Rugby Borough Council Net zero carbon local plan policy support

Evidence base:
Carbon budget assessment

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Version 2

Bioregional

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Introduction & overview

Bioregional is commissioned in 2024-25 by Rugby Borough Council to produce an evidence base on net zero carbon policymaking, to underpin the emerging Rugby Local Plan. This report is part of that evidence base. This report's purpose is to explore, through reasoned analysis, whether the emerging Rugby Local Plan draft Policy CL1 can be demonstrated necessary in order for Rugby to remain in line with its net zero ambition of 2030 and the national net zero target date of 2050. This is part of the policy justification as per the NPPF tests of soundness.

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

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

Draft Policy CL1 requires net zero operational emissions for new buildings, using absolute energy metrics, which diverge from the stipulations of the 2023 WMS[1]. This study concludes that there are demonstrated local circumstances to justify divergence from the 2023 WMS, as the approach set out in Policy CL1 is necessary for Rugby to align to local and national net zero target dates, including the national carbon budgets legislated via the Climate Change Act (thus part of the "objectives and provisions" that the NPPF instructs the local plan to pursue).

To determine whether local circumstances are demonstrated, this study sets a local carbon budget for the specific scope of operational carbon of new build housing in Rugby (derived from the national legislated carbon budgets). This study then models operational emissions in 2024-2045 (the plan period) associated with new homes in two policy scenarios: draft Policy CL1, and Future Homes Standard (FHS) Option 1 (which represents a 2023 WMS-compliant policy approach and is anticipated to pass into Building Regulations in 2025 or 2026).

Where the carbon budget for new build housing's operational emissions is exceeded by a policy scenario, this demonstrates that the policy scenario is not aligned with the net zero targets (and therefore the climate mitigation mandate in law and policy as above). It is key to understand that all sectors and associated subsectors in Rugby will need to stay within their reasonable share of the overall borough-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. While the Climate Change Act does not legislate limits on individual sectors, the national carbon budgets assume steep falls in all sectors' emissions[i], to a level that will be challenging for each sector to achieve even without trying to balance any underperformance by other sectors. It is thus effective to pursue indicative sectoral carbon budgets to avoid imbalances and keep the national mitigation target feasible. This is therefore an appropriate and logical test to apply when determining what policies are appropriate for the climate mitigation mandate laid on the local plan.

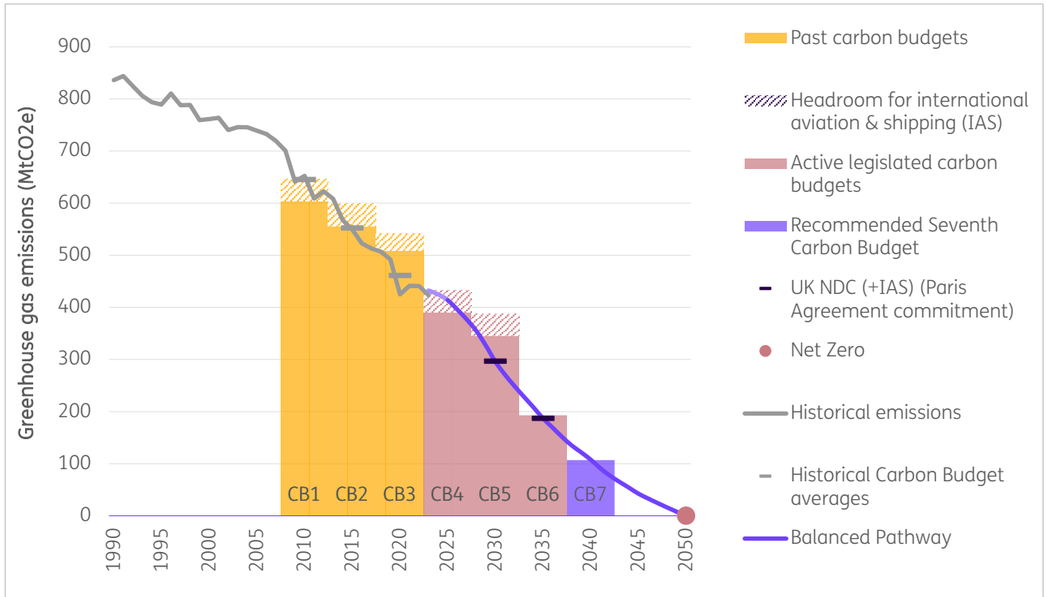


Figure 1: The UK's legislated carbon budgets (past, present and future) within the Climate Change Act. Adapted from: Climate Change Committee, 7th Carbon Budget report, 2025.

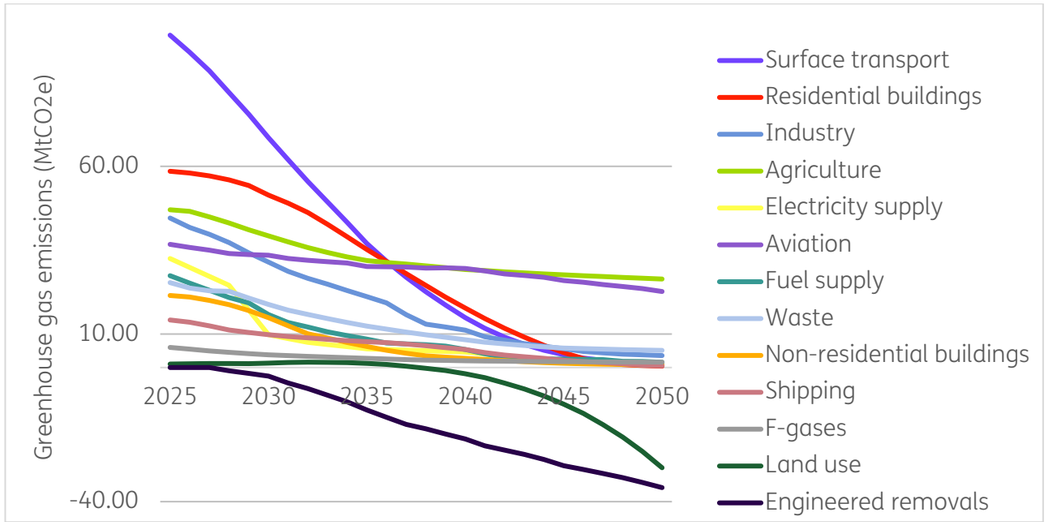


Figure 2: Chart showing how each sector's emissions must fall in the 'balanced' pathway to net zero in 2050. Adapted from: Climate Change Committee, 7th Carbon Budget report, 2025.

[1] Written Ministerial Statement 2023 on local energy efficiency standards. See separate full evidence report on net zero carbon for a fuller explanation of what that WMS entails.

