence base.

For each archetype and policy scenario, the energy modelling uses a defined set of assumptions for the building fabric, envelope performance and building services. These assumptions are set out in Appendix 1, in the “envelope performance” and “building services” tables. The assumptions were modelled using the Passive House Planning Package (PHPP⁵), a detailed energy-prediction tool, to estimate the total energy use of Gloucestershire’s typical new-build homes. This was done for both the ‘True Net Zero EUI’ policy scenario and the baseline scenario. The baseline assumes that homes completed up to the end of 2027 are built to Part L 2021, and homes completed thereafter are built to the Future Homes Standard.

With the predicted energy use established in each policy scenario, this energy use was then combined with projected grid decarbonisation factors during 2026–2050 (this period reflects the remaining years in the Climate Change Act national legally binding carbon budgeting period through to the national legislated ‘net zero’ target date). 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](#)).

The following section focuses on the carbon budget modelling process. For all policy scenarios, the cited energy use data came from energy modelling using PHPP, despite that the FHS (which is a TER-based scenario) uses SAP or HEM in implementation rather than PHPP. This is because if the ‘True Net Zero EUI’ scenario were tested using PHPP, whilst FHS were tested using SAP or HEM, inconsistency between the modelling tools would result in incomparable figures. Also, HEM is not yet available and SAP is inaccurate at predicting actual energy use^{iii,iv,v}, whereas PHPP has a track record of accuracy⁶. Therefore, the use of PHPP calculations for energy use in all 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 use⁷ from which operational carbon emissions are derived. Our analysis uses the modelled energy use of four archetypes: low-rise block of flats, bungalows, semi-detached homes, detached homes. The same archetypes were used for both policy scenarios (see [Appendix 1](#)), to ensure comparability between the two scenarios.

⁵ PHPP is a modelling tool used to accurately calculate a building’s energy use. This is a tool used in the design of Passivhaus buildings, but can also be used as a generic modelling tool in buildings that are not pursuing Passivhaus certification. The tool provides wide functionality through a range of input variables to predict heat loss, energy and broader comfort metrics.

⁶ As acknowledged by the industry (e.g. [RICS](#)) and also by national government via its [2023 HEM consultation](#), in which PHPP has been one of the validation tools during the development of that new national model HEM, thanks to PHPP being “regarded as demonstrably accurate for modelling of high-performance homes”.

⁷ In practice, a policy aligned with PM13’s TER-based formulation may not fully assess unregulated energy, because the TER metric only considers regulated energy. Yet homes built under such a policy would still have unregulated energy use, and associated carbon emissions, until the electricity grid is fully decarbonised. A PM13-aligned policy could seek to address unregulated energy by requiring it to be met through on-site renewable energy, rather than through an energy-efficiency requirement, because PM13 addresses energy-efficiency standards rather than renewable-energy requirements. However, where unregulated energy use is not minimised at source, which the TER metric cannot do, it may not be feasible in all cases to fully match that demand through on-site renewable-energy capacity.

Energy modelling results per home if built in 2026

Table 1: Emissions per home in carbon budget period 2026 to 2050, if built in 2026, in different energy performance scenarios

		Low-rise flats (one apartment as share of total 7-apartment 4-storey building)			Semi-detached (one house)			Bungalow (one house)			Detached (one house)		
Metric	Unit	Part L 2021 (today)	Future Homes Standard (FHS)	True Net Zero EUI-based policy	Part L 2021 (today)	Future Homes Standard (FHS)	True Net Zero EUI-based policy	Part L 2021 (today)	Future Homes Standard (FHS)	True Net Zero EUI-based policy	Part L 2021 (today)	Future Homes Standard (FHS)	True Net Zero EUI-based policy
Net total energy use per home, after deducting solar PV generation (same in each year)	kWh/yr	7,743 gas -1,654 electricity	0 gas 1,669 electricity	0 gas 0 electricity	7,302 gas -675 electricity	0 gas -74 electricity	0 gas -1406 electricity	5,051 gas -1,888 electricity	0 gas -1,329 electricity	0 gas -2,413 electricity	11,642 gas -2413 electricity	0 gas -256 electricity	0 gas -2332 electricity
Net annual carbon per home in 2026	kg CO ₂ e/yr	1,250 kg	164 kg	0 kg	1,265 kg	-7 kg	-138 kg	736 kg	-130 kg	-236 kg	1,886 kg	-25kg	-229 kg
Total operational carbon emissions per home, in the national carbon budget period (2026-2050) if this home is built in Year 1 (2026), with electricity grid decarbonisation	kg CO ₂ e/yr	34,220 kg	1,080 kg	0 kg	34,086 kg	-48 kg	-910 kg	21,801 kg	-860 kg	-1,561 kg	51,501 kg	-166 kg	-1509 kg
Total operational carbon emissions per home, in the local carbon budget period (2026-2045) if this home is built in Year 1 (2026), with electricity grid decarbonisation	kg CO ₂ e/yr	27,202 kg	1,040 kg	0 kg	26,203 kg	-46 kg	-876 kg	17,242 kg	-828 kg	-1,503 kg	40,946 kg	-159 kg	-1,453 kg

Table 2: Energy use and emissions per average home built to each building standard, taking into account the anticipated mix of housing types in Gloucestershire

		Weighted average per new-build home in Gloucestershire, reflecting local split of 19% apartments/81% houses		
Metric	Unit	Part L 2021 (today)	FHS (Baseline)	True Net Zero EUI-based policy
Net total energy use per home, after deducting solar PV generation (same in each year)	kWh/yr	8,931 kWh/year gas -1,528 kWh/year electricity	0 gas 151 kWh/year electricity	0 gas -1,511 kWh /year electricity
Net annual carbon per home in 2026	kg CO ₂ e/yr	1,478kg	15 kg	-198 kg
Total operational carbon emissions per home, in the national carbon budget period (2026-2050) if this home is built in Year 1 (2026), with electricity grid decarbonisation	kg CO ₂ e/yr	39,715 kg	98 kg	-978 kg
Total operational carbon emissions per home, in the local carbon budget period (2026-2045) if this home is built in Year 1 (2026), with electricity grid decarbonisation	kg CO ₂ e/yr	31,611 kg	94 kg	-942 kg

The above ‘total operational carbon emissions’ rows take into account the anticipated decarbonisation of the electricity grid in the stated period, based on [national projections of future grid decarbonisation](#)^{vi}. Please note that while those rows are given as an illustration of what a home’s total emissions to 2050 would be if the home were built in 2026, the analysis in the next steps of this work do take into account the fact that delivery of new homes will occur gradually across each year of the carbon budget period rather than all occurring in 2026.

Table 3: Relevant timelines within this assessment

Year	2008-2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Legislated carbon budget period	Carbon budgets 1, 2 & 3	Carbon budget 4				Carbon budget 5				Carbon budget 6				Carbon budget 7				Carbon budget 8				Carbon budget 9							
Local carbon budget period																													
(of which emissions already known)																													
Building Regulations Part L 2021																													
Building Regulations FHS ⁸																													

The ‘total operational carbon emissions’ in Table 1 take into account the [national projection of future decarbonisation of the electricity grid](#)^{vii} in the carbon budget timescale of 2026-2050.

The energy modelling found that in the low-rise flats archetype, the FHS did not include enough rooftop solar PV to annually match the building’s total electricity use. However, in the other house archetypes (semi-detached, bungalow and detached), the assumed amount of PV in the FHS could annually generate an amount of electricity that exceeds those houses’ annual electricity use. As shown in Table 1, this results in small negative emissions in 2026 for the semi-detached house (-7 kgCO₂e), bungalow (-130 kgCO₂e) and detached house (-25 kgCO₂e), while low-rise flats retains positive emissions of 164 kgCO₂e (As per Table 2). The modelling applies the published Part L 2026 requirement for solar PV, under which the capacity of the ‘notional’ PV array is determined as 40% of ground floor area × 0.22 kWp/m². In some cases, the FHS will allow less PV, or even none if any storey is over 18 metres height or if other constraints prevent the achievement of a ‘reasonable’ amount of solar PV output. The published FHS establishes that the ‘notional’ building will not have a fixed amount of PV but instead will have the same amount of PV as the actual proposed building, up to the amount described in the equation above. **Therefore, emissions shown in the FHS scenario in the current report might not actually be achieved if there are many new builds in Gloucestershire area whose developers convince Building Control that it is not feasible to accommodate as much PV as assumed here.**

The modelling shows that **in the ‘True Net Zero EUI’ policy scenario, a significant amount of negative emissions are produced** from all new home archetypes except the low-rise flat block. This is because the policy would very effectively minimise energy demand and require renewable electricity to at least equal annual energy demand and in some cases exceed this, where feasible. The energy modelling looked at a reasonable maximum amount of PV that could be fitted on the roofs of each typical home type, which is included in the ‘True Net Zero EUI-based policy’ scenario. The excess solar PV becomes ‘negative’ consumption as it is exported to the grid. Most archetypes were able to include enough PV on site to match their energy use in this scenario, but in the event that they could not (e.g. due to site-specific constraints such as overshadowing), this policy would require that exact amount of shortfall to be offset via a contribution to offsite PV.

⁸ The FHS will first enter force for applications submitted to building control from 24th March 2027. However, the FHS allows that new buildings whose full plans are submitted by 23rd March 2027 escape the FHS, so long as construction commences by 23rd March 2028. Given the delay between submission of plans through to construction and completion, this means that most homes actually completed across 2027 will be built to Part L 2021 standard. For the sake of simplicity, these calculations therefore assume that the FHS becomes the default standard for new homes completed from 2028, except for homes that the Gloucestershire housing trajectory figures show are expected to hold prior full permission.

Scaling up the per-home results to reflect Gloucestershire's total new housing delivery trajectory

To determine the relative contribution from houses and apartment (flats) archetypes to the overall new-build housing carbon emissions in Gloucestershire, the new-build housing in the plan period is assumed to follow the same split of houses versus apartments that has taken place in recent years in Gloucestershire as follows. According to the latest EPC [data](#) for new dwellings by housing type, the latest 5 years⁹ of data show that 81% of new domestic buildings in Gloucestershire were houses, whilst the remaining 19% were flats. This % split is assumed to remain constant for the delivery of new homes going forward.

A housing growth trajectory for homes with planning permission was provided by individual authorities in August 2026, showing the estimated amount of housing to be delivered in the plan period (detailed in Appendix 4). According to those housing projection figures, 94,323 and 117,723 homes should be delivered throughout the period of 2026-2045 and 2026-2050 respectively. The figures also showed the amount of new homes that have already attained planning permission¹⁰. However, these trajectory figures had to be adjusted in several small ways to align with the carbon budget periods that are set nationally, as follows:

- [Local authority housing trajectory for homes with planning permission and growth targets were presented in financial years \(e.g. 2027/28\)](#) which end in March of the latter year, whereas the national carbon budget figures are based on calendar years (as are the national emissions figures, grid carbon factors, and local-level energy use data). To ensure consistency between these datasets, the housing delivery figures were [converted from financial years to calendar years](#). For example, the housing figure for 2027 is calculated as 3/12 of the '2026/27' delivery (representing January–March 2027) plus 9/12 of the '2027/28' delivery (representing April–December 2027). This approach is applied consistently across this carbon budget analysis to align housing delivery data with the calendar-year basis of the national carbon budget.
 - The housing target provided by individual authorities (Cotswolds, Cheltenham, Gloucester, Forest of Dean, Stroud, Tewkesbury) were compiled to develop a combined housing trajectory. For every year, the number of dwellings with planning permission, where available, was subtracted from the total delivery target to give the number of dwellings that would be subject to new local plans.
 - In principle, dwellings with full planning permission are expected to follow Part L 2021. However, the FHS transitional arrangements include a cut-off by which construction must have commenced, namely 23 March 2028. Assuming a typical construction period of around 12–18 months, this would mean that most homes commencing under the transitional provisions should be completed by the end of 2029. On this basis, there should be few, if any, homes completed to Part L 2021 from 2030 onwards. The main exception would be where a developer had technically commenced a dwelling before 23 March 2028 - for example, by completing the foundations and ground-floor structure,
- but then delayed further construction for an extended period. While this may occur in a small number of cases, it is unlikely to be widespread. For simplicity, the analysis therefore assumes that [all homes with full planning permission that are delivered from 2030 onwards comply with the FHS](#).
- [Since 2026 Q1 and Q2 have already elapsed](#), actual housing delivery figures were used where available. However, at the time of analysis, the most recent dataset on *existing* housing stock was only available up to 2025. These existing housing stock figures represent a snapshot of 31st March in the given year. As a result, dwellings completed in Q2-Q4 2025 and Q1-Q2 2026 were estimated using live data tables on new-build EPCs. While the carbon budget period begins in 2026, it is assumed that the March 2025 'existing housing' snapshot is the baseline for the Gloucestershire's housing trajectory, thus new homes built in Q2-Q4 2025 are assumed count towards Gloucestershire's housing targets.
 - For 2026, it was estimated that 6,501 new dwellings had been delivered since the 'existing' housing number from March 2025. This figure includes both the 2,651 homes completed during 2025 and the 3,850 homes expected to be completed across Q1–Q4 2026, based on the combined housing trajectory. Emissions from dwellings built during 2025 would already have been captured within national 2025 emissions, but only for the part of the year in which those homes existed. National 2025 emissions thus do not reflect a full year of operational energy use from these dwellings. As the 2025 new-build homes are treated within the '2026 new builds', the 662 homes built in Q1 2025 were also deducted from the 2025 'existing housing' number at March 2025. This enabled the analysis to account for those homes' full annual emissions from 2026 onwards at Part L 2021 standard.
 - According to live data tables on new-build EPCs, 1,434 new dwellings were built during 2026. However, as the annual housing target is 3,850, the 1,434 homes identified as completed in Q1–Q2 2026 were assumed to be included within the 2026 trajectory figure. The remaining 1,416 unbuilt targeted dwellings were assumed to be delivered in 2026.
 - The resulting estimated total is 96,974 dwellings delivered across 2026–2045, and 120,374 across 2026–2050 of which:
 - 11,241 before the plan is adopted (2028), all subject to Part L 2021
 - 4,416 with outline prior permission thus are not affected by new policy (thus all FHS)
 - 81,317 and 104,717 that the plan policy can affect across 2026–2045 and 2026–2050 respectively.

