



University of  
**Strathclyde**  
Glasgow

# Embodied carbon

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10.02.25

# Agenda

- What is embodied carbon?
- How do you assess it?
- How is the UK ecosystem of requirements, standards and guidance evolving?
- How can I stay abreast of developments?

# UK ecosystem

**International standards**  
 ISO 14040, ISO 14044  
 BS EN 15978, BS EN 17472

**Local planning requirements**

**Public procurement standards**

**Assessment standard**

RICS PROFESSIONAL STANDARD  
 Whole life carbon assessment for the built environment  
 Global  
 2nd edition, September 2023  
 Effective from 1 July 2024  
 RICS

**UK Net Zero Carbon Buildings Standard**  
 Voluntary standard

**BECD**  
 Built Environment Carbon Database  
 Product & asset databases

**PART Z**  
 An industry-proposed amendment to UK Building Regulations 2010  
 Industry-proposed regulation

--- proposal

**Guidance, supplementary standards & benchmarks**

RICS RIBA CIBSE IStructE LETI PAS2080 UKGBC WLCN

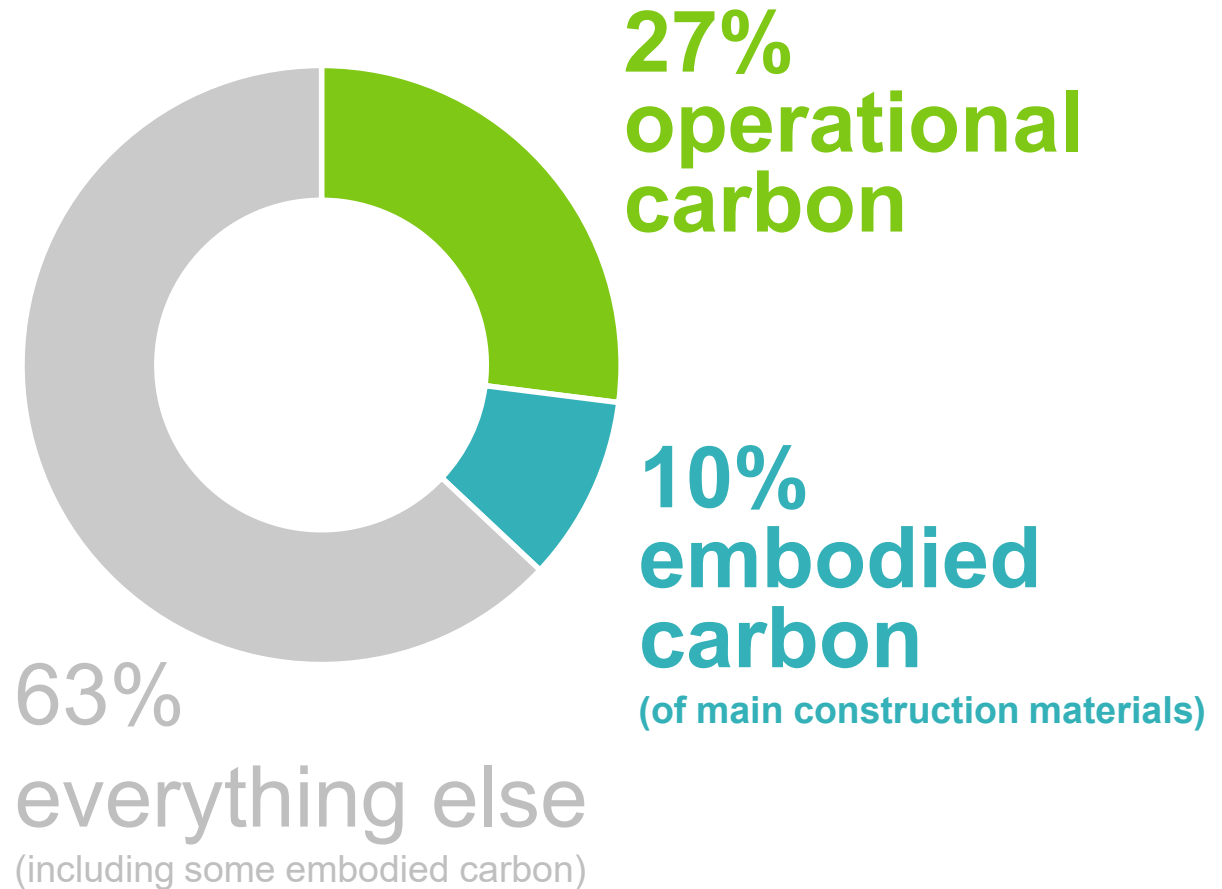
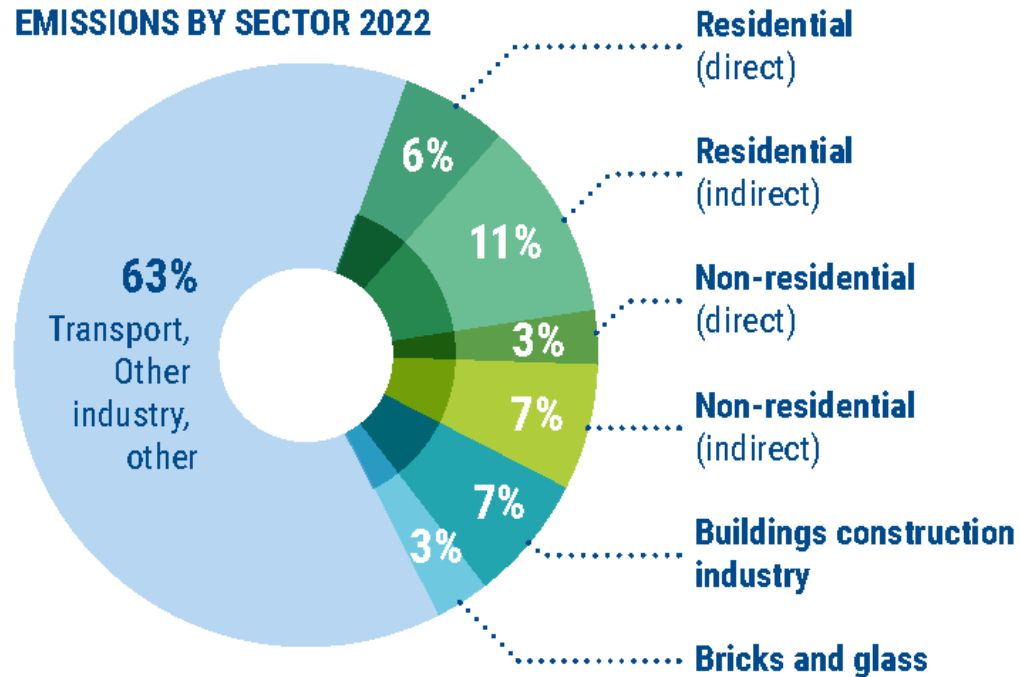
**Tools**