1. Comparison of policy scenarios

Scenarios tested

The first step of this study was to identify energy use data to reflect the situation with the proposed policy CL1 "true net zero" standard, versus an alternative policy that aligns with the stipulations of the Written Ministerial Statement 2023 (WMS). This energy use would then be converted to carbon emissions, to determine which policy scenario is best aligned to UK's legally binding net zero target of 2050 and Rugby's local net zero target of 2030.

To represent the emissions of a fully WMS-compliant policy, the Option 1 specification from the Future Homes Standard 2023 consultation was selected. This is anticipated to most likely reflect the new updated Building Regulations some time in 2025[2], and is a standard that can be expressed as a Target Emissions Rate % reduction, as the WMS seeks. Future Homes Standard Option 1 (FHS1) includes a heat pump and on-site solar PV, but barely any fabric improvement compared to today's building regulations (Part L 2021).

In contrast, emerging draft Policy CL1, which does not wholly align with the requirements of the 2023 WMS because it does not use the Target Emissions Rate metric, is tested as a standard that would more effectively assist fulfilling Rugby's contribution to the UK's national net zero target of 2050. Policy CL1 is aligned with industry best practice absolute energy metrics and represents a 'true net zero operational carbon' policy by requiring that on-site renewable energy generation is equal to total energy consumption.

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

	FHS Option 1 (WMS-compliant)	Rugby draft policy
Metrics used	Target Emissions Rate (63% reduction on today's TER); calculate with SAP or Home Energy Model[3]	Energy Use Intensity (EUI) and space heating demand, via an accurate method
On-site renewable energy generation (i.e. solar PV panels)	PV equivalent to ~40% of ground floor area	Match total energy consumption on an annual basis
Net zero building?	Once grid is fully decarbonised	Yes, from year 1
Fully aligned with the 2023 WMS?	Yes	No

WMS-compliant approach (FHS1 or FHS2)	EUI-based approach (draft policy CL1)
• Target Emissions Rate metric based on % improvement, not absolute values, which makes comparison difficult due to different baselines used • Only considers emissions of regulated energy use (heating, cooling and lighting), not unregulated energy use (plug-in appliances) • SAP is a compliance tool and does not accurately model energy use • Cannot be verified during operation to understand potential performance gap between designed and as-built building • Not fit for development of true net zero buildings, due to modelling inaccuracy • Will not deliver net-zero-carbon buildings (until the energy grid is fully decarbonised via future development of extensive standalone renewable energy).	• Uses absolute energy-based targets that directly limit energy consumption, which are measurable post-construction by the building occupier at the meter • 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 energy performance • Supported by industry evidence as 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.

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

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

Establishing the energy use in each of the two policy scenarios

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

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

- 'Task 3: Feasibility study (2023)' – this study included energy modelling of a proposed policy with identical residential energy targets to those of Rugby emerging proposed policy CL1. It also included energy modelling for homes built to the indicative Future Homes Standard specification that were consulted upon by Government in 2020-21.
- Local circumstances addendum (October 2024) – this study included updated energy modelling in which the Future Homes Standard was updated to reflect the two indicative two FHS options that Government consulted upon in December 2023.

Those studies tested different inputs of building elements for each policy scenario (see Appendix 1 'envelope performance' and 'building services' tables). They used a highly accurate energy prediction modelling method (i.e. Passive House Planning Package; PHPP[4]) to identify the total energy use of homes either in the proposed policy, or in 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 2025-2030 (period for Rugby local net zero target) and 2025-2050 (period for national net zero target). The emissions for each policy scenario can then be compared against the available local carbon budget for new build housing, as a share of the national carbon budget (explained later).

The following section focuses on the modelling process. For both policy scenarios, the cited energy use data came from energy modelling using PHPP, despite that the FHS1 policy scenario would use SAP in implementation rather than PHPP. This is because if Policy CL1 was tested using PHPP, whilst FHS1 was tested using SAP, inconsistency between the modelling tools would result in an inaccurate comparison of emissions between the two scenarios. Also, SAP is inaccurate at predicting actual energy use (see separate full net zero evidence report). Instead, the use of PHPP data for both policy scenarios ensures consistent and accurate predictions of energy use (and thus of carbon).

The cited PHPP modelling data includes both regulated and unregulated energy use of each of the home types, giving a detailed picture of home energy use[5]. Our analysis uses the modelled energy use of two archetypes: an apartment block (10 dwelling units) and a semi-detached house. The same archetypes were used for both policy scenarios. (see Appendix 1).

Energy modelling results per home

		Apartment (one unit)		Semi-detached (one house)	
Metric	Unit	FHS 1	CL1	FHS 1	CL1
EUI balance after PV (same in each year)	*kWh/yr*	*411*	*0*	*1901*	*0*
Net annual carbon (year 1 - 2025)	kg CO_2e/yr	62	0	288	0
Total operational carbon emissions (2025-2030)	**kg CO_2e/yr**	**193**	**0**	**892**	**0**
Total operational carbon emissions (2025-2050)	**kg CO_2e/yr**	**372**	**0**	**1,480**	**0**

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[ii].

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

- Since Policy CL1 is a 'true net zero' policy, the modelling shows that zero emissions are produced from both archetypes. This is because the policy would require renewable electricity to equal annual energy demand, which is made feasible by the fact that the policy also requires the building to meet tight energy efficiency targets.
- Due to there being some amount of solar PV on-site for FHS1 (specifically, PV area equal to 40% of the ground floor area), there are some emissions reductions from on-site solar, but far less so than CL1.
    - The apartment block was assumed to be low-rise. If it had more storeys, the final emissions per apartment would be larger, because the extra storeys would increase the energy use, but the PV area would not increase because the PV amount in the FHS policy is tied to the building footprint area not the height.

[4] 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.

[5] In practice, a 2023 WMS-compliant policy would not assess unregulated energy as the metric it required – Target Emissions Rate – only considers regulated energy. However, homes built under a WMS-compliant policy would still *have* unregulated energy use and associated carbon emissions until the grid is zero carbon.

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

To determine the relative contribution from houses[6] and apartment archetypes to the overall carbon emissions in Rugby from the two policy scenarios from 2025-2030 and 2025-2050, a % split is set based on the recent track record of new build housing types in Rugby.

According to the latest EPC data for new dwellings by housing type, the latest 5 years[7] of data show that 79% of new domestic buildings in Rugby are houses, whilst the remaining 21% are flats. This % split is assumed to remain constant for the delivery of new homes from now on.

According to the housing projection figures in Rugby, outlined by Policy S2 in the Preferred Options consultation, 12,978 homes need to be delivered throughout the plan period of 2024-2045. This would equate to 618 homes per year in the plan period, assuming a consistent build-out rate. As this study needs to cover the total period through to the UK's net zero carbon date of 2050 – which extends five years after the end of the plan period – we also assume that this same delivery rate of 618 homes/year also continues in 2046-2050.