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

¹⁰ This information is necessary because new local plan policies cannot be retrospectively applied to planning decisions that were already made.

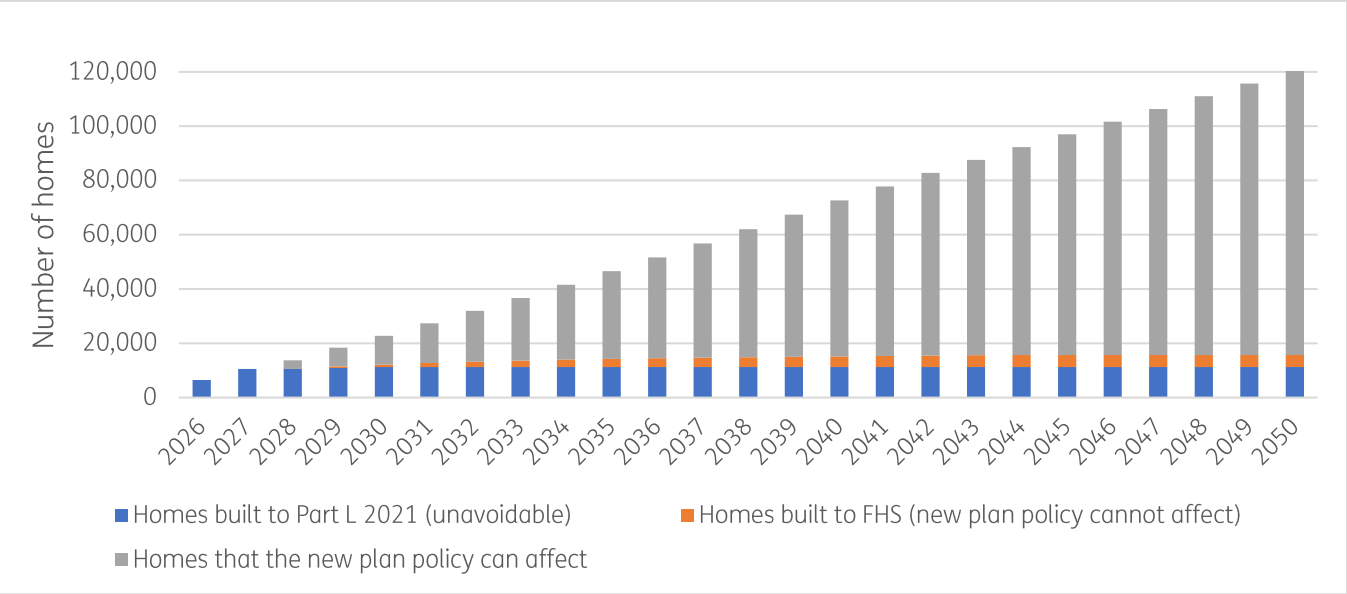


Figure 3: Illustration of Gloucestershire housing trajectory, adapted to calendar years and extended to end of carbon budget period

We assume that as each home is delivered, it is occupied and begins consuming energy in that year¹¹. Multiplying the cumulative number of new builds in each year with the energy use per home, we find the assumed total new build stock’s energy use in each year of the national carbon budget period (2026–2050 as previously noted).

Up to the end of 2027, new homes are assumed to be built to Part L 2021 standards¹² and therefore have gas boilers, resulting in associated operational emissions from gas throughout future years from those homes, as well as their electricity-related emissions. Homes from 2028 onwards are assumed to be all-electric (using electric heating not gas – as this is the specification for the FHS and all policy scenarios). Therefore:

- The total electricity use in each year (by the cumulative number of new homes completed up to that year) is multiplied by the electrical grid carbon factor for that year¹³.
- The annual gas use in each year (from the cumulative number of new homes completed up to that year) is multiplied by today’s latest available national carbon factor for natural gas use today^{viii}. There is no national projection dataset for future gas grid decarbonisation, therefore the same gas carbon factor is used for every year. As previously noted, the only new-build homes that have gas use are those built to Part L 2021 standard (here assumed to apply to all that are built from 2026-2027).
- The annual electricity-related emissions and the annual gas-related emissions of all ‘new build’ homes are summed together to get the operational carbon emissions of the cumulative number of new homes in each year of the carbon budget period. The

¹¹ This avoids the potential error of assuming all homes are using energy from the first year of the plan period. We recognise there may also be some cases where newly completed homes may have a period of non-occupation for marketing; yet such incidences should be rare and short if the housing demand is as urgent as stated by industry and government, especially given that [significant proportions of new builds are sold before completion](#).

emissions in each year can then be summed to give the total operational carbon emissions from new builds completed within the carbon budget period.

	Unit	Baseline scenario (FHS)	True Net Zero EUI-based policy
Total operational carbon emissions to end of 2050, from new housing that local plans can affect (ktCO ₂ e)	ktCO ₂ e	2.18 kt	-21.77 kt
Total operational carbon emissions to end of 2045, from new housing that local plans can affect (ktCO ₂ e)		1.84 kt	-18.40 kt

¹² This is because the Future Homes Standard was published on 24 March 2026 and confirms that it will first enter force on 24 March 2027. Yet as previously noted, it allows buildings to avoid meeting the new standard so long as their full plans are submitted before 24 March 2027 and construction begins no more than a year later.

¹³ See Appendix 2.

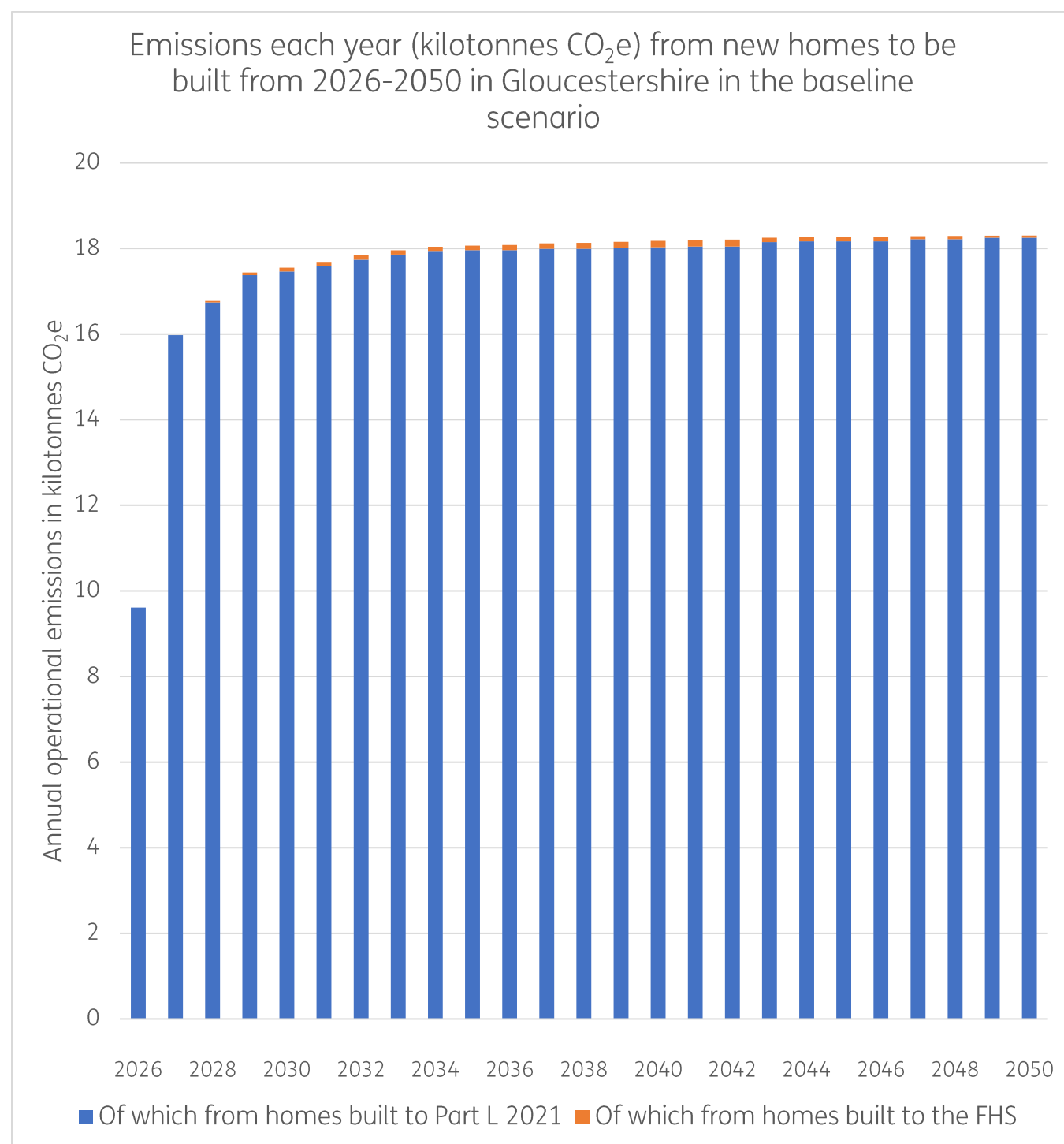


Figure 4: Annual operational emissions in each year from the growing stock of homes completed from 2026 onwards in Gloucestershire, under the assumed “no local policy” scenario

This first graph (Figure 4) shows the annual operational emissions in each individual year from all homes completed in Gloucestershire from 2026 onwards, under the assumed “no local policy” scenario, in absence of a policy requiring any improvement on Building Regulations standards for energy performance. In other words, each bar shows the emissions occurring in that year from the growing stock of new homes completed since 2026, rather than only the

emissions from homes completed in that specific year. Blue sections represent homes built to Part L 2021 standard (assumed here for all homes built up to end of 2027), while light orange bars represent homes built from 2028 onwards to the FHS. As Part L 2021 has gas heating, this means that the overall emissions are dominated by those Part L 2021 homes despite them only representing 3.36% of the total new-built homes represented here. This is because the Part L 2021 homes’ net energy use is dominated by gas usage. There is no future projection for gas grid decarbonisation, whereas there is for the electricity grid. Part L 2021 homes also generate renewable electricity from their rooftop PV, and the energy modelling figures indicated that the amount of electricity use was less than the amount of PV electricity generation, but this was nowhere near enough to offset the emissions of these homes’ gas usage. By contrast, the FHS is all-electric (gas-free). This graph therefore also reveals how grid decarbonisation changes the emissions of the FHS homes that would have been built up to each year (see the gradual change in the size of the orange bars). Decarbonisation of the grid electricity in each year means that the amount of carbon ‘saved’ per unit of PV energy sent to the grid is reducing annually.

