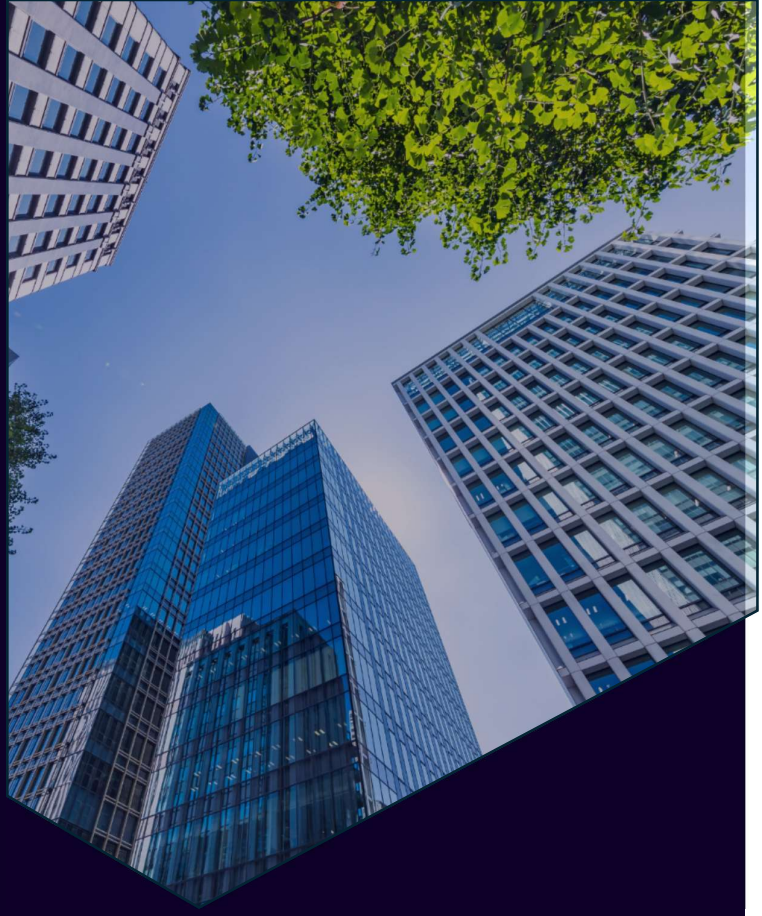

CUDWORTH PARKWAY ESTATE

5

WHOLE LIFECYCLE CARBON ASSESSMENT

Project no. 23225

enevo ENABLING EVOLUTION

CUDWORTH PARKWAY ESTATE

WHOLE LIFE CARBON ASSESSMENT

REVISION	DATE	PREPARED BY	REVIEWED BY	COMMENTS
2	28/04/2026	HH	Enevo	For Issue

C80 Solutions Ltd
Woodhead House,
Woodhead Rd,
Birstall,
WF17 9TD
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Contents

Executive Summary

This Whole Life Carbon Assessment has been prepared by enevo to support the proposed residential development at Cudworth Parkway, Cudworth, Barnsley.

The proposed residential development includes the provision of 144 homes, between 2-4 beds, as well as associated groundworks and landscaping.

This analysis & report measures the whole life carbon emissions of the proposed development, as well as identifying the measures in the design that have reduced the embodied carbon emissions of the development.

1.0 Project Summary

This Whole Life-Cycle Carbon assessment has been produced for the proposed development at Cudworth Parkway, Cudworth. Barnsley. The proposed development contains a provision for 144 new dwellings, as well as associated landscaping works.

Enevo have been appointed to produce this whole life carbon assessment in line with the RICS V2 WLCA methodology, measures are incorporated within the development to reduce carbon emissions in accordance with Barnsley Council's Supplementary Planning Document: Sustainable Construction and Climate Change Adaptation;

> A whole life carbon assessment will be required with full or hybrid applications or assessment of approval of reserved matters for major developments (10 dwellings or above and 1000m^2 or above for commercial developments or change of use developments). Where we receive an outline application, if minded to approve, a condition will be added requiring submission of a Whole life carbon assessment alongside the reserved matters. The whole life carbon assessment will be expected to follow the model set out in the RICS professional statement 'Whole Life Carbon Assessment for the Built Environment, 2017", or, if applicable, the latest subsequent version of this document or other recognised document setting out best practice for whole life carbon assessment. which RICS members must act in accordance with. https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf

2.0 Whole Life-Cycle Carbon Assessment Approach

This section gives details on the whole life-cycle carbon methodology that has been followed for this assessment, along with all assumptions considered to complete the study.