Applying the 21%/79% split of home types to that housing delivery rate per year, this means 130 flats and 488 houses will be delivered per year.

This means that if the carbon budget period is 2025-2030, a total of 3708 homes are built (618 per year x 6 years). Or if the period is 2025-2050 to align with the national net zero goal, then the total number of new homes built is 160,068 (of which 12,978 in the plan period).

We assume that as each home is delivered, it is occupied and begins consuming energy in that year[8]. 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 carbon budget period (either 2025-2030, or 2025–2050 as previously noted).

All of these homes are assumed to be all-electric (using electric heating not gas – as this is the specification for both the proposed Rugby policy CL1 and for the Future Homes Standard). Therefore, the total energy use in each year (from the cumulative number of homes completed up to that year) is multiplied by the electrical grid carbon factor for that year[9], to get the operational carbon emissions of the cumulative number of new homes in each year of the carbon budget period. The emissions in each year can then be summed to give the total operational carbon emissions from new builds completed within the carbon budget period.

		Flats		Houses	
Period	Unit	FHS 1	CL1	FHS 1	CL1
Total operational carbon emissions from new housing (2025-2030)	tCO_2e	73	0	1,267	0
Total operational carbon emissions from new housing (2025-2050)	tCO_2e	289	0	5,018	0

Period	**Unit**	**Policy: FHS1**	**Policy: CL1**
Total operational carbon emissions from new housing (2025-2030) (kt CO_2e) (Estimated 3708 homes delivered in this period)	**$ktCO_2e$**	**1.34**	**0**
Total operational carbon emissions from new housing (2025-2050) (kt CO_2e) (Estimated 160,068 homes delivered in this period, of which 12,978 within the local plan period to 2045)	**$ktCO_2e$**	**5.31**	**0**

[6] Based on semi-detached houses. The energy modelling source data did not offer other house archetypes other than semi-detached (e.g. terraced or detached) for both policy scenarios. For the purpose of this exercise, the semi-detached archetype can be reasonably assumed to be representative of houses as a whole, as it can be considered a 'middle ground' between the various types of house, reflecting an average house size and carbon emissions.
[7] At the time of conducting the analysis. This national dataset is released quarterly.
[8] This avoids the potential methodological error of assuming all 12,978 homes are using energy from the first year of the plan period. We recognise that there may also be some cases where newly completed homes may have a period of non-occupation for marketing purposes; however, such incidences should be rare and short if the housing demand is as urgent as stated by industry and government, especially given that approximately half of new builds in the West Midlands are sold before completion (and this rate has been higher in previous years). Additionally, in our ultimate comparison of Rugby's total carbon emissions against carbon budgets, any unoccupied periods in new builds should be more than balanced out by the fact that the data on local areas' existing carbon emissions has a 2-year data lag and therefore misses out any new builds completed between the most recently published data year (2022 at the time of this analysis) and our carbon budget start date (2025).
[9] See Appendix 2.

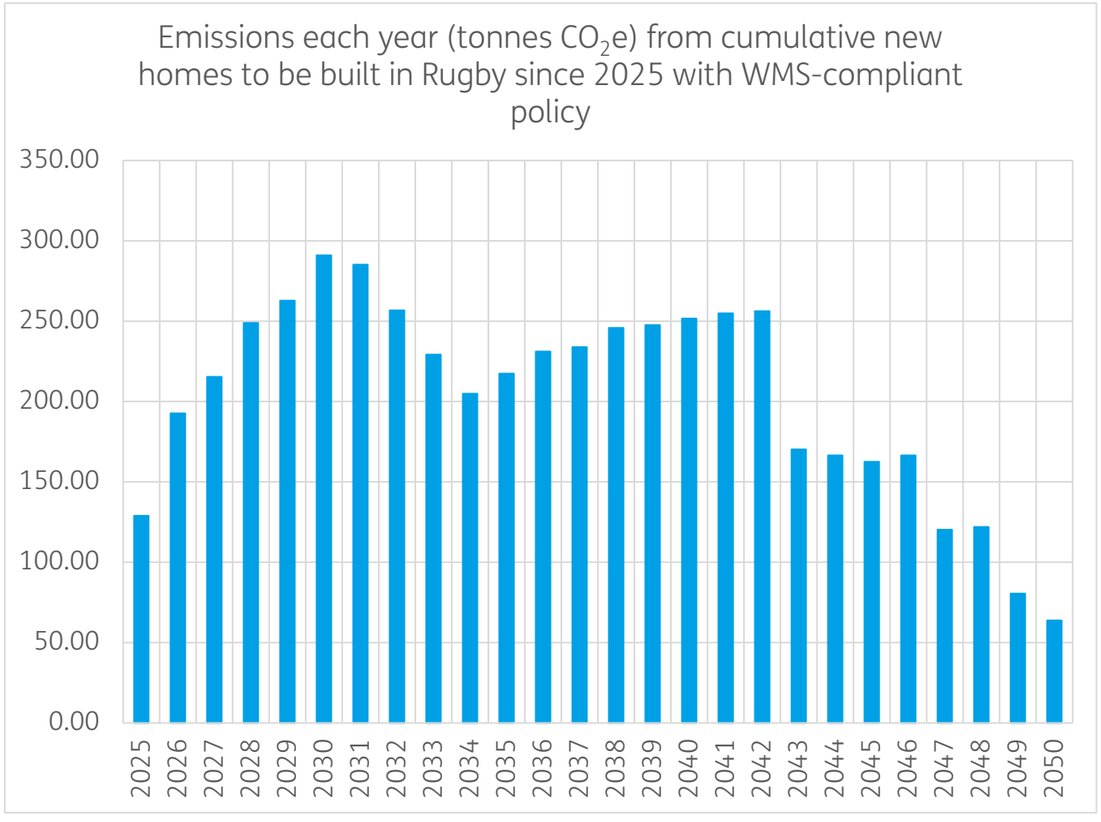


Figure 3: Emissions each year (tonnes CO2e) from all homes that would be completed from 2025 onward (cumulative homes; annual emissions) with the assumed WMS-compliant policy option (FHS1).

This first graph (Figure 3) shows how grid decarbonisation does very significantly reduce emissions of the homes that have been built up to each year, even though the cumulative number of homes built is increasing by 618 in each year as previously explained.

However, the second graph (Figure 4) shows that because the annual emissions figure is not zero, this adds up to a significant cumulative amount of emissions in the total national carbon budget period (up to 2050). Although the Government has described this sort of building standard as "net zero carbon ready" because they are all-electric and will therefore decarbonise along with the grid, the Government's own electricity grid decarbonisation projections used to perform our analysis (see Appendix 2) do not show the grid getting all the way to zero carbon in this period. Although the electricity grid carbon is projected to get very low in the mid 2030s, the fact that the homes are not zero carbon from day 1 means that their cumulative emissions do add up over time especially as the required housing delivery steadily increases the total number of homes that exist each year.