The second graph (Figure 5) shows the running cumulative total of emissions from the same homes over time. Each bar therefore adds that year’s emissions to the emissions already produced in previous years, showing the total carbon-budget impact by each year. This demonstrates that, even where many homes move onto the FHS from 2028 onwards, the operational emissions from new homes still accumulate to a significant total over the local and national carbon-budget periods. As previously noted, under the no local policy scenario, total emissions from new-build homes would reach 346.78 kilotonnes CO₂e over 2026–2045 and 437.88 kilotonnes CO₂e over 2026–2050. The Government has described the FHS as “net zero carbon ready” because it is all-electric and will therefore gradually decarbonise along with the grid. Yet 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 by 2050, although it is projected to get very low in the mid-2030s.

In this modelled scenario for Gloucestershire, most of the emissions in this period come from the unavoidable Part L 2021 homes. This is because, although the flat archetype retains some net energy use under the FHS scenario, the energy modelling underpinning this analysis found that all **house archetypes**, which are expected to make up the greater share of new homes across Gloucestershire, generate slightly more electricity from on-site PV over the course of a year than they consume annually. The modelling reflects the published requirement for solar PV, under which the required level of generation is determined with reference to the building’s ground floor area and the actual PV provision must achieve the corresponding notional annual generation. As shown in Figure 4, homes built to the FHS therefore make a relatively small additional contribution to annual emissions compared with homes built to Part L 2021, while Figure 5 shows how emissions from successive years of new development accumulate over the carbon budget period. The figures should nevertheless be understood as modelled outcomes based on the representative Gloucestershire archetypes and their assumed PV provision; actual energy use and renewable generation will vary between developments according to factors such as dwelling type, building form, roof configuration, orientation and overshadowing.

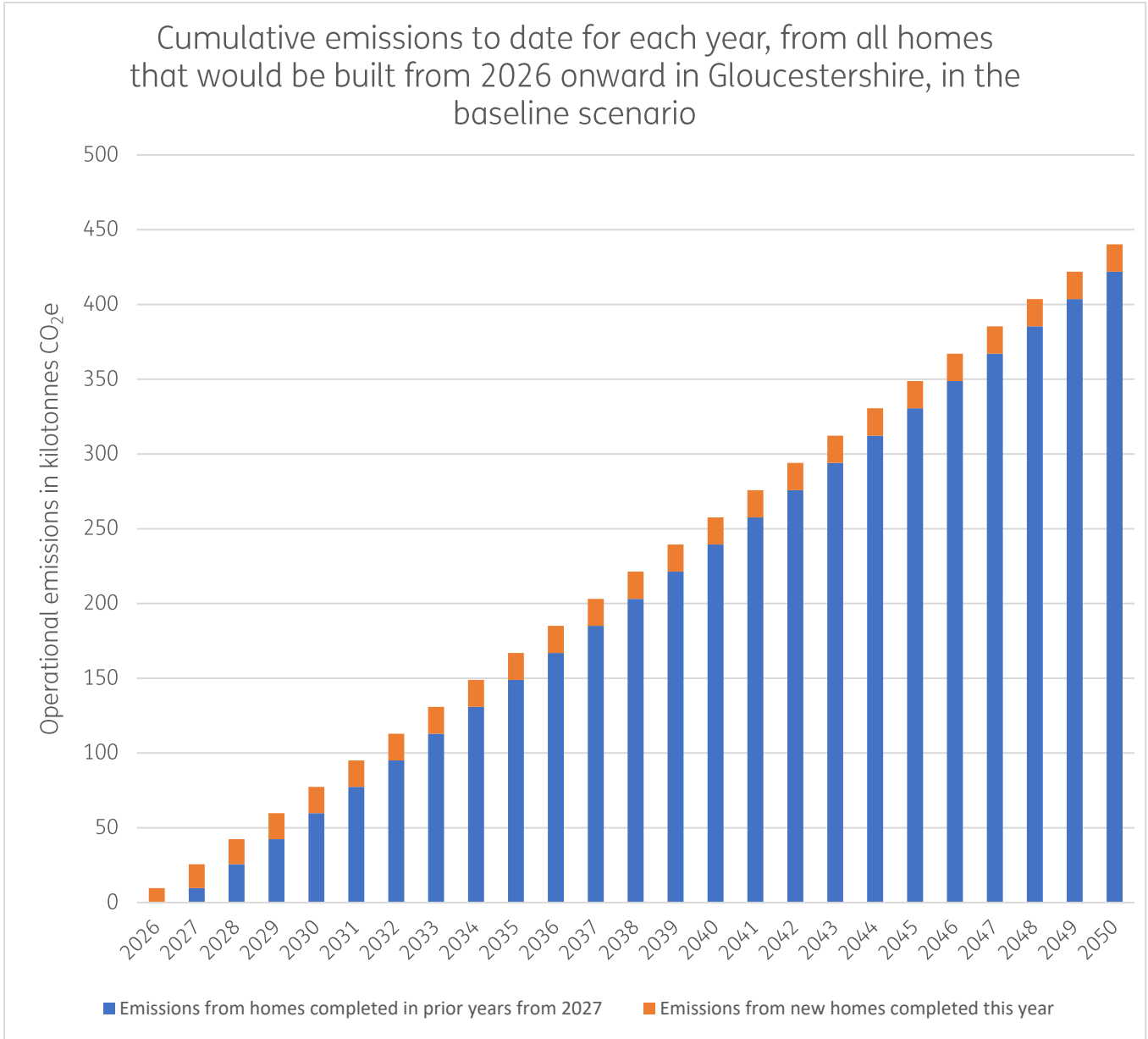


Figure 5: Running cumulative operational emissions to date from homes completed from 2026 onwards in Gloucestershire, under the assumed “no local policy” scenario).

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, as a share of local and national carbon budgets (and eventual net zero 2050 goal) set within the Climate Change Act 2008.

2. Setting a carbon budget for Gloucestershire

Importance of setting a carbon budget

The exercises in this section are crucial to determine whether the ‘True Net Zero EUI’ policy scenario is necessary for Gloucestershire to sufficiently contribute to the legislated national carbon budgets through to the local and national net zero target date of 2050, by staying within its share of those legislated national carbon budgets. 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 and 2026 (i.e. proactively and in line with the Climate Change Act), as the Climate Change Act includes the national carbon budgets.

To fulfil the NPPF 2026’s expectation to demonstrate local circumstances to justify the policy, the estimated emissions with and without the policy (identified in Section 1) can be compared against the carbon budget that is available for the operational emissions of new build homes in Gloucestershire, as set by the carbon budget identified in this section.

By testing these policy scenarios against the available carbon budget, it can be determined whether the ‘True Net Zero EUI’ policy is justified and required for the new housing sector to sufficiently contribute to climate change mitigation. If it is found that the ‘True Net Zero EUI’ policy scenario stays within the carbon budget, while the baseline (FHS) scenario fails to do so, this would demonstrate clear local circumstances to justify divergence from the WMS in pursuing the ‘True Net Zero EUI’ policy scenario.

Net zero context for Gloucestershire

Gloucestershire County Council declared a climate emergency on 15 May 2019^{ix,x}. All local authorities in Gloucestershire also declared climate emergencies by October 2019 and in 2023, Gloucestershire County Council and all six of the local authorities in the county signed an agreement to **achieve net zero across the county by 2045^{xi}**. For the specific scope of this study, net zero operational carbon in new build housing¹⁴, it is therefore, both locally and nationally important to consider what policy requirements are aligned achieving 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 goal), states that new build homes should be net zero from no later than 2025^{xii}. Prior analysis^{xiii} had shown that this will need to include that new homes achieve a space heating demand of 15-20 kWh/m²/yr. The ‘True Net Zero EUI’ policy scenario requires that all new housing achieves exactly these two points, and is thus aligned with national legislated carbon goals and the local net zero 2050 aspiration.

¹⁴ The 2023 WMS applied specifically to energy efficiency standards in new-build housing, asking that these be expressed in terms of TER, which relates to operational carbon from regulated energy only. NPPF 2026 Policy PM13 now applies more broadly to quantitative standards covering matters addressed by Building Regulations, including energy efficiency, although its specific requirement to express standards as a percentage uplift of TER calculated using SAP or another approved methodology is framed in relation to dwellings. Operational carbon is any carbon emitted during the occupancy of a building.

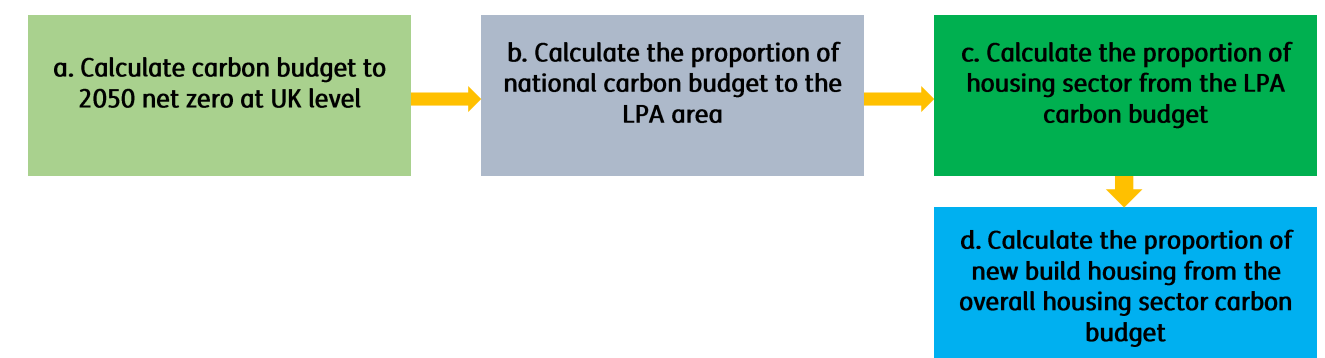
It is crucial that local plans fulfil their mandate to contribute to the national legislated Climate Change Act target of 2050 (and legislated carbon budgets). As per the NPPF (cited above), it is the responsibility of local authorities to ensure their plan *proactively* plays its fair role in this. 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 be less 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 in line with those carbon budgets set via the Climate Change Act.

Carbon budget methodology

The first step in determining whether any of the policy scenarios (‘True Net Zero EUI’ policy scenario or an baseline (FHS) scenario) would ensure new build housing is compatible with local and national carbon goals is to rationally establish a specific carbon budget for new build housing in the carbon budget period through to 2045 and 2050.

The established carbon budget will reflect the local net zero 2045 goal and the national 2050 goal. The policy scenarios will be compared against this budget. This local carbon budget does not assume any level of plan policy ambition. Rather, it represents the maximum allowable emissions to align Gloucestershire’s anticipated housing growth with the Climate Change Act.

While NPPF 2026 Policy PM13 applies more broadly to quantitative standards set through development plan policies, its specific TER/SAP formulation for energy-efficiency standards is framed in relation to dwellings. Accordingly, and consistent with the scope of the residential operational-energy analysis, the carbon budgets derived here represent the maximum allowable emissions associated with operational energy use in new-build housing in Gloucestershire; embodied carbon, existing buildings and non-residential development are considered outside this calculation.



Energy efficiency is using less energy to achieve the desired result (in this case, homes that function well for their occupants, including remaining at a comfortable temperature year-round).

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

Our first step is to identify the remaining carbon budget at a national level through to the net zero date of 2050.

We here reflect the actual legislated carbon budget figures where those are available (all years up to 2042). The actual budget for the 2043-2050 period has not been defined by the CCC and won't be until the 8th and 9th Carbon Budget reports in a few years. For the purposes of this local carbon budget exercise, these figures for 2043-2050 have been indicatively derived from the Balanced Pathway trajectory. In short, this reflects Climate Change Committee reports on the Balanced Pathway to Net Zero in 2043-2050, adjusted by the % by which the legislated carbon budgets have historically differed very slightly from the 'Balanced Pathway' figures. See Appendix 3 for more detail on this.

Our resulting overall carbon budget value for the entire UK, on its path from 2026 to net zero by 2050, is therefore 4,180.8 MtCO₂e.