The assessment for the scheme is based on information provided by the client and the project team.

The methodology and assumptions for the whole life-cycle carbon assessments reflect the scope, design and material choices proposed for the scheme's detailed RICS WLCA application.

2.1 WLCA Assessment Purpose(s)

The purpose(s) for carrying out the whole life carbon assessment are as follows:

Assessment purpose	**RIBA Stage 4 Whole Life Carbon Reporting and Benchmarking**
Body/organisation setting the requirements	Barnsley Council
Key standard(s) or methodology(ies) reference(s)	(i) BS EN 15978, Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method (ii) RICS Whole life carbon assessment for the built environment 2nd edition (iii) Supplementary Planning Document: Sustainable Construction and Climate Change Adaptation (iv) Centre for Window and Cladding Technology's (CWCT) 'How to calculate the embodied carbon of facades: A methodology'

2.2 WLCA Assessment Details

Assessor Name	Harry Hinchliffe
Assessor Organisation Name	Enevo
Date Assessment Completed	23/04/2026
Building LCA Software Used	OneClickLCA (*this tool is accepted by RICS)
Building LCA Dataset Used	OneClickLCA Dataset available under the Licence '(UK) Business, 1 named user + BREEAM & IMPACT PRODUCTION'

2.3 WLCA Assessment Study Period

As per requirements set out in the RICS WLC Methodology (2nd Edition) and GLA Whole Life-Cycle Carbon Assessments Guidance, the study period for this assessment is 60 years.

2.4 WLCA Assessment Scope – Study Impact Categories

The following impact categories have been included in the assessment. This scope is aligned with the assessment purpose(s).

Impact category	Indicator	Unit
Embodied Carbon - total	Global Warming Potential total (GWP-total)	kgCO2eq.
Climate Change - biogenic	Global Warming Potential biogenic (GWP-biogenic) Note: For modules A1-A3 only.	kgCO2eq.

2.5 WLCA Assessment Scope – Study Life Cycle Modules

The following life cycle modules have been included in the assessment. This scope is aligned with the assessment purpose(s);

EN 15978 : Life Cycle Module Code	Life Cycle Module Name	Assessment
A1-A3	Product stage	Included
A4	Transport	Included
A5	Construction installation process	Included
B1	Use	Included
B2	Maintenance	Included
B3	Repair	Included
B4	Replacement	Included
B5	Refurbishment	Excluded – *No Pre-Planned Refurbishment Works*
B6	Operational energy use	Included
B7	Operational water use	Included
C1	Deconstruction / demolition	Included
C2	Transport	Included
C3	Waste processing	Included
C4	Disposal	Included
D	Benefits and loads beyond the system boundary	Included

2.6 WLCA Assessment Scope – Building Elements

The following construction elements have been included in the assessment. This scope is aligned with the assessment purpose(s).The scope includes newly installed and retained existing products/materials, including temporary works.

The percentage of each element category by capital cost included in the assessment is shown below – at least 95% per element category. Any excluded items each account for less than 1% of the total capital cost of that building element category. An adjustment factor has not been applied for remaining items not covered in the assessment scope.

Element category (RICS NRM)		LCA Analysis
1 Substructure	1.1 Substructure	Included
2 Superstructure	2.1 Frame	Included
	2.2 Upper floors incl. balconies	Included
	2.3 Roof	Included
	2.4 Stairs and ramps	Included
	2.5 External walls	Included
	2.6 Windows and external doors	Included
	2.7 Internal walls and partitions	Included
	2.8 Internal doors	Included
3 Finishes	3.1 Wall finishes	Included
	3.2 Floor finishes	Included
	3.3 Ceiling finishes	Included
4 Fittings, furnishings and equipment (FFE)	4.1 FFE including building-related* and non-building- related	Included
5 Building services/MEP	5.1–5.14 Services including building-related* and non-building-related	Included

** Building-related items: building-integrated technical systems and furniture, fittings and fixtures built into the fabric or included in the shell and core specification. Stage 4 BoQ has been used to calculate the carbon levels relating to the Building Services.*

2.7 Assumptions and Limitations

The assessment is based on the following assumptions and limitations. The listed assumptions and limitations are either in addition to or override the building LCA tool default assumptions and limitations.