# **WHAT IS EMBODIED CARBON?**

## Terminology, guidance & trends

# Global energy & process CO<sub>2</sub> emissions

EMISSIONS BY SECTOR 2022





# Improving Consistency in Whole Life Carbon Assessment and Reporting

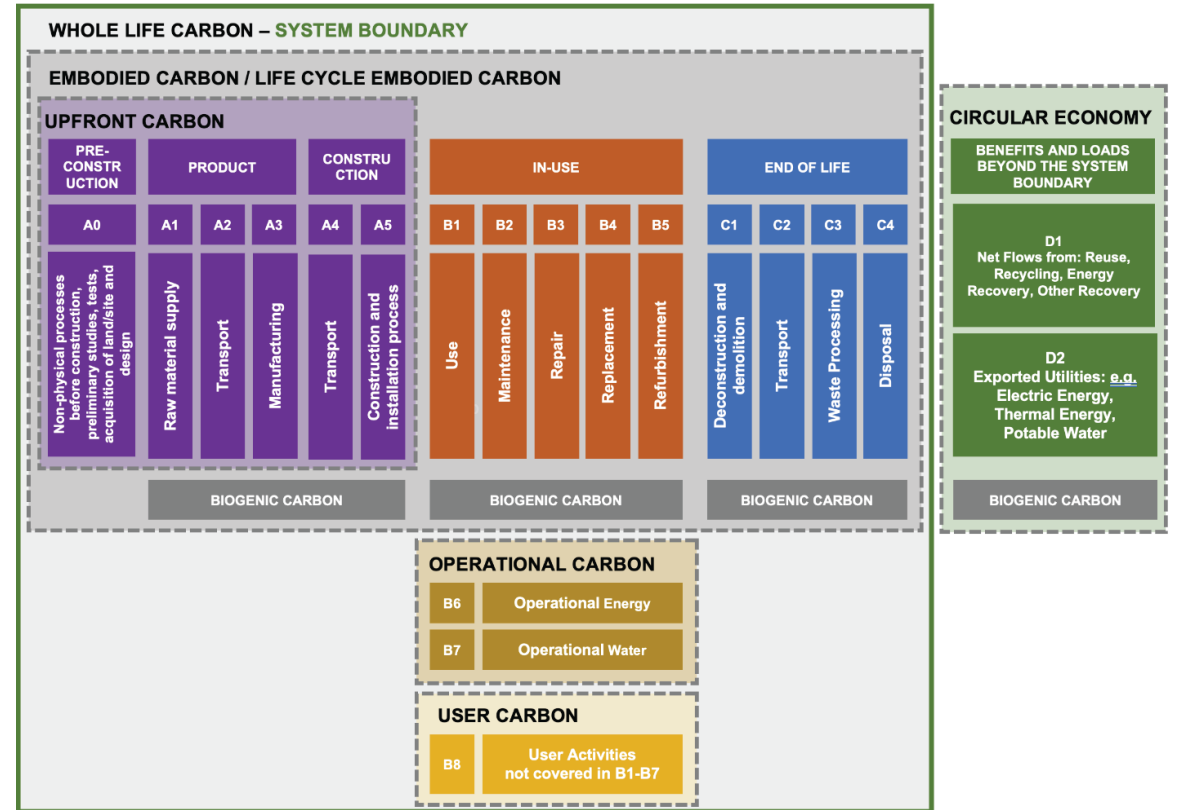
## Carbon Definitions for the Built Environment, Buildings & Infrastructure

For inclusion in the update of the RICS Professional Statement: 'Whole life carbon assessment for the built environment' - 2023