Period	Budget source	Carbon budget (MtCO ₂ e)	Average/yr (MtCO ₂ e/yr)
2026–2027	Remainder of 4th Carbon Budget (2026 to 2027 total = 705.70 MtCO ₂ e; actual emissions in 2023+2024+2025 totalled 1244.30. 1950 – 1244.30 = 705.70)	705.7	390/yr across whole CB; 353/yr in 2026-2027
2028–2032	5th Carbon Budget (legally binding)	1,725	345
2033–2037	6th Carbon Budget (legally binding)	965	193
2038–2042	7th Carbon Budget (legally binding)	535	107
2043–2050	Not officially budgeted, but assume the following based on CCC “Balanced Pathway” annual emissions figures in each year (summing to 250.1 MtCO ₂ e):		
	2043: (65.29 x 103.1%)	65.3	
	2044: (54.07 x 103.1%)	54.1	
	2045: (42.47 x 103.1%)	42.5	
	2046: (33.33 x 103.1%)	33.3	
	2047: (24.58 x 103.1%)	24.6	
	2048: (16.09 x 103.1%)	16.1	
	2049: (7.99 x 103.1%)	7.9	
	2050*: (-1.11 x 103.1%)	-1.1	
Total		4,180.8	n/a

The local carbon budget for Gloucestershire is set by applying a linear trajectory from 352.85 MtCO₂e/yr in 2025 to 0 MtCO₂e/yr for the target net zero date of 2045, shown in the table below. At this point in the process, national emissions values are still being used as the starting point, but it is important to set the target date correctly before portioning-off the locally-specific carbon budget value in the next stage.

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. However, in the national Balanced Pathway, residential buildings are not one of the sectors expected to have significant residual emissions in 2050. 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 apparent in 2050, 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 ₂ e)	% reduction vs 2026
2026	352.85	0.00%
2027	334.28	-5.26%
2028	315.71	-10.53%
2029	297.14	-15.79%
2030	278.57	-21.05%
2031	259.99	-26.32%
2032	241.42	-31.58%
2033	222.85	-36.84%
2034	204.28	-42.11%
2035	185.71	-47.37%
2036	167.14	-52.63%
2037	148.57	-57.89%
2038	130.00	-63.16%
2039	111.43	-68.42%
2040	92.86	-73.68%
2041	74.28	-78.95%
2042	55.71	-84.21%
2043	37.14	-89.47%
2044	18.57	-94.74%
2045	0.00	-100.00%
Total	3,528.48 MtCO ₂ e	

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¹⁵ 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

b. Deriving Gloucestershire’s share of the total national carbon budget

This next step identifies what share of national carbon budget value can reasonably be assumed to be available for this local area.

A reasonable principle is to assume that each local area’s respective share of current national emissions will continue into the future¹⁵. Therefore it is necessary to identify what % this local area’s current emissions contribute to current national emissions, using the DESNZ UK Local Authority GHG Emissions [dataset](#) (2026 is the latest release; 2024 latest emissions values).

For Gloucestershire, this calculation is 3,338.3 ktCO₂e (Gloucestershire annual emissions total) divided by 351,272.8 ktCO₂e (UK annual emissions total) = **0.95%**.

0.95% is therefore applied to the national carbon budget value (from the previous stage of this report), to represent the specific carbon budget for Gloucestershire. This results in the following carbon budget share for Gloucestershire:

- Carbon budget to net zero 2045 local goal: **33.53 MtCO₂e** (0.95% of 3,528 MtCO₂e)
- Carbon budget to net zero 2050 national goal: **39.73 MtCO₂e** (0.95% of 4,180 MtCO₂e)

c. Deriving the housing sector’s share of the total local carbon budgets

This step apportions a share of the aforementioned total Gloucestershire carbon budget to the housing sector in Gloucestershire. As per the previous stage, here the housing sector is apportioned a share that reflects the housing sector’s existing share of existing total Gloucestershire emissions, based on DESNZ UK Local Authority GHG Emissions [dataset](#) as previously cited.

The share of emissions made up by each local sector can vary year-by-year due to shocks such as the COVID lockdowns (which strongly reduced transport emissions for one year). To avoid such distortions, instead of using the single latest year’s data to base the local sectoral breakdown, 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 Gloucestershire’s typical total emissions.

In Gloucestershire, 2015-2024 average annual housing emissions were 936.9 ktCO₂e, whilst Gloucestershire’s average annual total emissions were 3845.8 ktCO₂e. Thus the housing sector contributes 24.36% to Gloucestershire’s total emissions.

- This 24.36% value is therefore applied to the local carbon budget value from the previous step.
- 33.53 MtCO₂e (total local share of national carbon budget value 2026 to 2045) x 24.36% = **8168.80 ktCO₂e** is the local carbon budget for housing in 2026 to 2045.

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 (e.g. in Rugby’s case, heavy industrial emissions, most likely from a cement plant).

- 39.73 MtCO₂e (total local share of national carbon budget value 2026 to 2050) x 24.36% = **9679.06 ktCO₂e** is the local carbon budget for housing in 2026 to 2050.

d. 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 steps are to separate the housing sector carbon budget between existing housing and new-builds, and then to further separate out the *avoidable* new build housing emissions. This last step is to focus in on only what local plans' new-build housing policies can affect.

Firstly, the expected emissions from existing homes and new build homes throughout local and national carbon budget periods (2026-2045; 2026-2050) are calculated. The new homes are then separated into 'avoidable emissions' (those that this policy can affect) and 'unavoidable' (those that this policy cannot affect). Note that the 'unavoidable' category includes any homes that would be built during the plan period that will not be affected by the policy (due to holding existing permission). "New housing avoidable emissions" therefore will only consist of homes that can be influenced by the policy.

Hence, the % split between the expected emissions from existing homes (all unavoidable), new build homes with unavoidable emissions, and policy-affectable new build homes from 2026 to the net zero target date in the baseline scenario, are identified. This will be the % split that will be applied to the previous stage's housing sector total carbon budget value. By applying this % split, the value apportioned to "policy-affectable new build homes" forms the final carbon budget value to assess policy scenarios within.

Unavoidable emissions - Existing housing built before the carbon budget period

To calculate the expected emissions from actual existing homes within the carbon budget periods, we first needed to determine the figure for the existing housing stock.

The latest MHCLG live housing stock figure for 2024 (310,474 dwellings) is a March 2025 snapshot and therefore excludes homes completed from 1 April to December 2025. These April-December dwellings are thus not included in the official 'existing housing stock' baseline.

However, emissions arising in 2025, including those from homes completed during that year, are already captured within the 2025 national emissions (which were deducted from the national 2023-2027 carbon budget as described in previous step 2.a.) and local energy use data (that were used to derive the local share of the carbon budget). Yet, as the homes built in 2025 were built gradually throughout the year and therefore were not all in use for the full year, the 2025 national emissions did not fully capture what the energy use of those homes would be in all future years. For this reason, we need to separate those 2025 homes from the 2025 'existing housing' baseline so that their full annual energy use can be separately accounted for as Part L 2021 'new homes' for all subsequent years of the plan period. Hence, homes built in 2025 are subsequently included in 2026 'new homes'. The 2025 'existing

housing' baseline, as above, is a snapshot of March that year, therefore would have only captured the homes that were built in the first quarter of the year. Utilising the proxy of new-build home EPCs issued in Q1 2025, that number of new-builds was 662. Therefore:

- 310,474 (existing housing stock March 2025) – 662 (2025 Q1 new homes built, which are instead treated in the 'new homes' figure) = 309,812

We use actual local domestic energy consumption data as the basis for the prediction of emissions of the existing housing stock throughout the carbon budget period. The latest available figures on local energy consumption reflect 2024. It is important to note that the new homes built since 2025, would have been built to current building regulations (Part L 2021) therefore would have a different energy use profile than the rest of the local existing housing stock, most of which is much older and thus less efficient especially in terms of heating use. Moreover, as those new-build homes in 2025 would have been delivered gradually throughout the year and not occupied from 1st Jan 2025, the 2025 energy consumption figures would not reflect the amount of energy use that these homes will have when occupied for a full year. Therefore, for year 2026 onwards, when calculating the energy use of Gloucestershire's existing housing we utilise the *per-home* consumption figures from year 2024 so as to exclude the impact of energy use of the homes that were built in 2025. This 2024 energy use data is the final year that represents the energy performance of the housing sector before those 2025 new-build homes existed. It is as follows:

- In Gloucestershire the average 2024 electricity consumption (per existing home, annual) was 3,571 kWh and gas consumption 8,417 kWh (per existing home, annual, domestic standard meters)¹⁶.
- Multiplied by local existing housing stock of 309,812 homes¹⁷ built before 2025, this makes 2,607,708,917 kWh of electricity use and 1,106,462,683 kWh of gas use per year across pre-existing housing in Gloucestershire from 2026 onwards. In this first instance, these figures are assumed to continue throughout the carbon budget period.

To calculate the greenhouse gas emissions of this energy use by existing homes in each year, these consumption values are multiplied by the relevant carbon factors, using UK Government datasets for electricity (Table 1; Grid average, consumption, domestic) and gas (Fuels tab; natural gas; gross CV) for years 2026-2050.

- The electricity factor includes future grid decarbonisation, whereas no such decarbonisation projections exist for the gas grid¹⁸.
- The gas-related emissions and electricity-related emissions are then summed to identify the total emissions of the existing housing (built before 2025) in each year of the carbon budget study period.
 - As a result, the emissions of these existing homes built before the carbon budget period is predicted at 583,845 tonnes in 2026, falling to 484,263 tonnes in 2045

¹⁶ Per-home figures derived by dividing the Gloucestershire 2024 total domestic gas and total domestic electricity use by the number of homes in Gloucestershire in 2024 from [MHCLG live tables on housing stock](#).

¹⁷ As previously described

¹⁸ This means that while the emissions from electricity fall steadily in each year even if electricity use remains static, the emissions from gas are equal in each year of the carbon budget period.

and 478,731 tonnes in 2050 because of the future electricity grid decarbonisation.

Summing each of the years in the carbon budget periods from the housing stock of 309,812 homes gives a cumulative total of:

- 10,197,555 tonnes (10,197.56 kt) of emissions in 2026-2045
- 12,601,167 tonnes (12,601.17 kt) of emissions in 2026-2050

Crucially, this reveals that the predicted emissions from existing housing built prior to the carbon budget periods already exceed the available Gloucestershire housing sector carbon budget previously identified, by

- 25% for 2026-2045 local carbon budget period
- 30% for 2026-2045 national carbon budget period

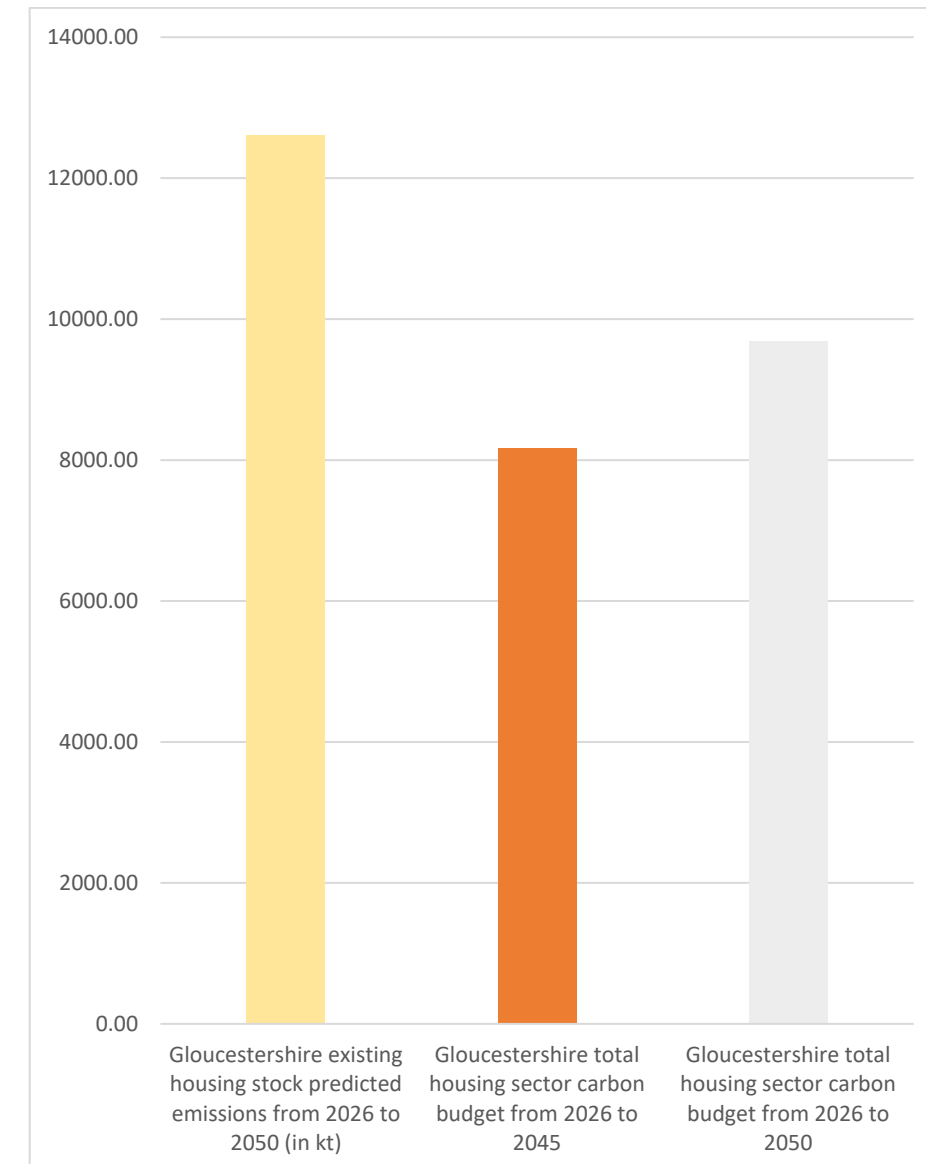


Figure 6: Comparison between predicted emissions of existing homes and total housing sector carbon budget in Gloucestershire from 2026 to 2045 and 2050 (in kt)