This WLCA assessment does not include an apportionment of the district energy network or the main energy centre.

Reference Document: 'Cudworth Estates – LCA Data Collection Sheet'

The material quantities have been based on the quantities given in the above titled Bills of Quantities which have been provided by the client.

1. Product Stage

A1-A3 - Biogenic carbon reporting

It is assumed timber-based products are sustainably sourced; specified to have FSC and PEFC certification.

Based on values reported by the building LCA tool for the 'Climate change – biogenic', Global Warming Potential biogenic (GWP-biogenic) kgCO2eq. indicator.

Where negative only module A1-A3 values are reported, this is simply based on deleting positive A1-A3 Global Warming Potential biogenic (GWP-biogenic) values where they occur for reporting categories.

A1-A3 - Product stage

See design data sources above. Generic LCA data was used. Where available for proprietary specified product(s), EN 15804 compliant EPD are have been used.

Proposed Design Major Items

- Concrete (Substructure) – 70% Cement Replacement
- Concrete (Superstructure) - 30% Cement Replacement
- Rebar (Substructure, Frame, Upper Floor) - 97% Recycled Content
- Structural Steel - 30% Recycled Content
- Overall 6% Contingency to Results

2. Construction Stage

A4 – Transport

OneClickLCA Default

A5 - Construction installation process

RICS PS default: 1400kgCO2e/£100k of project value
(default A5 impacts estimated by the LCA tool has not been considered, to avoid double counting)

3. Use Stage

B1 – Use

N/A

B2 - Maintenance

10 kgCO2e/m2 gross internal area (GIA) is used to cover all building element categories, or 1% of modules A1-A5, whichever is greater.

B3 – Repair

RICS PS default: 25% of module B2.

B4 – Replacement

RICS PS default service lives or a reasonable estimate have been used. Assumed 100% replacement at each replacement interval.

B5 – Refurbishment

Excluded as no pre-planned refurbishment considered.

B6 - Operational energy use

Stage 3 PHPP Results used.

B7 - Operational water use

N/A – Part G Water Efficiency Calculation Results Used

4. End Of Life Stage

C1 - Deconstruction / demolition

RICS PS default: 3.4 kgCO2e/m2 GIA

C2 – Transport

LCA software tool defaults.

C3 - Waste processing

LCA software tool defaults.

C4 - Disposal

LCA software tool defaults.

5. D - Benefits and loads beyond the system boundary

Building LCA software tool default assumptions.