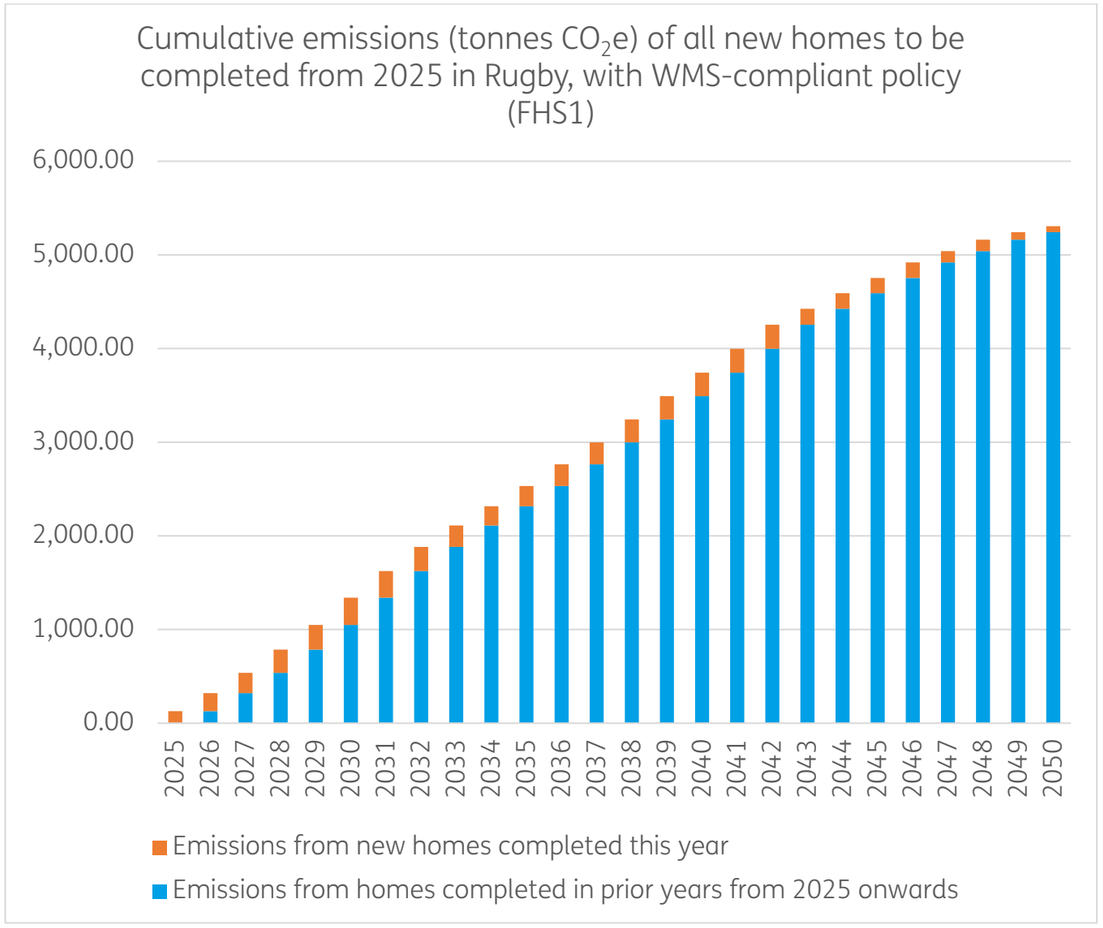


Figure 4: Cumulative emissions to date for each year, from all homes that would be completed from 2025 onward (cumulative homes; annual emissions) with the assumed WMS-compliant policy option (FHS1).

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

2. Setting a carbon budget for Rugby Borough

Importance of setting a carbon budget

The exercises in this section are crucial to determine whether Policy CL1 is necessary for Rugby to meet their local net zero target date of 2030 and sufficiently contribute to the national net zero target of 2050. These are considered the only rational tests for whether the plan will sufficiently fulfil its legal duty to mitigate climate change (set by the Planning & Compulsory Purchase Act 2004) to the extent required by the NPPF 2024 (i.e. proactively and in line with the Climate Change Act), as the Climate Change Act includes the national carbon budgets.

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

By testing these policy scenarios against the available carbon budget, it can be determined whether Policy CL1 is justified and required for the new build housing sector to sufficiently contribute to mitigation of climate change. If it is found that CL1 remains in line with the carbon budget, while the WMS-compliant alternative (FHS1) does not, this would demonstrate clear local circumstances to justify divergence from the WMS and retain Policy CL1.

Net zero context for Rugby

Rugby declared a climate emergency in 2019 and set a target for net zero by 2030. For the specific scope of this study, net zero operational carbon in new build housing[10], it therefore is important to consider what policy requirements are aligned achieving net zero by 2030, as well as with the national carbon budgets on the way to the national goal of net zero by 2050.

The Balanced Pathway to Net Zero (set out in the 6th Carbon Budget, which is one of the series of legally binding national carbon budgets passed into law under the aegis of the Climate Change Act 2008 that also sets the UK's 2050 net zero target), clearly states that all new build housing must be net zero from no later than 2025[iii] and prior analysis[iv] had shown that this will need to include that new homes achieve a space heating demand of 15-20 kWh/m^2/yr. Draft Policy CL1 requires that all new housing achieves exactly these two requirements, and is therefore aligned with national legislated carbon goals and the local net zero 2030 aspiration.

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

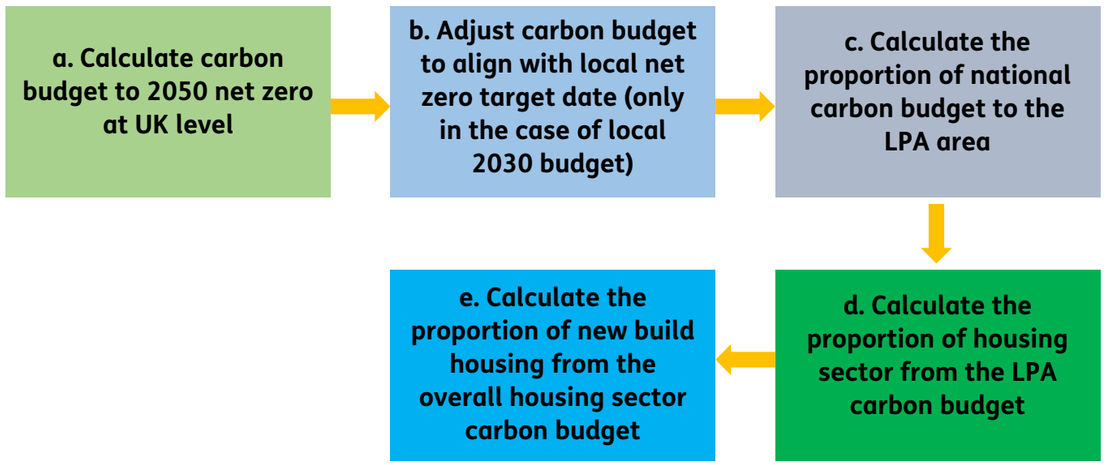
Carbon budget methodology

The first step in determining whether either of the policy scenarios (proposed policy CL1 or a WMS-compliant policy) would ensure new build housing is compatible with local or national carbon goals is to rationally establish a specific carbon budget for new build housing in Rugby.