Taken at face value, this would imply that there is no room in the carbon budget for any new homes. However, other than grid decarbonisation, these figures do not assume any future changes to existing homes, e.g. energy efficiency retrofit or switching from gas to electric heating. Realistically it is likely this will occur to some extent. Therefore, the next step divides the total available local housing carbon budget between policy-affected and non-affected homes (of which the latter includes these existing homes), in proportion to what their predicted emissions would be in the absence of policy. This has the effect of assuming that both the pre-2026 and post-2026 homes will undergo some degree of future improvement versus their current energy use profile, especially in pre-2026 existing housing (well beyond the electricity grid decarbonisation that has already been factored into the predicted emissions), to make room in the budget for the emissions of new homes.

‘Avoidable’ and ‘unavoidable’ emissions from housing built during the carbon budget period

To recap: ‘Avoidable’ and ‘unavoidable’ here refer to whether new local plan policies for new housing has the opportunity to prevent the emissions of these homes or not.

Of the homes built during the carbon budget period, we assume that those built up to end of 2027 would meet Part L 2021 standard, and those built from 2028 onward would meet the FHS (as per the [previous section](#)) in the baselinescenario (i.e. in the absence of any local plan policy on energy / carbon performance). As previously noted, new local plans are expected take effect for planning decisions only from 2028 onwards, therefore any homes built before then *and* any homes that have full planning permission already would follow the ‘business as usual’ path. It is also worth noting that even after 2028, homes that already have with full planning permission would still follow Part L 2021 standard (as it is expected that construction would start before the FHS transition period ends in March 2028, and a typical 12-month construction period would mean these would start to be delivered in 2029. This should mean that few, if any, homes are completed to Part L 2021 from 2030 onwards). In the housing trajectory figures received from Climate Leadership Gloucestershire on behalf of the relevant local districts (Cheltenham, Gloucester, Forest of Dean, Stroud, Tewkesbury), only a very small number of proposed new homes already hold *full* permission *and* are stated to be delivered in 2029-2030¹⁹. Those that currently only hold *outline* permission are assumed follow the FHS from 2028 along with all other new builds.

The weighted average energy use figure from the four archetypes (noted [previously](#)), is reflective of an average new-build home in Gloucestershire, based on what is known about the typical split of housing types in Gloucestershire. As [previously described](#), based on housing growth values from 2026 onwards, the cumulative emissions for homes built in Gloucestershire from 2026 are calculated as follows in the baseline scenario.

For local carbon budget period of 2026-2045:

- Unavoidable emissions for new homes built in 2026 until end of 2027 and those that have ‘full plans’ permission already (therefore meeting Part L 2021): **346.78 ktCO₂e**
- Unavoidable emissions for new homes built from 2028 onwards (built to Future Homes Standard; these are policy-unaffected homes due to prior permission): **0.16 ktCO₂e**
- Avoidable emissions for homes built from 2028 (policy affectable-homes, but built to the FHS in this baseline scenario): **1.84 ktCO₂e**.

For national carbon budget period of 2026-2050:

- Unavoidable emissions for new homes built in 2026 until end of 2027 and those that have ‘full plans’ permission already (therefore meeting Part L 2021): **437.88 ktCO₂e**
- Unavoidable emissions for new homes built from 2028 onwards (built to Future Homes Standard; these are policy-unaffected homes due to prior permission): **0.1kt8 CO₂e**
- Avoidable emissions for homes built from 2028 (policy affectable-homes, but built to the FHS in this baseline scenario): **2.18 ktCO₂e**.

Adding together the aforementioned *existing homes cumulative emissions* over the respective carbon budget period to that of homes built during carbon budget periods, this gives the following total housing sector emissions figures:

- 2026-2045: 10,197.55 ktCO₂e (existing homes) + 346.78 ktCO₂e + 0.16 ktCO₂e + 1.84 ktCO₂e = **10,546.34 ktCO₂e**
- 2026-2050: 12,601.17 ktCO₂e (existing homes) + 437.88 ktCO₂e + 0.18 ktCO₂e + 2.18 ktCO₂e = **13,041.40 ktCO₂e**

Based on the cumulative emission calculations for the carbon budget period, the respective % contributions from each housing segment to overall expected housing sector emissions in the 2026-2045 carbon budget period are:

- From existing housing built before 2026: 10,197.55 / 10,546.34 = 96.69%
- From new-build homes built to Part L 2021 (those built in 2025 to end of 2027 and homes built in 2028-2029 with prior full permission): 346.78 / 10,546.34 = 3.29%
- From policy-unaffected homes built from 2028 (unavoidable FHS): 0.16 / 10,546.34 = 0.002%
- From policy-affectable homes built from 2028 onwards (avoidable FHS, ‘no-policy’ scenario: 1.84 / 10,546.34 = **0.017%**.

Similarly, the respective % contributions from each housing segment to overall expected housing sector emissions in the 2026-2050 carbon budget period are:

- From existing housing built before 2026: 12,601.17 / 13,041.40 = 96.62%
- From new-build homes built to Part L 2021 (those built in 2026 to end of 2027 and homes built in 2028-2029 with prior full permission): 437.88 / 13,041.40 = 2.45%
- From policy-unaffected homes built from 2028 (unavoidable FHS): 0.18 / 13,041.40 = - 0.001%
- From policy-affectable homes built from 2028 onwards (avoidable FHS, ‘no-policy’ scenario: 2.18 / 13,041.40 = **0.017%**.

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 Gloucestershire 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 policy-affectable new homes’ % of actual predicted emissions, as above.

Applying this % contribution to the previously identified 2026-2045 and 2026-2050 Gloucestershire housing sector carbon budget values, results in final carbon budgets for each housing segment as follows:

For 2026-2045 local carbon budget period:

- Existing housing: 8,168.80 ktCO₂e x 96.69% = **7,898.65 ktCO₂e**.
- Homes built until end of 2027 (Part L 2021 homes, unavoidable):

¹⁹ This number is only 314 in 2029, which is only 4% of the unavoidable Part L 2021 homes and 2% of the total new build homes that the policy cannot affect in both carbon budget periods.

- 8,168.80 ktCO₂e x 3.29% = 268.60 ktCO₂e.
- Policy-unaffected (unavoidable FHS) homes built from 2028 onwards: 8,168.80
ktCO₂e x 0.002 % = 0.13 ktCO₂e.
- Policy-affectable homes built from 2028 onwards: 8,168.80
ktCO₂e x 0.017 % = 1.43 ktCO₂e.

For 2026-2050 local carbon budget period:

- Existing housing: 9679.06 ktCO₂e x 96.62% = 9,352.32 ktCO₂e.
- Homes built until end of 2027 (Part L 2021 homes, unavoidable):
9679.06 ktCO₂e x 3.36% = 324.98 ktCO₂e.
- Policy-unaffected (unavoidable FHS) homes built from 2028 onwards: 9679.06
ktCO₂e x 0.001% = 0.13 ktCO₂e.
- Policy-affectable homes built from 2028 onwards: 9679.06
ktCO₂e x 0.017% = 1.62 ktCO₂e.

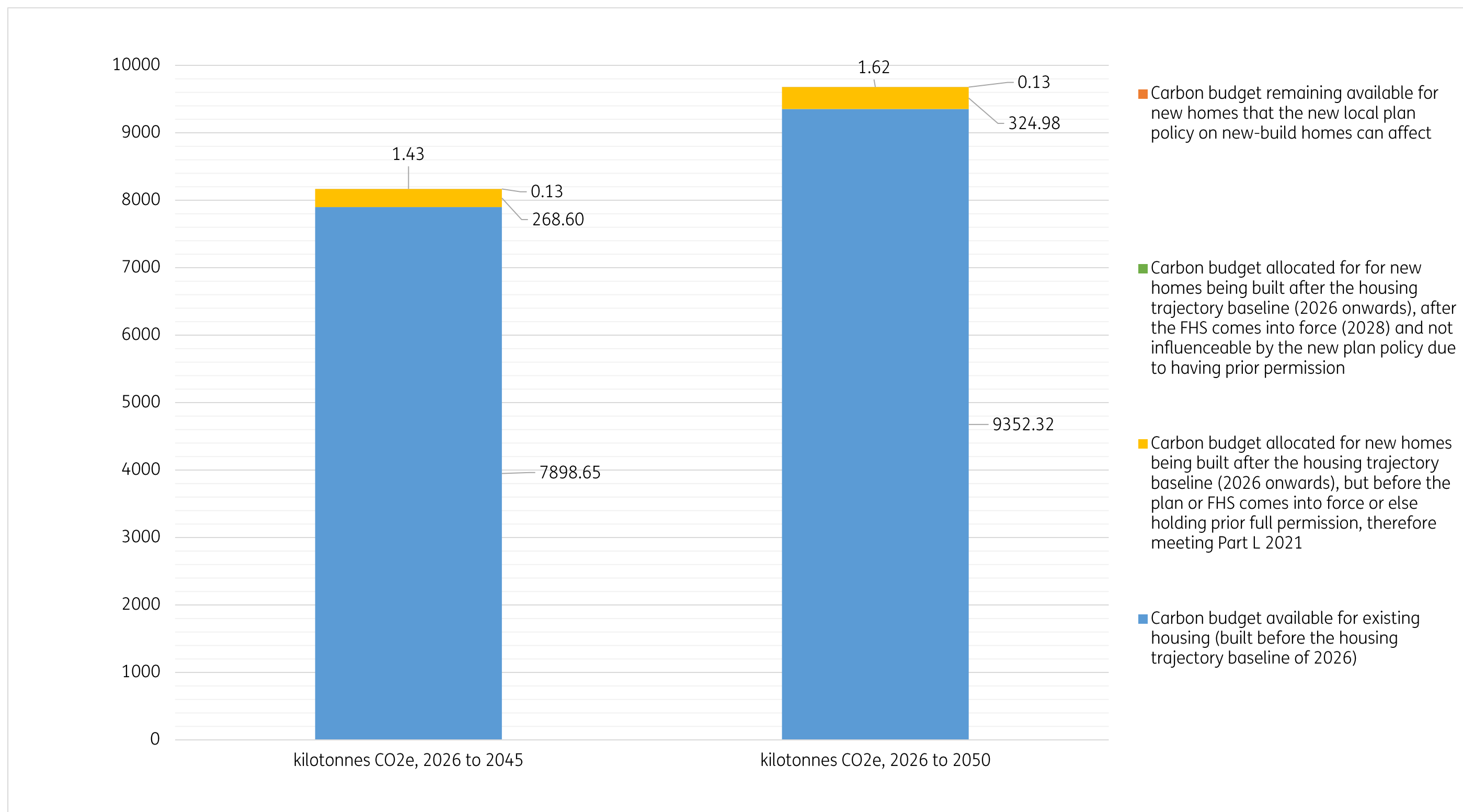


Figure 7: Available carbon budget in 2026-2050 and 2026-2050 for operational emissions of different parts of the housing sector in Gloucestershire, derived from national carbon budgets as previously described.

3. Conclusion to determine alignment with net zero targets

Headline conclusions

The aim of this report has been to determine whether either of the two policy approaches (baseline scenario, or a ‘True Net Zero EUI’ policy scenario), would keep new homes within the remaining carbon budget available for new build housing in Gloucestershire in 2025-2045 and 2025-2050:

- This is crucial to the question of whether each policy scenario will ensure that housing development in Gloucestershire would “contribute to the mitigation of climate change” as per the local plans’ 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” (NPPF 2024; NPPF 2026).
- These figures provide an illustration of local circumstances that further justify policy going beyond Building Regulations.