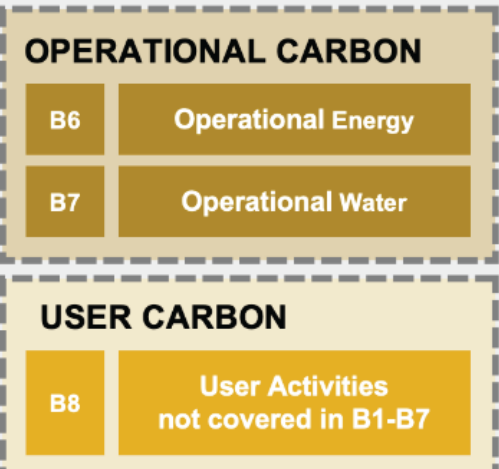
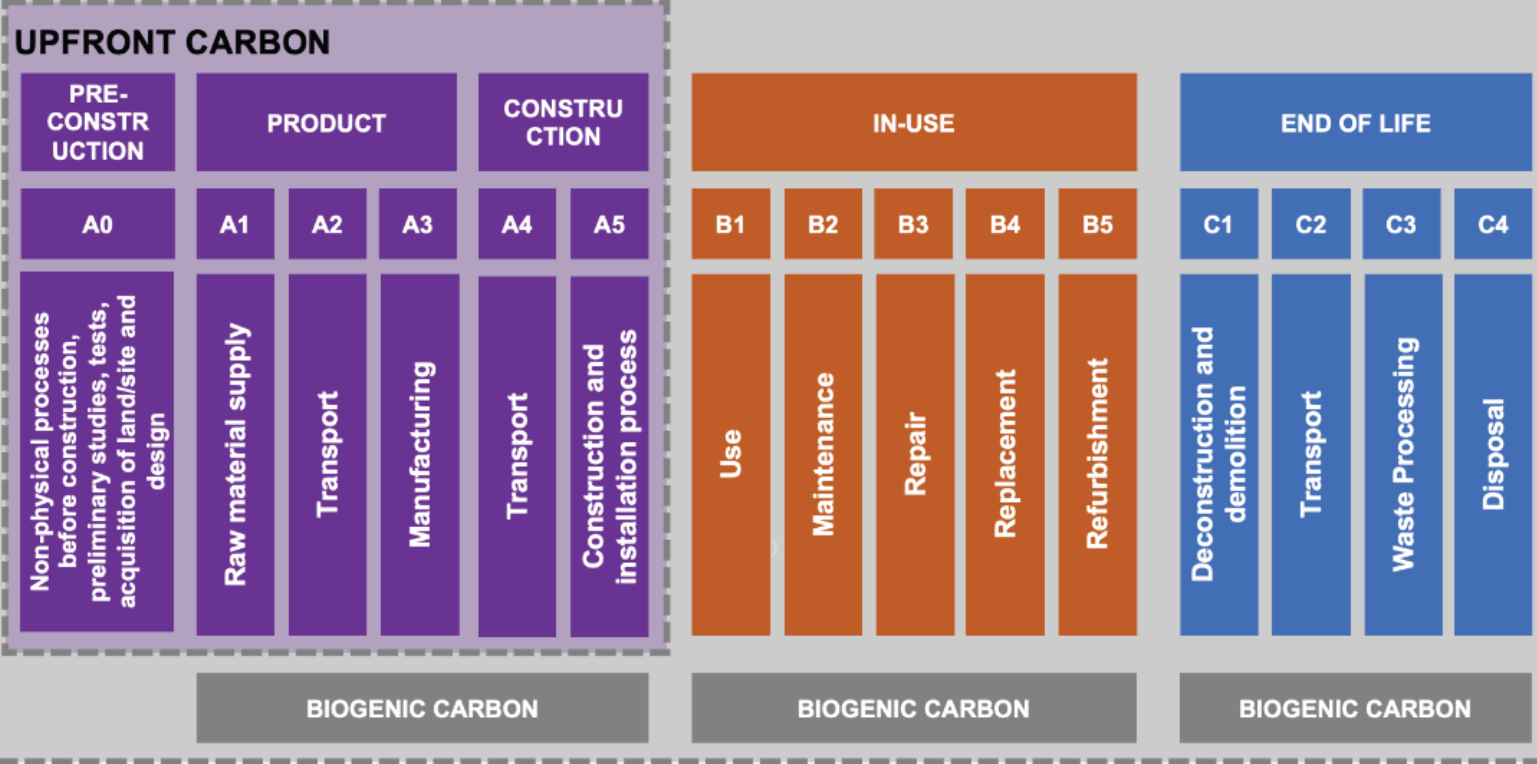
January 2023