3.0 WLCA Results – Proposed Design

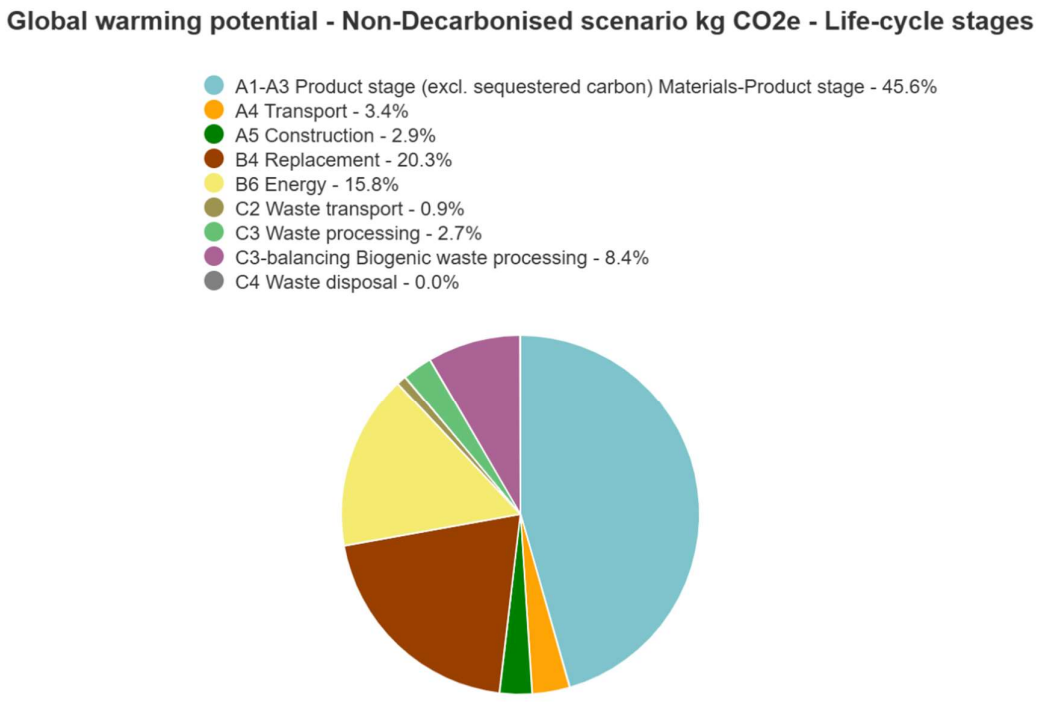
3.1 Whole Life GWP Overview (Module Breakdown)

The completed analysis for this proposed development showed a total Global Warming Potential (GWP) of 738.29 kgCO2e/m².

The breakdown of the 60-year analysis can be seen below;

Building Element Category	**GWP(kgCO2e/m²)**
Upfront Embodied Carbon (A1-A3)	339.44
Sequestered Carbon (A1-A3)	(-52.82)
Construction & Installation Embodied Carbon (A4-A5)	42.92
In-Use Embodied Carbon (B1-B5)	181.03
In-Use Operation Energy Carbon (B6)	99.4
In-Use Operation Water Carbon (B7)	-
End of Life Embodied Carbon (C1-C4)	75.85
Total	**738.29**

Embodied Carbon by Life-Cycle Stage (kgCO2e)



Graph: 60 Year GWP Breakdown by Life Cycle Stage

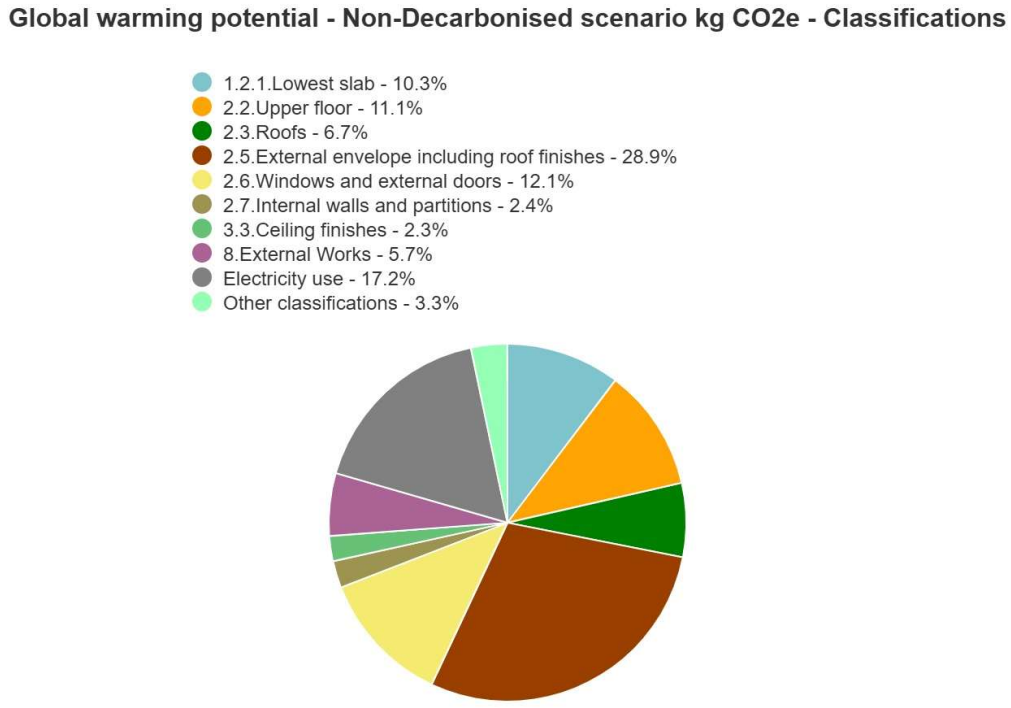
3.2 Embodied GWP Overview (Element Breakdown)