	Unit	Available carbon budget	baseline (therefore FHS)	True Net Zero EUI-based policy
Total operational carbon emissions (2026-2045) from new housing that new local plans can affect (kt CO ₂ e) (Estimated 81,317 homes delivered in this period)	ktCO ₂ e	1.43	1.84	-18.40
Total operational carbon emissions (2026-2050) from new housing that new local plans can affect (kt CO ₂ e) (Estimated 104,717 homes delivered in this period)	ktCO ₂ e	1.62	2.18	-21.77

The ‘True Net Zero EUI’ policy scenario results in notable decrease in total operational carbon emissions from new housing within both carbon budget periods, resulting in net negative emissions. The policy achieves this by ensuring that every home is extremely energy efficient to the point that its annual on-site renewable electricity generation meets or exceeds the total annual energy use. Key elements of this policy are energy efficiency metrics that cover the home’s total energy use (not just the regulated energy use²⁰) and that are demonstrated using accurate energy use prediction methods (PHPP, CIBSE TM54 or similar²¹).

²⁰ This is in contrast to the TER metric stipulated by the Written Ministerial Statement 2023 as previously noted. The TER metric by definition can only account for regulated energy uses, which make up only circa 25-75% of a building’s total energy use, depending on building type.

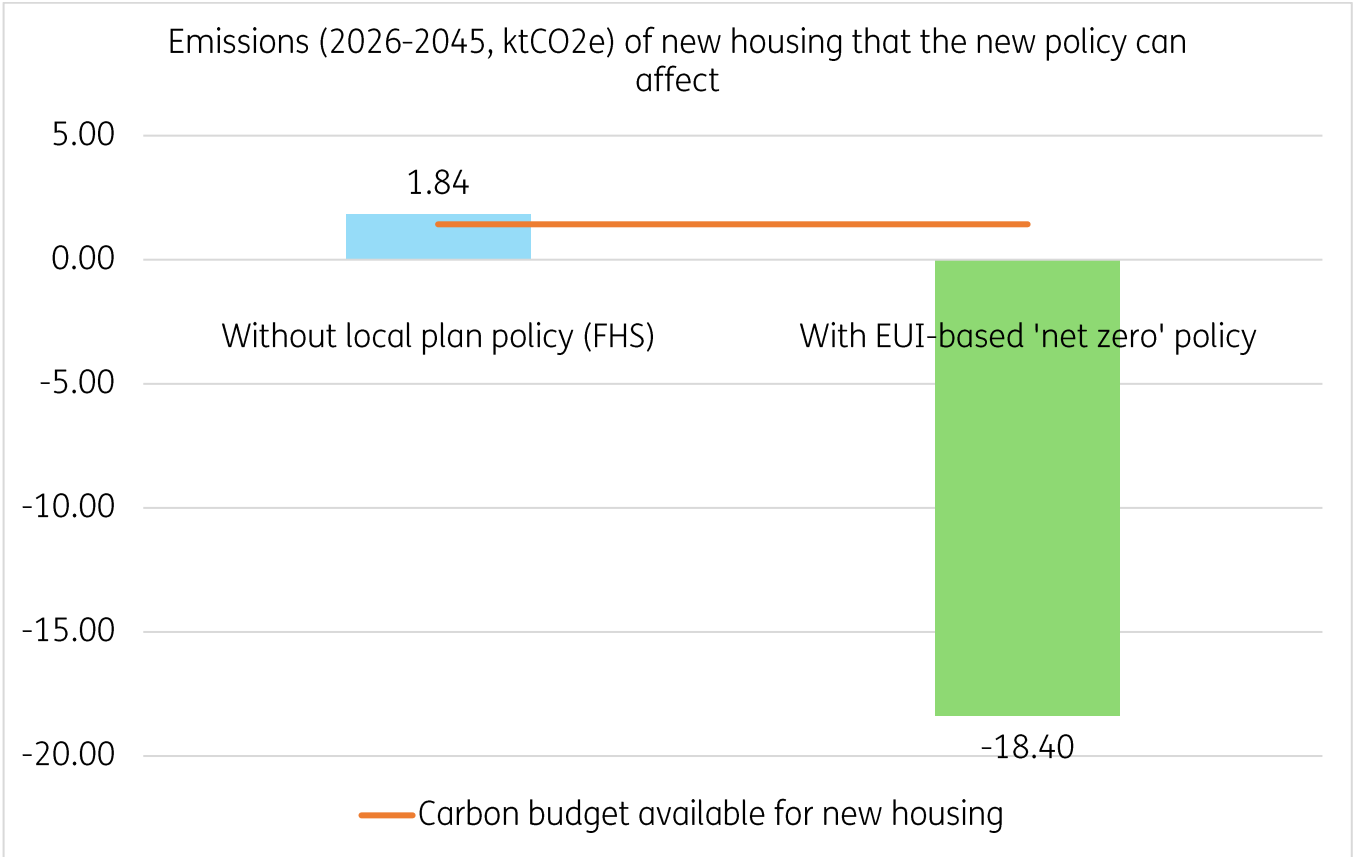


Figure 8: Chart showing the emissions of new homes built from 2026 to 2045 with and without the policy.

²¹ 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).

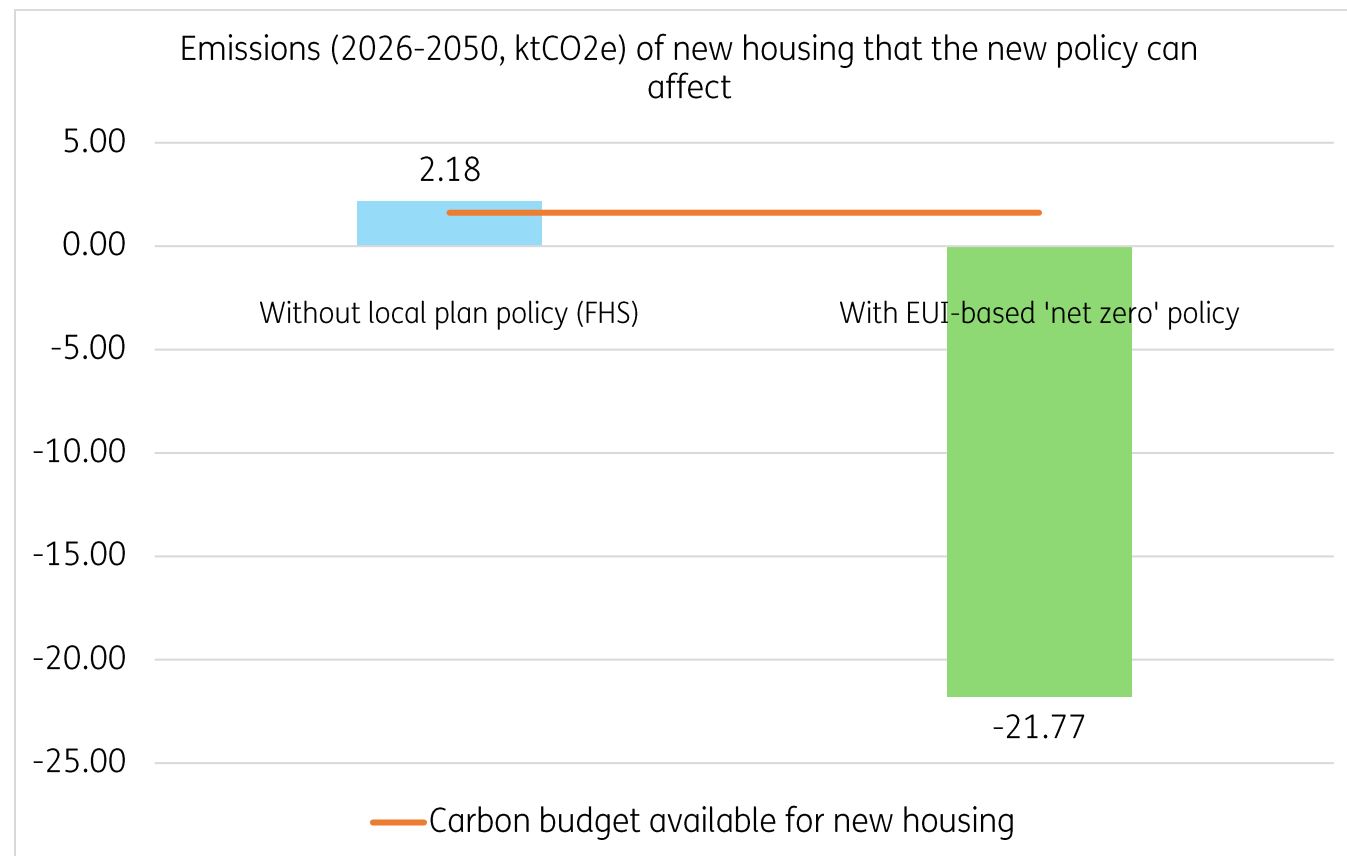


Figure 9: Chart showing the emissions of new homes built from 2026 to 2050 with and without the policy.

Figure 8 and 9 (above) show another view of the available carbon budget, allocating a share of the budget only for new housing that can be influenced by the net zero policy (i.e. 'avoidable' new homes as previously explained). Following the same previously described approach to dividing up the available carbon budget in accordance with these homes' share of total emissions in the baseline scenario:

- For 2026-2045: their share is 0.017% and the carbon budget for this housing is 1.43ktCO₂e. In the baseline scenario, these homes are built to the FHS.
- For 2026-2050: their share is also 0.017% and the carbon budget for this housing is 1.62 ktCO₂e. In the baseline scenario, these homes are built to the FHS.

Discussion

In summary, the True Net Zero EUI policy is the only policy that has negative emissions effect in both carbon budget periods to be certain of staying within the available carbon budget after accounting for margins of error. Therefore, it is the only one that contributes to counteract the locked-in excess emissions from new build homes (346.94 kt for 2026-2045; 437.88 kt for 2026-2050). These will occur from the Part L 2021 homes built in the period before FHS comes into effect and homes built in 2028-2029 with prior full permission, as previously described.

The True Net Zero EUI policy is therefore demonstrated to be the only policy approach that ‘proactively’ mitigates climate change and helps deliver the objectives of the Climate Change Act as instructed by the NPPF and helps fulfil the local plan’s legal duty to mitigate climate change.

Determining if policy-affected new housing would remain within the remaining carbon budget for new homes

For policy evaluation, it was important to reflect what the policy could influence. This is because, local authorities (Cotswolds, Cheltenham, Gloucester, Forest of Dean, Stroud, Tewkesbury) will only be able to influence emissions from new housing granted permission after the adoption of their respective local plans in the coming years. As a result, from the existing housing baseline of 2026, there will be 15,657 new homes built in Gloucestershire that will hold existing full or outline permission, thus escaping the policy. This is made up of 11,241 homes built to Part L 2021 (between 2026 and 2029) and 4,416 homes built to the FHS after the FHS transition period based on prior permission. Consequently, when dividing the carbon budget between what the new plan policy can or cannot influence, the category of ‘unavoidable/policy unaffected’ includes these 15,657 homes as well as existing homes.

As a result, the cumulative unavoidable emissions for Gloucestershire sums the cumulative emissions of the existing housing stock with the cumulative unavoidable emissions of new homes built against Part L 2021 and new homes built to FHS (2028 onwards, except for 707 homes that already hold full permission before the FHS comes into force and are assumed to commence on site before the end of the FHS transition cutoff of March 2028).

For the local carbon budget period 2026-2045:

- 10,197.55 ktCO₂e (Predicted emissions from existing housing built before 2026) + 346.78 ktCO₂e (predicted emissions from unavoidable Part L 2021 new homes) + (0.16 ktCO₂e) (predicted emissions from unavoidable FHS new homes) = **10,544.50 ktCO₂e** (Predicted total unavoidable housing emissions, not affectable by new local plan policies)
- This means that **the unavoidable emissions already exceed the total Gloucestershire carbon budget to 2045 (8,168.80 ktCO₂e) by 2,375.70 ktCO₂e.**

For the national carbon budget period 2026-2050:

- 12,601.17 ktCO₂e (Predicted emissions from existing housing built before 2026) + 437.88 ktCO₂e (predicted emissions from unavoidable Part L 2021 new homes) + 0.18 ktCO₂e (predicted emissions from unavoidable FHS new homes) = **13,039.22 ktCO₂e**

(Predicted total unavoidable housing emissions, not affectable by new local plan policies)

- This means that **the unavoidable emissions already exceed the total Gloucestershire carbon budget to 2050 (9679.06 ktCO₂e) by 3,360.16 ktCO₂e.**

Therefore, it is important that the new build home emissions that can be avoided must be actively mitigated via the policy – which would only be reliably achieved via the ‘True Net Zero EUI-based’ policy standard.