# Definitions

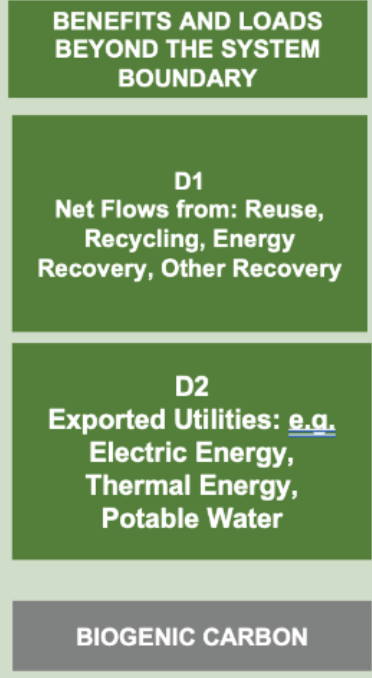


# WHOLE LIFE CARBON – SYSTEM BOUNDARY

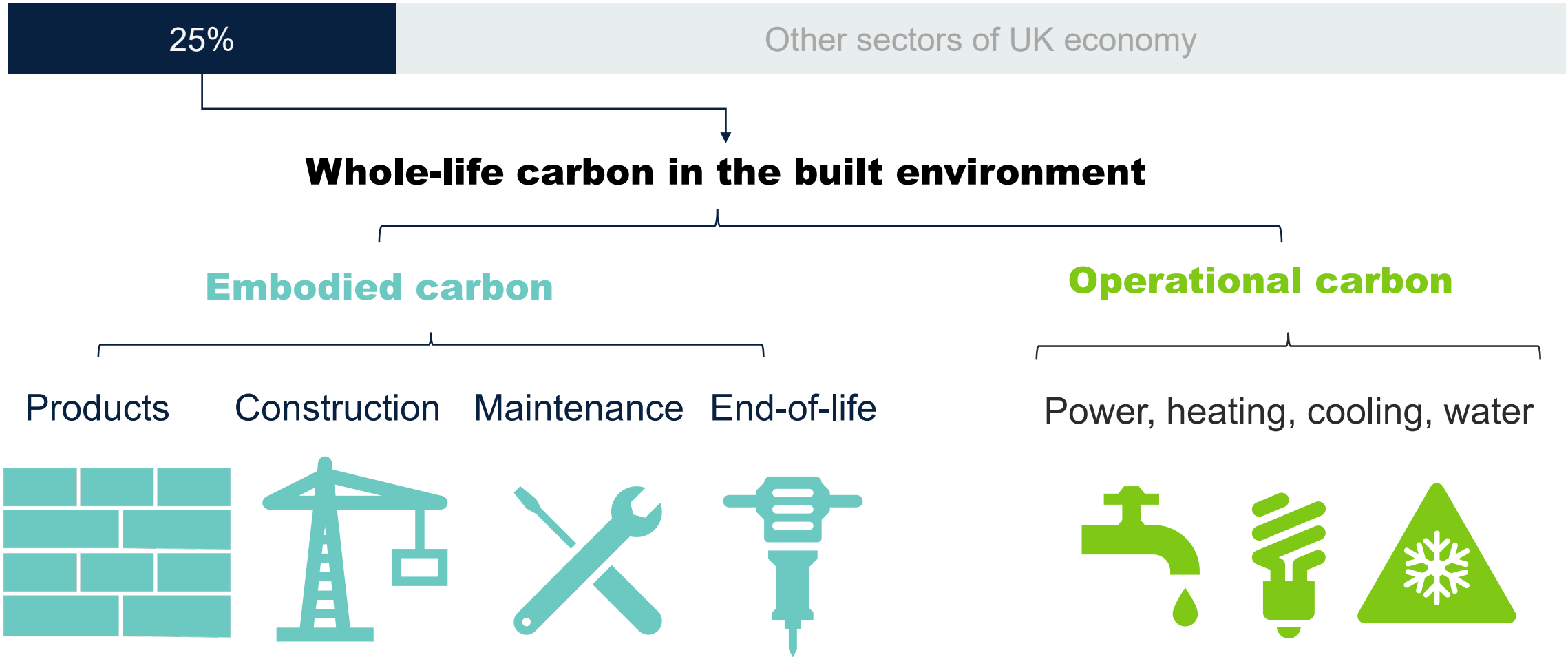
## EMBODIED CARBON / LIFE CYCLE EMBODIED CARBON