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

These local carbon budgets do not assume any level of plan policy ambition. Rather, they represent the maximum allowable emissions to align with Rugby achieving either their local 2030 net zero emissions goal, or Rugby's share of national carbon budgets to net zero 2050.

As the 2023 WMS has a specific scope that does not apply to embodied carbon, existing buildings nor non-residential buildings, we here derive local carbon budgets that represent only the maximum allowable emissions apportioned to energy use of new build *housing* in Rugby.



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

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

Our first step is to determine to remaining carbon budget to achieving net zero by 2050 at a national level. We here take the carbon budget values from Climate Change Committee reports for the Balanced Pathway to Net Zero, as follows:

Period	Budget source	Carbon budget ($MtCO_2e$)	Average/yr ($MtCO_2e/yr$)
2025–2027	Remainder of 4th Carbon Budget (2023 to 2027 total = 1,950$MtCO_2e$) 3/5 of 1,950 = **1,170** *(National carbon budget periods are 5 years, thus 2025+2026+2027 assumed to represent 3/5 of total)*	1,170	390
2028–2032	5th Carbon Budget (legally binding)	1,725	345
2033–2037	6th Carbon Budget (legally binding)	965	193
2038–2042	CCC's 7th Budget recommendation (2025)	535	107
2043–2050	Not officially budgeted; CCC Balanced Pathway implies annual emissions fall from ~65 $MtCO_2e$ to ~-1 $MtCO_2e$. Estimate[11] total: **256.2** $MtCO_2e$.	256.2	32
Total		**4,651.2**	

Our overall carbon budget value for the UK to reach net zero by 2050 is therefore 4,651.2 MtCO2e. The actual budget for the 2043-2050 period has not been defined by the CCC and won't be until the 8th Carbon Budget report in a few years. The 256.2 figure assumed here for 2043-2050 is indicatively derived from the Balanced Pathway trajectory (see Appendix 3).

b. Aligning budget to timescale of the local net zero target date

This stage is not relevant for the national 2050 carbon budget value.

The local carbon budget for Rugby is set by applying a linear trajectory from 390 $MtCO_2e/yr$ in 2025 to 0 MtCO2e/yr for the target net zero date of 2030, 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 ($MtCO_2e$)	% reduction vs 2025
2025	390	0% (baseline)
2026	312	−20%
2027	234	−40%
2028	156	−60%
2029	78	−80%
2030	0	−100%
Total	**1,170 $MtCO_2e$**	

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

This next step takes the national carbon budget value and tailors it to an equivalent reduced value for Rugby. A reasonable principle is to assume that each local area's respective share of current national emissions will continue into the future[12].

[11] See Appendix 3.

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

Therefore it is necessary to identify what % Rugby's current emissions contribute to current national emissions, using the DESNZ UK Local Authority GHG Emissions dataset (2024 release; 2022 latest emissions values).

For Rugby, this calculation is 1,812 $ktCO_2e$ (Rugby annual emissions total) / 375,929 $ktCO_2e$ (UK annual emissions total) = **0.48%**

0.48% is therefore applied to the previous carbon budget value stage to represent the specific carbon budget for Rugby. This results in the following carbon budget share for Rugby:

- Carbon budget to net zero 2030 local goal: **5.6 $MtCO_2e$** (0.48% of 1,170 $MtCO_2e$)
- Carbon budget to net zero 2050 national goal: **22.42 $MtCO_2e$** (0.48% of 4,651 $MtCO_2e$)

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

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

To determine the contribution from the housing sector in Rugby, 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 Rugby's total emissions over a recent period.

In Rugby, 2013-2022 average annual housing emissions were 171 $ktCO_2e$, whilst the average annual total emissions were 1,995 $ktCO_2e$. Thus the housing sector contributes 8.6% to Rugby's total emissions.

This 9% value is therefore applied to the local carbon budget value from the previous step.

- 5.6 $MtCO_2e$ total local carbon budget vale with net zero *2030* local goal
  - x 8.6% = local carbon budget for housing to 2030 is **484 $ktCO_2e$**.
- 22.4 $MtCO_2e$ total local share of national carbon budget value to net zero *2050*
  - x 8.6% = local carbon budget for housing to 2050 is **1,926 $ktCO_2e$**.

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

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

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

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

Existing housing

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

In Rugby, the average electricity consumption (per existing home, annual) is 3,240 kWh and gas consumption 11,552 kWh (per existing home, annual, domestic standard meters).

To calculate the cumulative emissions of an average existing home in the carbon budget period, the mean 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). The electricity factor includes future grid decarbonisation.

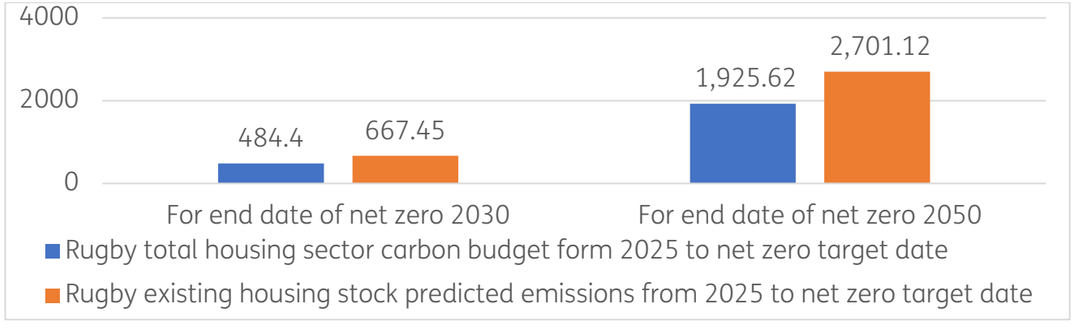
The following cumulative emissions for an average existing home in Rugby are:

- Within local carbon budget period (2025-2030): 14.20 tCO_2e (0.0142 $ktCO_2e$)
- Within national carbon budget period (2025-2050): 57.45 tCO_2e (0.0575 $ktCO_2e$)