The True Net Zero EUI-based policy achieves significant negative emissions, to a scale which would offset 5.3% in 2026-2045 and 5.0% in 2026-2050 of the emissions of homes built to the Part L 2021 within carbon budget periods. The baseline scenario, although marginal, would still add to the total emissions from new build homes. Hence, the ‘True net zero EUI-based’ policy thus is the only scenario that reliably, proactively mitigates climate change.

The baseline scenario (FHS or an equivalent TER-based policy aligned to the FHS) is therefore not an appropriate policy approach to fulfil local plans’ mandate to proactively mitigate climate change in line with the Climate Change Act.

Could a TER-based policy be formulated that does better than the baseline scenario yet doesn’t go as far as the ‘True Net Zero EUI’ policy, and would this be good enough?

Clearly, this study has not attempted to test every possible formulation of a policy scenario compliant with NPPF 2026 Policy PM13, which has now superseded the relevant approach previously set out in WMS2023. It may be possible to design a PM13-compliant policy that makes to some extent more carbon savings than shown here in the baseline (FHS) scenario. However, PM13 stipulates that any energy efficiency standard going beyond current or proposed Building Regulations should be expressed as a percentage uplift of a dwelling’s TER, calculated using SAP or another approved calculation methodology. TER, by definition, does not cover the total energy use of a home and does not accurately reflect homes’ actual energy performance because of the shortcomings of SAP as previously noted in this report and in the previous overarching Literature Review report for Gloucestershire.

Therefore, a policy relying solely on PM13’s TER-based energy efficiency formulation 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 on-site solar PV provision to counteract SAP’s underestimation of energy use, which could make housing delivery unviable and might not be compatible with electricity grid constraints in some areas. By contrast, the ‘True Net Zero EUI’ policy scenario keeps energy use so low that only small amounts of solar panels on site are needed to match (and even slightly exceed) the home’s annual energy use, therefore not bringing excessive construction cost uplifts and minimising the burden that these new homes will place on the electrical grid.

Additionally, we reiterate that [the carbon budget assumed ‘available’ to policy-affectable new homes in this study depends on significant reductions in the emissions of existing homes and unavoidable Part L 2021 homes, beyond what will occur via the predicted electricity grid decarbonisation](#). It is important to focus on the fact that the predicted emissions from existing buildings alone significantly exceed the overall housing (existing and new build) carbon budget values in Gloucestershire.

- Those reductions will need to be delivered by significant rollout of energy efficiency improvements and electric heating (ideally heat pumps) to replace existing gas boilers in the existing housing stock (pre-2025) and in recent homes built to Part L 2021.
- These changes in existing housing a very uncertain prospect, with the [latest national progress report](#) 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 Gloucestershire does not occur](#), there will be no space for new homes available in the housing sector carbon budget, and in fact that housing sector carbon budget will be exceeded even just by the emissions of existing homes in the carbon budget period as follows:
 - For 2026-2045: Overall Gloucestershire housing carbon budget of 8,168.80 ktCO₂e will be exceeded by 1,339.43 ktCO₂e (25%) just by the emissions of the existing housing stock without retrofit.
 - For 2026-2050: Overall Gloucestershire housing carbon budget of 9,689.06 ktCO₂e will be exceeded by 2,922.11 ktCO₂e (30%) just by the emissions of the existing housing stock without retrofit.

We reiterate also that [these housing sector carbon budgets are derived directly from the legislated national carbon budgets](#) via a logical series of steps previously described in sections 2.a – 2.d. Remaining within these carbon budgets is untenable in light of local plans’ mandate to mitigate climate change in line with the objectives of the Climate Change Act. While these changes to existing buildings cannot be ensured by local plans (which only exerts power where permission is needed and cannot force change to happen in existing buildings), it is the responsibility of local plans to proactively take the mitigation actions that are within its power to reduce the likelihood of these carbon budgets being breached as shown here.

Given that Gloucestershire’s existing housing emissions are unlikely to remain within the available carbon budget for the entire housing sector in Gloucestershire, it is essential that new build housing adds minimal burden to remaining within the budget. It could be argued that a carbon budget of zero should be apportioned to new build housing, since the existing housing subsector is already expected to use the whole housing sector carbon budget for both local and national periods.

Local plan policies must therefore require robust targets and metrics that truly result in nearly zero carbon development, as the ‘True Net Zero EUI’ policy scenario would achieve. This is currently not achievable through a policy relying solely on NPPF 2026 Policy PM13’s TER-based

energy efficiency formulation, such as one relying on the FHS baseline, because the Target Emissions Rate calculated through SAP does not account for unregulated energy use, which can represent approximately 25–75% of operational carbon emissions in new buildings. The modelling found that ‘True Net Zero EUI’ policy scenario contributed less than zero emissions in the buildings that would be affected by the policy, which – even after the unavoidable emissions of homes that would be built to Building Regulations standards due to holding permissions/making applications before the policy is in place – results in overall much lower emissions from new build housing compared to the baseline scenario.

It is therefore explicitly apparent that new build housing must be subject to stringent policy that genuinely achieves zero carbon development in the buildings that it can influence, in order to meet local plans’ climate mitigation mandate to the extent required by the NPPF. Expressing a policy in the way that NPPF 2026 stipulates – i.e. as a percentage reduction on the TER metric calculated using SAP – would make the policy subject to the inadequacies and inaccuracies of Building Regulations metrics and SAP tool (see separate overarching literature review report). This clearly cannot be risked in light of the carbon budget analysis presented here, if the local plan is to meet its climate change mitigation mandate set by law and policy as previously described in this report and the separate literature review. This study has clearly shown that the modelled WMS-compliant policy (baseline scenario) is not appropriate to be aligned with Gloucestershire’s local net zero target nor with the UK’s legally binding targets. It is only the ‘True Net Zero EUI’ policy scenario that can be considered appropriate as a proactive mitigation step in line with the net zero targets.

Thus, this study has clearly shown that local circumstances exist to justify a locally specific approach that diverges from the TER-based formulation set out in NPPF 2026 Policy PM13, as Gloucestershire would exceed its remaining carbon budget for new-build housing by a significant amount if a policy relying solely on that approach were implemented, whilst the ‘True Net Zero EUI’ policy scenario would contribute towards the mitigation needed in the housing sector.

Appendix 1

Building specifications assumed in each policy scenario

Policy scenarios in this analysis involved a mix of three standards: Part L 2021, Part L 2026 (i.e. FHS), and “True net zero” EUI-based policy standard. Building specifications for FHS and ‘True Net Zero EUI’ policy are taken from the primary energy modelling exercise for Gloucestershire, which identified what specifications would be needed in typical new-build home types in Gloucestershire to achieve the selected energy performance targets in the policy for homes. As Part L 2021 was not part of the modelling exercise for Gloucestershire, specifications established for an adjacent local authority was used. These inputs represent different specifications set for different policy scenarios, which are the key factors that influence space heating demand, energy consumption, energy generation and resulting carbon emissions of buildings. The proposed ‘True Net Zero EUI’ policy applies the “ultra-low energy” specification to the detached house, semi-detached house and low-rise flats, and the “low energy” specification to bungalows, reflecting energy modelling finding that the bungalow’s higher form factor makes the more stringent ultra-low space-heating demand limit less feasible at scale.

We here provide an extract of four dwelling types that represent the range of difference between the specifications.

Envelope performance

	Part L 2021				FHS				“True Net Zero” EUI-based policy				
Building element	Bungalow	Detached	Semi-detached	Low-rise flats	Bungalow	Detached	Semi-detached	Low-rise flats	Bungalow	Detached	Semi-detached	Low-rise flats	
Roof U-value (W/(m².K))	0.10				0.11				0.09	0.11			
External wall U-value (W/(m².K))	0.18	0.16		0.17	0.18				0.15	0.14	0.18	0.15	
Floor U-value (W/(m².K))	0.12				0.135		0.13	0.17	0.135		0.13		
Door U-value (W/(m².K))	1.00				1.00				1.00				
Glazing U-value (W/(m².K))	1.20 (Double Glazing)				1.1 (Double-glazing)			1.2 (Double-glazing)	0.6 (Triple Glazing)			0.9 (Triple Glazing)	
Air permeability	5 m³/(m²h)				4 m³/(m²h)				1.4 m³/(m²h)	1.0 m³/(m²h)	1.4 m³/(m²h)	1.06 m³/(m²h)	

Building services

	Part L 2021				FHS				‘True Net Zero’ EUI-based policy			
Building element	Bungalow	Detached	Semi-Detached	Low-rise flats	Bungalow	Detached	Semi-Detached	Low-rise flats	Bungalow	Detached	Semi-Detached	Low-rise flats
Heat source	Gas combi boiler				Air Source Heat Pump Radiators				Air Source Heat Pump Radiators			
Ventilation	0% heat recovery with intermittent extract				Decentralised Mechanical Extract Ventilation				Mechanical Ventilation with Heat Recovery (90% efficiency)			
Renewable energy	5.85 kWp	4.95 kWp	2.70 kWp	4.50 kWp	4.7 kWp	6.26 kWp	4.1 kWp	10.5 kWp	4.7 kWp	6.26 kWp	4.1 kWp	17.2 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”^{xiv}, data tables 1-19. The relevant table is “Table 1: Electricity emissions factors to 2100, kgCO₂e/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 January 2026, 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 Gloucestershire, 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 ₂ e 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
2050	0.009
2044	0.008
2045	0.008
2046	0.008
2047	0.005
2048	0.005
2049	0.003
2050	0.003

Table 4: 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 Gloucestershire 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 been legislated up to year 2042 (the Seventh Carbon budget), and the next carbon budget is yet to be devised by the CCC.

Because the NPPF 2026 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 2042 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:

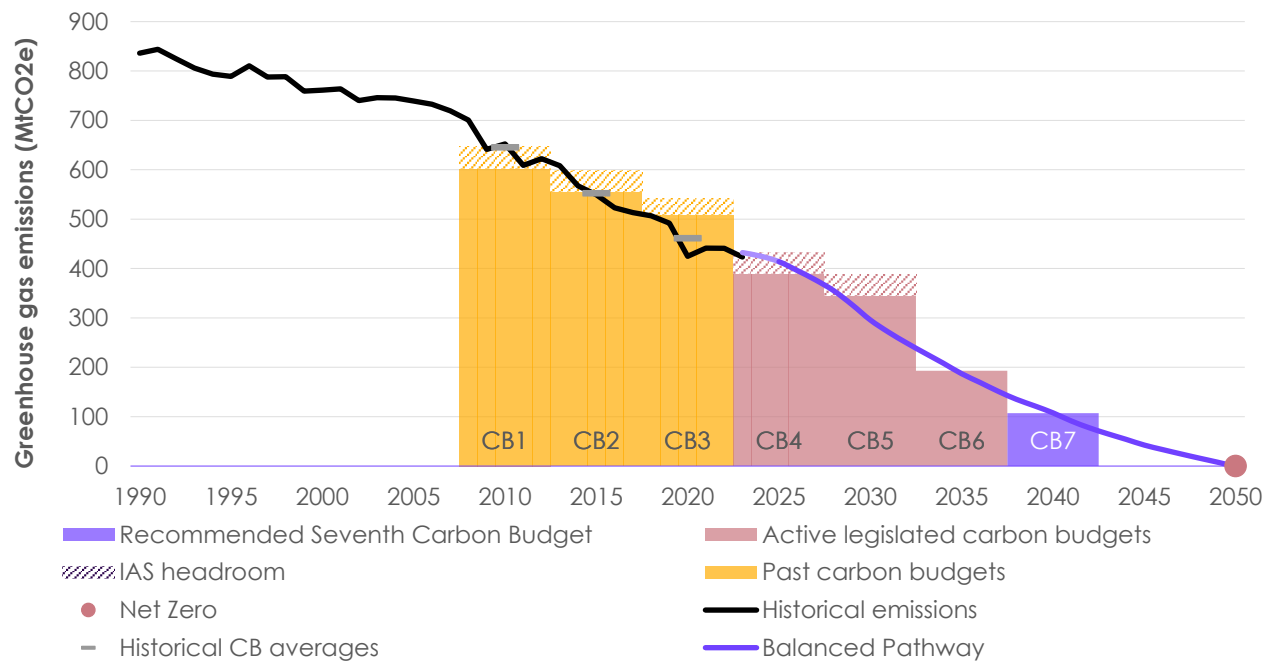


Figure 10: Legislated carbon budgets and 'balanced pathway to net zero'. “CB” = Carbon Budget. IAS = International aviation & shipping. Climate Change Committee 7th Carbon Budget, 2025

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 CO₂e:

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 MtCO₂e.