The 60-year material embodied carbon for the scheme is estimated to be 639.25 kgCO2e/m² (modules - A1-A5, B1-B5, C1-C4). These figures measure the amount carbon related to the production and lifecycle of all materials used in the development, including any maintenance & replacement. These figures do not include operational carbon.

The figure below shows the embodied carbon broken down by building element category;

NRM	Building Element Category	GWP (kgCO2e/m²)	%
1	Substructure	70.0859954	10.96%
2.1	Superstructure – Structural Elements	404.808432	63.33%
2.2	Superstructure – Building Envelope	138.68	31.69%
2.3	Superstructure – Internal Elements	9.08	2.08%
3	Finishes	25.3561841	3.97%
5	Services	106.50416	16.66%
8	External works	32.4974849	5.08%
	Total	**639.25**	**100%**

Embodied Carbon by Building Element (kgCO2e)



Graph: 60 Year GWP Breakdown by Building Element

3.3 A1-A5 Upfront Embodied GWP Overview

The Module A1-A5 material upfront embodied carbon for the scheme is estimated to be **381.88** kgCO2eq/m². (Modules A1-A3 represent product stage, Modules A4 represent transportation to site and Modules A5 represent construction). These results only take into account the carbon associated with the production of all materials used during construction, and not operational carbon or maintenance/ replacement of products during the development's 60-year life cycle.

NRM	Building Element Category	GWP (kgCO2e/m²)	%
1	Substructure	64.49754979	6.24%
2.1	Superstructure – Structural Elements	242.3447527	35.68%
2.2	Superstructure – Building Envelope	118.26	35.52%
2.3	Superstructure – Internal Elements	7.29	2.19%
3	Finishes	7.114261953	2.13%
5	Services	52.49717759	15.52%
8	External works	15.42683896	2.73%
	Total	381.88	100%

Embodied Carbon by Building Element (kgCO2e) – Life Cycle Stages A1-A5

3.4 Embodied Carbon Hotspots

To assist the design team in prioritising and decision making for future stages to reduce Module A1-A3 Carbon, it is noted that the following items have the highest Module A1-A3 GWP upfront embodied carbon (highest to lowest):

Building Element	A1-A3 GWP (Tonnes/CO2e)	% of Total A1-A3
2.5.1. External Walls – PIR Insulation	755	16.60%
2.5.1. External Walls - Brickwork	651	14.30%
2.1.1. Floor Construction - Concrete	421	9.20%
2.5.1. External Walls - Blockwork	372	8.20%
5.1.1. MEP Services – Heating Distribution	308	6.80%
2.3. Roofs – Mineral Wool Insulation	295	6.50%

Embodied Carbon Hotspots

4.0 Opportunities for Lowering Embodied Carbon – Material Alternatives

There are 3 main strategies that are commonly undertaken when attempting to reduce whole life GWP, these are;

- Reduction in Quantities
- Specifying alternative products that can demonstrate low carbon impact (i.e. Referring to manufacturers EPDs)
- Specifying alternative product/system types that have a lower carbon impact

In the spirit of the above strategies, investigations have been made as part of this assessment process on measures that could be implemented into the designs for this development going forward to reduce the GWP. These investigations have led to the following design measures being implemented;

- **Specification of concrete used in the substructure to have a total GBBS content of a minimum of 70%.**
- **Specification of a timber framing system that is 100% PEFC/FSC certified.**
- **Specification of PIR insulation that has a 3rd party approved EPD (Kingspan/Celotex or equiv.)**

The impact of this recommendation on the total embodied carbon can be seen in the figures below;