To determine the expected emissions of all existing homes in Rugby within the carbon budget periods, the cumulative emissions of one existing home must be multiplied by the amount of existing homes in Rugby. ONS Census 2021 data shows that there are 47,013 homes in Rugby:

- Local carbon budget period (2025-2030): 47,013 x 0.142 $ktCO_2e$ = 667.45 $ktCO_2e$
- National carbon budget period (2025-2050): 47,013 x 0.0575 $ktCO_2e$ = 2,701.12 $ktCO_2e$

Crucially, this reveals that the predicted emissions from existing housing already exceed the available Rugby housing sector carbon budget previously identified, by 38% or 40%:



Taken at face value, this would imply that there is no room in the carbon budget for any new homes. However, these figures do not assume any future changes to existing homes, e.g. energy efficiency or switching from gas to electric heating. Realistically it is likely this will occur to some extent. Therefore, the next step allocates a share of carbon budget to *new* homes by dividing the available housing sector carbon budget between existing and new homes in proportion to these static predicted emissions – effectively assuming that they together *will* fit within the housing sector carbon budget. This has the effect of assuming that both the pre-2025 and post-2025 homes will undergo some degree of future improvement, especially in pre-2025 existing housing to make room in the budget for the emissions of new homes.

New build housing

To determine the cumulative expected emissions of all new build homes, FHS Option 1 specification (as explored in the previous section) is assumed as the standard that new homes will be built to as a business-as-usual-scenario (i.e. in the absence of any local plan policy on energy / carbon performance). It is also assumed that the emissions from a semi-detached house are reflective of an average new build home in Rugby over the carbon budget periods. As previously described, based on housing growth values on 618 homes being delivered each year from 2025, the following cumulative emissions for all new build homes in Rugby from 2025 are calculated as:

- Within carbon budget period to local net zero target date (2025-2030): 1.34 $ktCO_2e$
- Within carbon budget to national net zero target date (2025-2050): 5.31 $ktCO_2e$

Balance between existing and new build homes

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

- Within carbon budget period to local net zero target date (2025-2030):
  - 667.45 $ktCO_2e$ (existing homes) + 1.34 $ktCO_2e$ (new homes) = 668.79 $ktCO_2e$
- Within carbon budget to national net zero target date (2025-2050):
  - 2,701.12 $ktCO_2e$ (existing homes) + 5.31 $ktCO_2e$ (new homes) = 2706.42 $ktCO_2e$

Based on the cumulative emission calculations for new build and existing homes for both carbon budget periods, the % contribution from new build housing to overall expected housing sector emissions are:

- Local carbon budget period (2025-2030): 1.34 / 668.79 = 0.200%
  - National carbon budget period (2025-2050): 5.31 / 2706.42 = 0.196%

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 Rugby will not be allowed to exceed the available local housing sector carbon budget and therefore will undergo some sort of carbon performance improvement in future years). We allocate that room for new housing based on new homes' % of actual predicted emissions, as above.

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

- **Within carbon budget period to local net zero target date (2025-2030):**
  - 484 $ktCO_2e$ (total Rugby housing sector) x 0.200% = **0.97 $ktCO_2e$**
- **Within carbon budget to national net zero target date (2025-2050):**
  - 1,926 $ktCO_2e$ (total Rugby housing sector) x 0.196% = **3.78 $ktCO_2e$**.

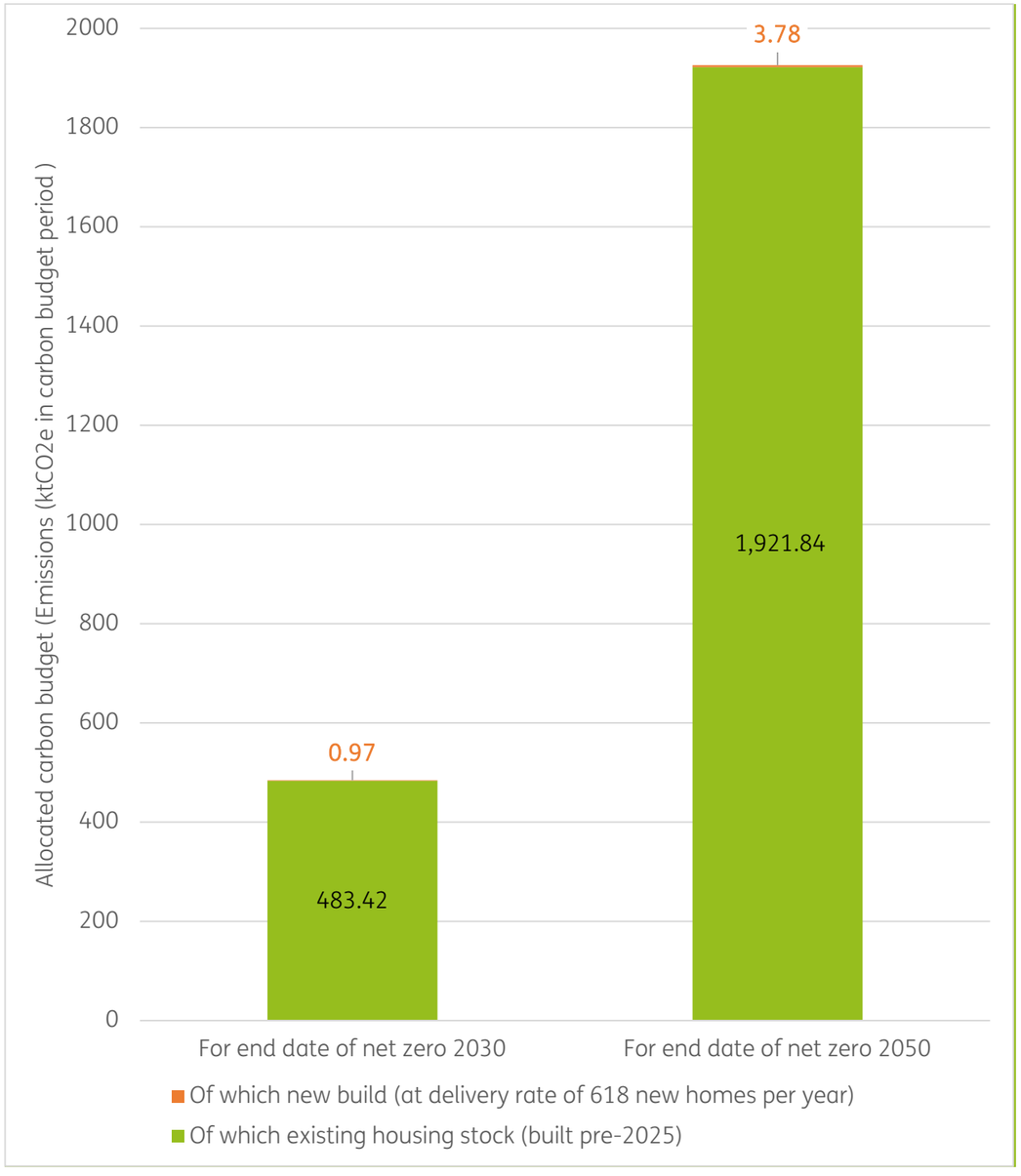


Figure 5: Available carbon budget for housing sector operational emissions from 2025 to either 2030 or 2050, derived from national carbon budgets as previously described.