We could assume that this will be the legislated carbon budget in those years.

However, the CCC’s data also show the balanced pathway for years up to 2043, and the actual set carbon budgets. In fact, these actual carbon budgets are not precisely equal to the sum of the ‘balanced pathway’ annual emissions for the respective years in the period. The current ‘live’ carbon budget is for 2023-27. As a whole, the sum of all actual carbon budgets from today’s onwards is 3.1% higher than the sum of all ‘balanced pathway’ annual emissions figures in the same period:

-	Total MtCO ₂ e, 2023 to 2042
Sum of all “Balanced Pathway” annual emissions:	5019.3
Sum of all actual national carbon budgets: (including the 7 th carbon budget)	5175.0
Actual national carbon budgets total as a % of ‘Balanced Pathway’ total	103.1%

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 MtCO₂e x 103.1% = 250.1 MtCO₂e.

This figure of 250.1 MtCO₂e 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:

- 3930.7 (budget 2026 to 2042) + 250.1 (budget 2043 to 2050) = 4180.8 MtCO₂e.

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

Appendix 4

Derivation of Gloucestershire's total new housing delivery trajectory

Overall Approach

The carbon budget analysis requires an estimate of the number of new dwellings expected to be delivered across Gloucestershire over the assessment period, together with sufficient information on the planning status and likely delivery timing of those dwellings to determine the energy-performance standard that is likely to apply. The analysis therefore sought housing trajectory, planning-status, housing-mix and existing-stock information directly from the Gloucestershire local planning authorities. The information available varied considerably between authorities and reflected differences in the stage of plan preparation, monitoring practices and the level of detail retained in individual housing datasets. The methodology consequently followed a **hierarchy of evidence**, using the most up-to-date and locally specific information available in the first instance, and supplementing this with the **2026 Gloucestershire Housing and Economic Needs Assessment (HENA)** and other consistent datasets where local information was incomplete.

For consistency with the carbon-budget analysis, housing delivery was assessed over **2026–2045** and **2026–2050**, corresponding respectively with the Gloucestershire local net-zero target year and the national net-zero target year.

This required some standardisation because the underlying planning documents do not all use the same plan period. For example, the SLP evidence refers to a 2023–2043 plan period, while Cotswold's emerging Local Plan runs to 2043.

Where authority trajectories were expressed in **financial years**, figures were converted to calendar years on a pro-rata basis so that they could be combined with the annual carbon calculations. Where an authority's trajectory ended before 2050, the latest available annual housing requirement was used to extend the trajectory where necessary.

Authority-specific housing trajectory data

Strategic Local Plan area: Cheltenham, Gloucester and Tewkesbury

Detailed trajectory information was available through the SLP **Spatial Options Topic Paper**, including information on existing permissions. However, the overall housing figures in that document did not align with the subsequently published 2026 HENA. Following discussion with the Gloucestershire project team, the HENA was considered the more appropriate source for the overall housing quantum, while the SLP evidence was retained where useful for understanding existing commitments.

The analysis therefore applies the **May 2026 HENA housing requirement of 2,159 dwellings per annum** across the SLP area. This comprises:

- Cheltenham: **808 dpa**;

- Gloucester: **706 dpa**; and
- Tewkesbury: **645 dpa**.

The combined 2,159 dpa rate is applied through the carbon-budget period where a more detailed later-year trajectory is not available. This produces approximately **43,180 dwellings over 2026–2045** and **53,975 dwellings over 2026–2050**.

For modelling purposes, homes delivered in 2026 and 2027 are treated as falling within the existing Part L 2021 pipeline, while subsequent housing is modelled against the post-transition housing standards and relevant policy scenarios. This provides a simplified but consistent treatment where detailed application-by-application delivery information is not available across all three SLP authorities.

Stroud District

Stroud was unable to assemble a sufficiently detailed site-by-site trajectory within the timetable for the carbon-budget work. The analysis therefore uses the **2026 HENA figure of 869 dwellings per annum** as the most consistent and up-to-date estimate of future housing delivery.

The HENA figure is applied consistently across the assessment period, producing approximately:

- **17,380 dwellings over 2026–2045**; and
- **21,725 dwellings over 2026–2050**.

As with the SLP area, the calculation treats homes expected to be completed in 2026 and 2027 as part of the existing Part L 2021 pipeline, with later housing assessed against the Future Homes Standard and the potential effect of future local policy.

This is necessarily a higher-level assumption than the approach applied to Cotswold and Forest of Dean, where more detailed information on individual planning commitments was available.

Forest of Dean District

Forest of Dean provided its available housing-trajectory information, although officers advised that more detailed evidence would not be available until later in the project timetable. Given the need to complete the carbon-budget analysis before that information became available, the calculation uses a combination of:

1. the **2026 HENA housing requirement of 598 dpa** as the overall housing quantum; and
2. the Council's **September 2025 housing trajectory** to identify the planning status and expected delivery of existing commitments.

This approach was preferred to relying solely on the Council's broader indicative range, because the HENA figure of 598 dpa provides a defined and consistent annual requirement and was considered reasonably close to the approximately 600 dpa level indicated locally.

The trajectory information distinguishes between existing full and outline permissions. Small-site permissions are not generally identified individually where they comprise fewer than five dwellings; instead, these are represented through a **windfall allowance of 40 dwellings per year**, which the Council indicated is normally exceeded in practice.

For the purposes of the calculation:

- **full permissions** were used to identify dwellings likely to remain within the Part L 2021 pipeline;
- **outline permissions** were treated as development whose final regulatory standard remained to be determined;
- **technical starts** were treated as equivalent to outline permission where they were not accompanied by an identifiable full permission; and
- the windfall allowance was initially treated as unavoidable future development, before being absorbed into the residual housing requirement once the identified commitment pipeline had substantially run out.
- homes built in 2028 were assumed to escape the local plan policy as the local plan will only come into force in May 2029.

Because the source trajectory was prepared during 2025 rather than at the beginning of 2026, a pro-rata adjustment was made when converting the source information into the calendar-year trajectory used in the carbon model.

The overall 598 dpa assumption produces approximately:

- 11,960 dwellings over 2026–2045; and
- 14,950 dwellings over 2026–2050.

Cotswold District

Cotswold provided the most detailed and up-to-date authority-specific trajectory used in the analysis. The Council supplied its latest housing trajectory, prepared with a **base date of 1 April 2026**, which forms part of the evidence supporting its forthcoming Regulation 19 Local Plan.

The trajectory incorporates:

- proposed Regulation 19 strategic allocations;
- proposed non-strategic allocations;
- committed dwellings; and
- a windfall allowance.

The Council advised that the trajectory was still subject to minor amendments but that no significant changes were anticipated before Regulation 19 consultation.

Cotswold's Local Plan period runs to **2043**, rather than 2045 or 2050. The Council advised, however, that two proposed strategic allocations are expected to continue delivering beyond 2043 and identified those within its trajectory. For the period beyond the available trajectory, the Council's annual housing need of **1,054 dwellings** was used to support a reasonable continuation assumption.

After conversion from financial to calendar years, the Cotswold trajectory contributes approximately:

- 21,803 dwellings over 2026–2045; and
- 27,073 dwellings over 2026–2050.

Because the Cotswold information includes detailed planning-status information, a more granular classification was possible than for the SLP area or Stroud.

Treatment of planning status and likely Building Regulations standard

Planning application status was used as a practical proxy for determining how far each dwelling had progressed through the development process and, consequently, whether it was more likely to be delivered under **Part L 2021** or the **Future Homes Standard / Part L 2026**.

Planning status does not legally determine the applicable Building Regulations standard: this ultimately depends upon the relevant building-control submission and commencement dates. The planning data were therefore used as a modelling proxy where building-control information was unavailable.

For Cotswold, the detailed planning records were classified broadly as follows:

Planning status	Carbon-budget treatment
Full planning permission	Existing/detailed commitment; Part L 2021 pipeline
Reserved Matters	Detailed commitment; treated with full permissions
Technical Details Consent	Detailed commitment
Outline permission	Future / unresolved detailed design
Permission in Principle	Future / unresolved detailed design
Conversion / prior approval	Treated separately as an existing-building conversion (assumed to meet Part L 2021 standards)

CLOPUD	Reviewed case-by-case
CLEUD	Removed where it represented confirmation of an existing lawful use rather than future new construction
Listed Building Consent	Not treated as a standalone new housing commitment
ENQ / enquiry reference	Not treated as the operative housing permission

The Cotswold data also included several prior-approval routes, including agricultural-to-residential Class Q permissions (AGRPAN), commercial-to-residential prior notifications (OPANOT) and office-to-residential prior notifications (OFRPAN). These relate primarily to conversion of existing buildings and were therefore not treated in the same way as conventional new-build FHS dwellings.

The calculation also recognises the transitional period between Part L 2021 and the Future Homes Standard. Although a detailed planning permission may have been granted before introduction of the FHS, this alone does not guarantee that the dwelling will ultimately be built to Part L 2021. The analysis therefore assumes that dwellings associated with the pre-existing detailed permission pipeline may continue to be completed to Part L 2021 during the transitional period, but that all dwellings completed from 2030 onwards are treated as FHS-compliant, on the basis that only exceptional cases would remain under the earlier standard after that point.

This avoids assuming that technically commenced but substantially delayed schemes remain under Part L 2021 indefinitely.

References & endnotes

- ⁱ Keep Bourne End Green v Buckinghamshire CC & SSHCLG [2020] EWHC 1984 (Admin) paragraph 105, cited in Estelle Dehon KC to Essex County Council and Essex Climate Action Commission (2025), *FURTHER UPDATED OPEN ADVICE. IN THE MATTER OF THE BUILDING REGULATIONS, PART L 2021 AND THE PLANNING AND ENERGY ACT 2008 Re: Ability of local planning authorities to set local plan policies that require development to achieve energy efficiency standards above Building Regulations*. <https://www.essexdesignguide.co.uk/media/3129/essex-open-legal-advice-a-updated-may-2025-energy-policy-in-plans-and-building-regulations.pdf>
- 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 CIBSE (no date), *Carbon Bites: The Performance Gap*. <https://www.cibse.org/media/a1skdgsi/cb11.pdf>
- ^{iv} Etude, CIBSE, Levitt Bernstein, Elementa, WSP, Clarion Housing Group & UCL (2021). Making SAP and RdSAP 11 fit for Net Zero. https://www.levittbernstein.co.uk/site/assets/files/3670/making_sap_and_rdsap_11_fit_for_net_zero-full_report.pdf
- ^v RICS (2024), *Whole life carbon assessment for the built environment*. For direction on what energy modelling methods are acceptably accurate, in particular that Part L 2021 calculations (i.e. SAP and SBEM) are not, see section ‘5.3.1 Energy modelling for buildings’, page 103. https://www.rics.org/content/dam/ricsglobal/documents/standards/Whole_life_carbon_assessment_PS_Sept23.pdf#page=103#page=103
- ^{vi} 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>
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- ^{ix} Gloucestershire County Council (2019), *Motion 836 – Carbon action plan motion*. <https://glostext.gloucestershire.gov.uk/mgAi.aspx?ID=23573>
- ^x Gloucestershire County Council (2019), *Leading the response to the climate emergency. Gloucestershire’s Climate Change Strategy Part 1- December 2019*. <https://www.gloucestershire.gov.uk/media/vxqfj5kq/here-pdf-906-kb-gloucestershire-climate-change-strategy.pdf>
- ^{xi} Gloucestershire County Council. About Climate Leadership Gloucestershire (CLG). <https://www.gloucestershire.gov.uk/planning-and-environment/greener-gloucestershire-dashboard/useful-information/climate-leadership-gloucestershire-clg/about-climate-leadership-gloucestershire-clg/>
- ^{xii} 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>
- ^{xiii} Climate Change Committee (2019) *UK Housing: Fit for the future?*. <https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/>
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