	A1-A3 Materials ($kgCO_2e/m^2$)	A4 Transportation ($kgCO_2e/m^2$)	A5 Site ($kgCO_2e/m^2$)	Embodied Carbon (A1-A5) ($kgCO_2e/m^2$)
Baseline Design	339.44	24.37	18.55	382.36
Improved Design	308.22	24.37	18.55	390.88
Reduction	-31.22	0	0.00	-31.22

Comparison of GWP Figures of Baseline Design vs Improved Design

5.0 Conclusions & Recommendations

This report has provided a Whole Life-Cycle Carbon Assessment of the proposed residential development at Cudworth Parkway, Cudworth, Barnsley.

This 60-year assessment has shown that the current proposed designs have a total embodied carbon of at a rate of **382.36 kgCO2e/m²** and a Whole Lifecycle Carbon rate of **738.29 kgCO2e/m².**

As part of this assessment, an investigation has been made on methods to reduce the embodied carbon of the development. These recommendations as shown in section 4.0 of this report, show and opportunity to reduce the embodied carbon of the development to a rate of **351.14 kgCO2e/m²**.

6.0 Carbon Offsetting

The term “carbon offset” is shorthand for GHG emission reductions or removals that compensate for CO2 emissions. In this section, we explain the difference between different carbon offset projects and programs.

The UK Green Building Council (UKGBC) published Net Zero Carbon Buildings (NZCB): A Framework Definition, which provides the built environment industry clarity on how to achieve net zero carbon buildings in both construction and in operation. This was followed by detailed guidance on how best to approach carbon offsetting and the standards for doing so.

The UKGBC framework encourages reductions in whole life carbon and improvements in energy efficiency as the most important steps in decarbonising buildings. However, it also recognises that the procurement of renewable energy and carbon offsets must play a role in a building’s transition to a state of net zero.

8.1 Best practice approach

1.1.1 Oxford University Carbon Offsetting Principles

Along with the UKGBC, Oxford University is one of the organisations that has published a set of guiding principles which is now generally recognised across the industry as the best practice approach to carbon offsetting in the short, medium and long-term. These principles should be considered when developing a carbon offsetting strategy.

The Oxford Principles for Net Zero aligned carbon offsetting can be summarised as follows:

1. **Cut emissions, use high quality offsets, and regularly revise offsetting strategy as best practice evolves,**
    a) **Prioritise reducing your own emissions** - Minimise the need for offsets in the first place.
    b) **Ensure environmental integrity -** Use offsets that are verifiable and correctly accounted for and have a low risk of non-additionality, reversal, and creating negative unintended consequences for people and the environment.
    c) **Maintain transparency -** Disclose current emissions, accounting practices, targets to reach net zero, and the type of offsets you employ.
2. **Shift to carbon removal offsetting,**
3. **Shift to long-lived storage carbon offsets,**
4. **Support the development of net zero aligned offsetting.**

1.1.2 UKGBC Requirements for Carbon Offsetting

In addition to the Oxford University offsetting principles, the UKGBC have published best practice guidance for procurement of carbon offsets for the UK Construction sector. The