3. Conclusion to determine alignment with net zero targets

The aim of this report has been to determine whether either of the two policy approaches, Rugby Local Plan existing proposed draft Policy CL1 or a WMS-compliant FHS policy, would keep new homes within the remaining carbon budget for new build housing in Rugby:

- The figures for the 2050 end date are crucial to the question of whether each policy scenario will ensure that housing development in Rugby will "contribute to the mitigation of climate change" as per local plan's legal duty, to the extent of being consistent with the national policy instruction to do so "proactively … in line with the Climate Change Act" and "support the transition to net zero by 2050".
- The figures for the local ambition of net zero by 2030 provide a further illustration of local circumstances that further justify policy going beyond Building Regulations.

Carbon budget period	Available carbon budget	FHS1 (WMS 2023 compliant policy)	Policy CL1 (Rugby proposed 'true net zero' policy)
Total operational carbon emissions from new housing (2025-2030) ($ktCO_2e$)	**0.97**	**1.34**	**0**
Total operational carbon emissions from new housing (2025-2050) ($ktCO_2e$)	**3.78**	**5.31**	**0**

As previously noted, draft proposed Policy CL1 has zero total carbon emissions from new housing, as the policy represents true zero carbon development and therefore is aligned to both carbon budget scenarios. The policy achieves this by ensuring that a home is extremely energy efficient to the point that its *total* annual energy use is equalled by annual on-site renewable electricity generation. Key elements of this policy are energy efficiency metrics that cover the home's *total* energy use (not just the regulated energy use[13]) and that are demonstrated using accurate energy use prediction methods (PHPP, CIBSE TM54 or similar[14]).

These key elements for success are precisely what diverges from the Written Ministerial Statement 2023, previously outlined.

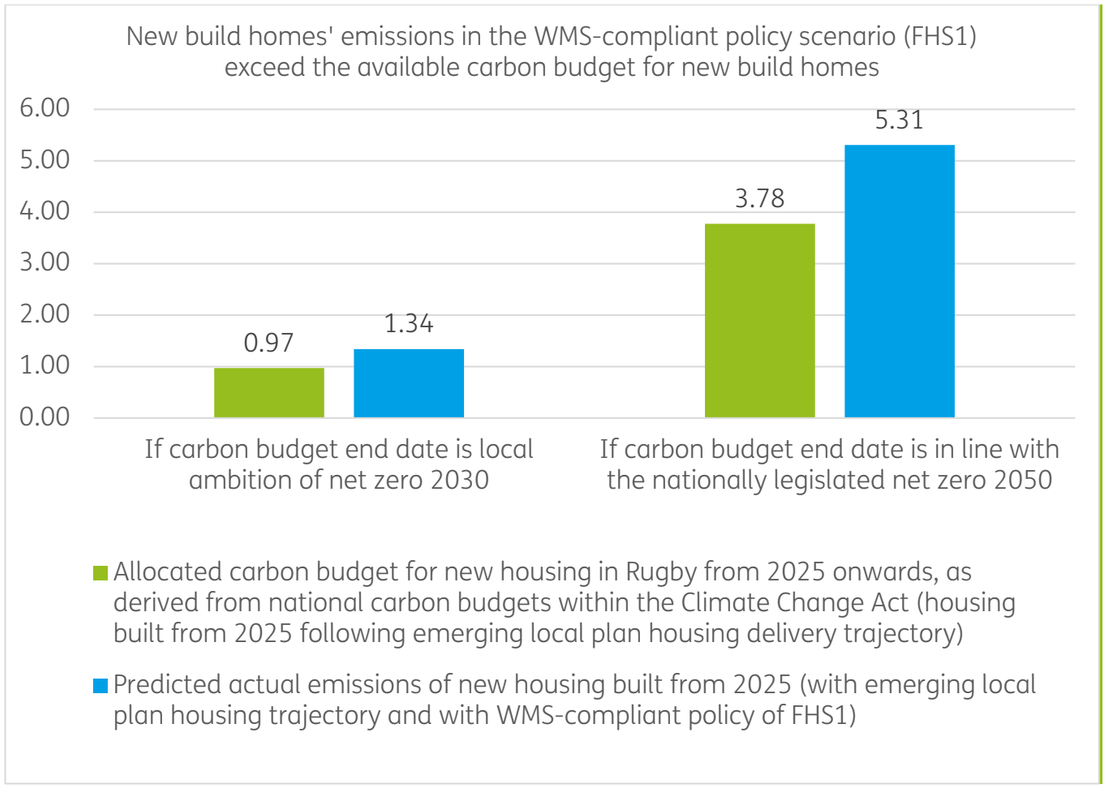


Figure 6: Chart showing the available carbon budget for new housing operational emissions in Rugby (derived as share of national carbon budgets as previously described), compared to actual predicted emissions of new homes with a WMS-compliant policy (FHS1 policy scenario previously described).

The FHS1 policy scenario (WMS-compliant) exceeds the available carbon budget value available for new housing in Rugby, whether that carbon budget is aligned to the local ambition of net zero 2030 or the national legally binding net zero date of 2050.

This WMS-compliant policy (FHS1) is therefore not an appropriate policy approach to fulfil the local plan's mandate to proactively mitigate climate change in line with the Climate Change Act.

[13] 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 approximately 25-75% of a building's total energy use, depending on type of building.

[14] 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).

Discussion

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

Therefore any WMS-compliant policy cannot ensure that homes' energy use is kept low enough that it can be met with on-site renewable energy in actual operation and therefore achieve the actual net zero carbon homes that are necessary for the achievement of national carbon budgets - at least without needing to specify excessive amounts of onsite solar PV provision to counteract SAP's dramatic underestimation of energy use, which could make housing delivery unviable and might not be compatible with electricity grid constraints in some areas. By contrast, Rugby's draft policy CL1 (true net zero carbon) keeps energy use so low that only small amounts of solar panels on site are needed to match the home's annual energy use, therefore not bringing excessive construction costs and minimising the burden that these new homes will place on the electrical grid.