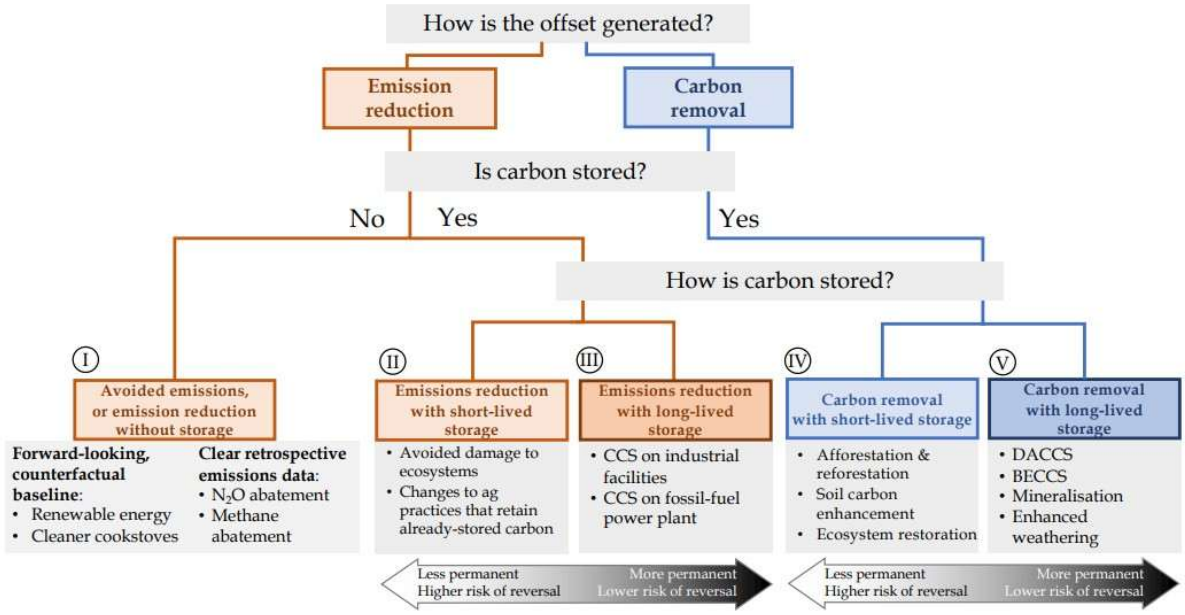
UKGBC's 'Leading Practice' approach is one that aligns to the 'Transition Fund' approach, which is detailed below.

Transition Fund approach to Carbon Offsetting

Organisations and consumers seeking to demonstrate leadership can consider taking a transition fund approach. The core premise of this approach is to release funds to further support the transition to net zero, on top of payments made to offset the residual carbon emission of a project using voluntary offsetting.
It is recommended that the carbon price is at least equal to the HM Treasury Green Book non-traded central scenario. For 2023, this is priced at approximately £85/tCO2. An overview of how this approach works is provided in Figure below.

8.2 Types of Carbon Offsets

Figure below provides a simplified classification scheme, showing five types of carbon offset based on whether carbon is stored, and the nature of that storage. Carbon removal is defined as the act of taking CO2 out of the air and permanently storing it. The buyer of carbon offsets on the voluntary market, will generally have options to buy carbon offsets under one of these 5 categories. It should be noted that as we approach 2050, buyers should shift to carbon removal offsetting as well as to long-lived storage carbon offsets, i.e. moving towards Type III and/or Type V carbon offsets overtime, between now and 2050.



8.3 Carbon Offsetting Options

The residual carbon balance of the project should be offset through an approved international or domestic carbon standard. The leading schemes currently are provided in Table below. These schemes provide the opportunity to invest in carbon offsets for a range of specific projects in the UK or internationally.

Scheme	Scope / Link	Pros / Cons	Typical Cost of Carbon Offsets
Gold Standard	International https://marketplace.goldstandard.org/collections/projects	Supports climate resilience in developing countries where it's needed most + supports local labor market. Cons: At times international accreditation schemes are not as robust as those in the UK	$10 - $100 USD/tonnes CO2
Verified Carbon Standard	International https://verra.org/programs/verified-carbon-standard		$10 - $100 USD/tonnes CO2
Clean Development Mechanism	International		$10 - $100 USD/tonnes CO2
UK Woodland Carbon Code	UK only https://woodlandcarboncode.org.uk/	Promotes UK biodiversity enhancement in areas where it's needed. Supports general local community climate resilience. Cons: Projects can be quite small with a limit to offset availability	£20 -£30/tonnes CO2
UK Peatland Code	UK only https://www.iucn-uk-peatlandprogramme.org/peatland-code-0		£20 -£30/tonnes CO2

7.0 Acknowledgements

In preparing this report we acknowledge use of the following sources:

- London Plan Policy i.e. Part F of SI2
- Mayor of London WLC_Guidance_March_2022.pdf
- RICS Whole life carbon assessment for the built environment (1st edition, November 2017)
- The Oxford Principles for Net Zero Aligned Carbon Offsetting (September 2020)
- Renewable Energy Procurement & Carbon Offsetting Guidance for net zero carbon buildings, March 2021