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

- Those reductions will need to be delivered by significant rollout of energy efficiency improvements and electric heating (ideally heat pumps) to replace existing homes' gas boilers.
- This change in existing housing is fact 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 Rugby 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 (whether to 2030 or 2050), as follows:
    - If carbon budget is to 2030: Overall Rugby housing carbon budget of 484 $ktCO_2e$, which would be exceeded by 183 $ktCO_2e$ just by existing housing stock emissions
    - If carbon budget is to 2050: Overall Rugby housing carbon budget of 1,926 $ktCO_2e$ will be exceeded by 776 $ktCO_2e$.

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.e, this is untenable. While these changes to existing buildings cannot be ensured by the local plan (which only exerts power where permission is needed, and cannot force change to happen in existing buildings), it is the responsibility of the local plan to proactively take the mitigation actions that are within its power to reduce the likelihood of these carbon budgets being breached as shown here.

Given that Rugby's existing housing emissions are unlikely to remain within the available carbon budget for the entire housing sector in Rugby, it is essential that new build housing does not further add to the burden of remaining within the budget. It is arguably sensical that a carbon budget of zero should be apportioned to new build housing since the existing housing subsector is already expected to use up all the whole housing sector carbon budget for both local and national periods.

Local plan policy must therefore require robust targets and metrics that truly result in zero carbon development, as Rugby existing draft Local Plan Policy CL1 would achieve. This is currently not achievable under a 2023 WMS-compliant policy, such as one reflecting the FHS, as the Target Emissions Rate in the Standard Assessment Procedure, as required by the WMS, does not consider unregulated energy that can account for approximately 25-75% of operational carbon emissions in new buildings. The modelling found that Future Homes Standard Option 1[15] resulted in residual emissions from new build housing which resulted in a 38-40% exceedance of the available carbon budget for new housing, whilst Rugby Local Plan draft proposed Policy CL1 did not contribute any emissions from new build housing.

It is therefore explicitly apparent that new build housing must be subject to stringent policy that genuinely achieves zero carbon development, in order to meet the local plan's climate mitigation mandate to the extent required by the NPPF. Expressing a policy in the way that the WMS2023 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 full evidence base report). This clearly cannot be risked in light of the carbon budget analysis presented here. This study has clearly shown that the modelled WMS-compliant policy (FHS1) is not an appropriate policy to be aligned with Rugby's local net zero target nor with the UK's legally binding target. Even if some carbon budget were made available to the new build housing subsector, it is only a true net zero policy such as Policy CL1 that should 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 departure from national policy, i.e. the 2023 WMS, as Rugby would exceed its remaining carbon budget for new build housing if a policy aligned to the 2023 WMS was implemented, whilst Policy CL1 would help to remain within wider carbon budget efforts across all sectors.

[15] It is also important to keep in mind that Future Homes Standard Option 1 was the more stringent of the two FHS options consulted upon by government (2023 consultation) and in fact the actual FHS that eventually forms the new Building Regulations Part L may even have worse carbon emissions than this.

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

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

These were selected because the emerging South Oxfordshire & Vale of White Horse emerging policy on 'net zero carbon homes' has identical energy use intensity and renewable energy targets as those of Rugby emerging local plan policy CL1. As an area relatively central to the UK and not coastal, Rugby's climate is likely to be sufficiently similar to that of South & Vale and thus it is unlikely to make any significant difference in the specification that would be needed to achieve these identical energy targets.

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

Envelope performance

Building element	FHS Option 1	Policy CL1	
		Apartment	Semi-detached
Roof U-value (W/(m^2.K))	0.11	0.10	0.11
External wall U-value (W/(m^2.K))	0.18	0.10	0.15
Floor U-value (W/(m^2.K))	0.13	0.10	0.11
Door U-value (W/(m^2.K))	1.00	1.00	0.80
Glazing U-value (W/(m^2.K))	1.20	0.80	0.80
Air permeability (m3/(h.m2) @ 50Pa)	4	0.60	0.60

Building services

	FHS Option 1	Policy CL1
Wastewater heat recovery	Yes	Yes
Heat source	Air source heat pump	
Ventilation	Decentralised mechanical vent (dMEV)	Mechanical ventilation with heat recovery (MVHR)
Renewable energy	Apartment: 38 kWp Semi-detached: 4 kWp	Apartment: 47 kWp Semi-detached: 3 kWp

Appendix 2
Electricity carbon factor change over time

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

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

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

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

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

These two forms are further differentiated into:

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

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

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

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

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

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

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

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

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

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

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

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

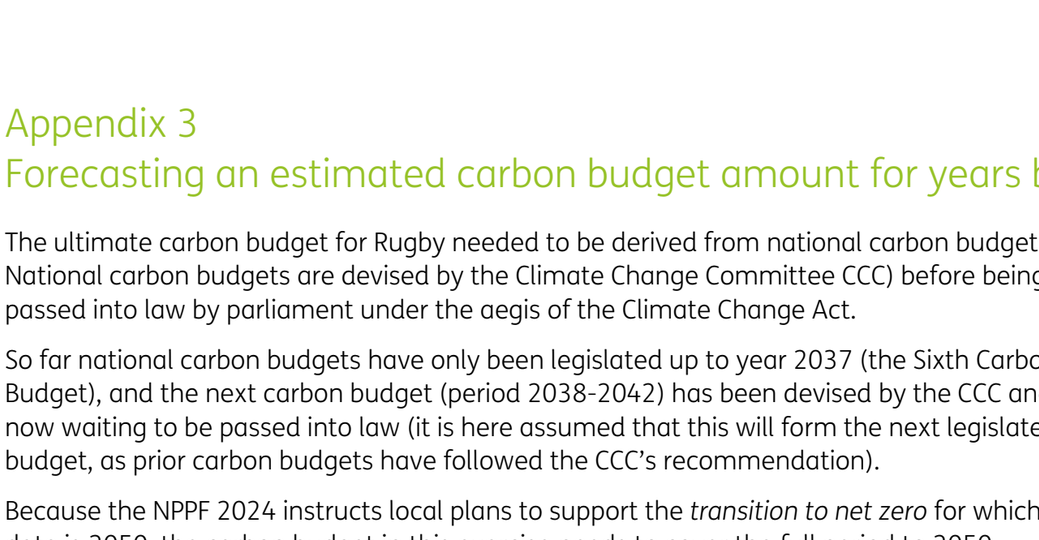


Figure 7: Legislated carbon budgets, soon-to-be-legislated 7th carbon budget, and 'balanced pathway to net zero'. "CB" = Carbon Budget. IAS = International aviation & shipping. Climate Change Committee 7th Carbon Budget, 2025

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

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

The sum of these is 242.61 $MtCO_2e$.

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

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

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

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

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

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

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

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

References & endnotes

[i] 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.

[ii] 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

[iii] 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

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

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