## CIRCULAR ECONOMY

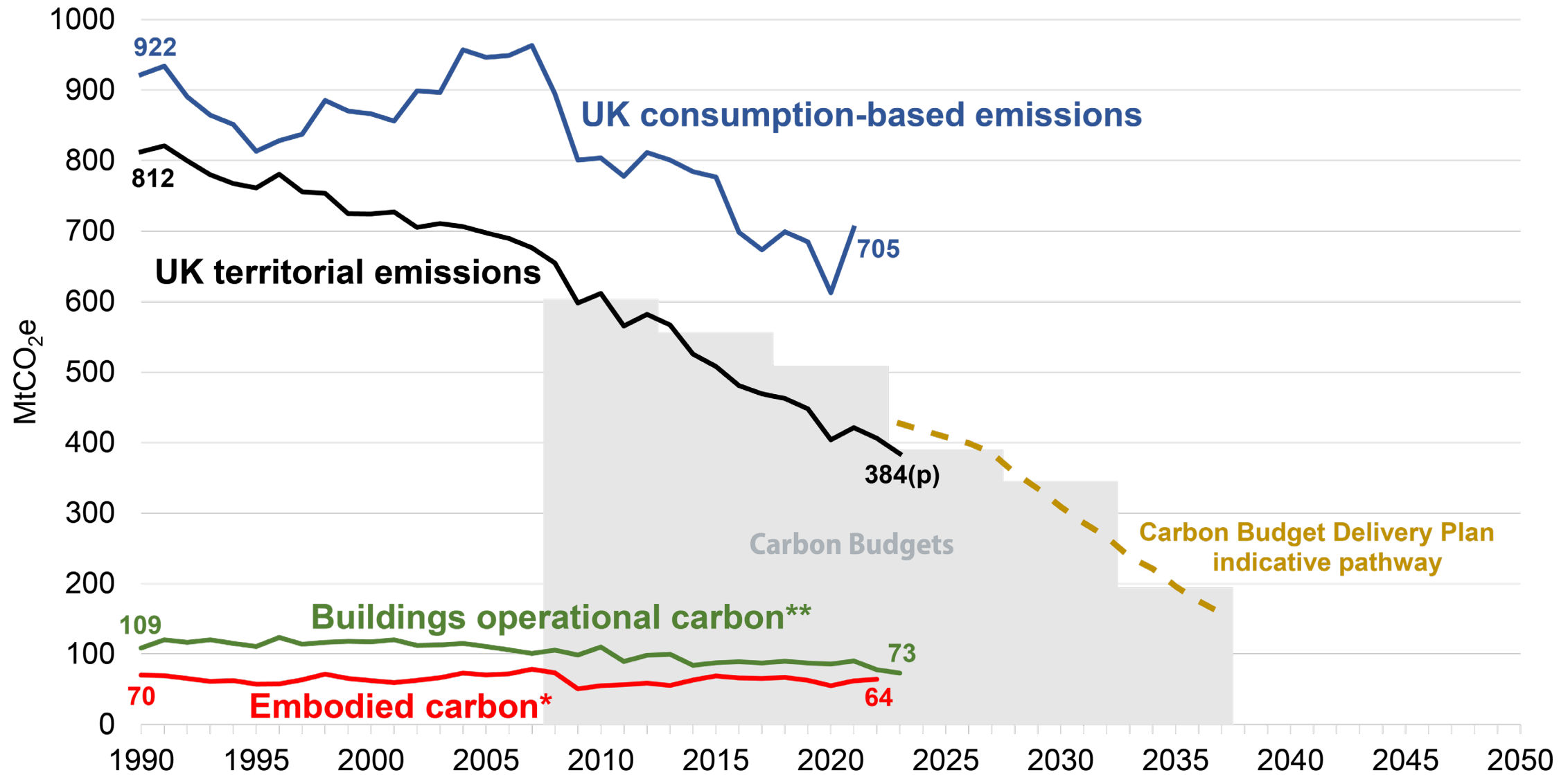


# UK's carbon footprint



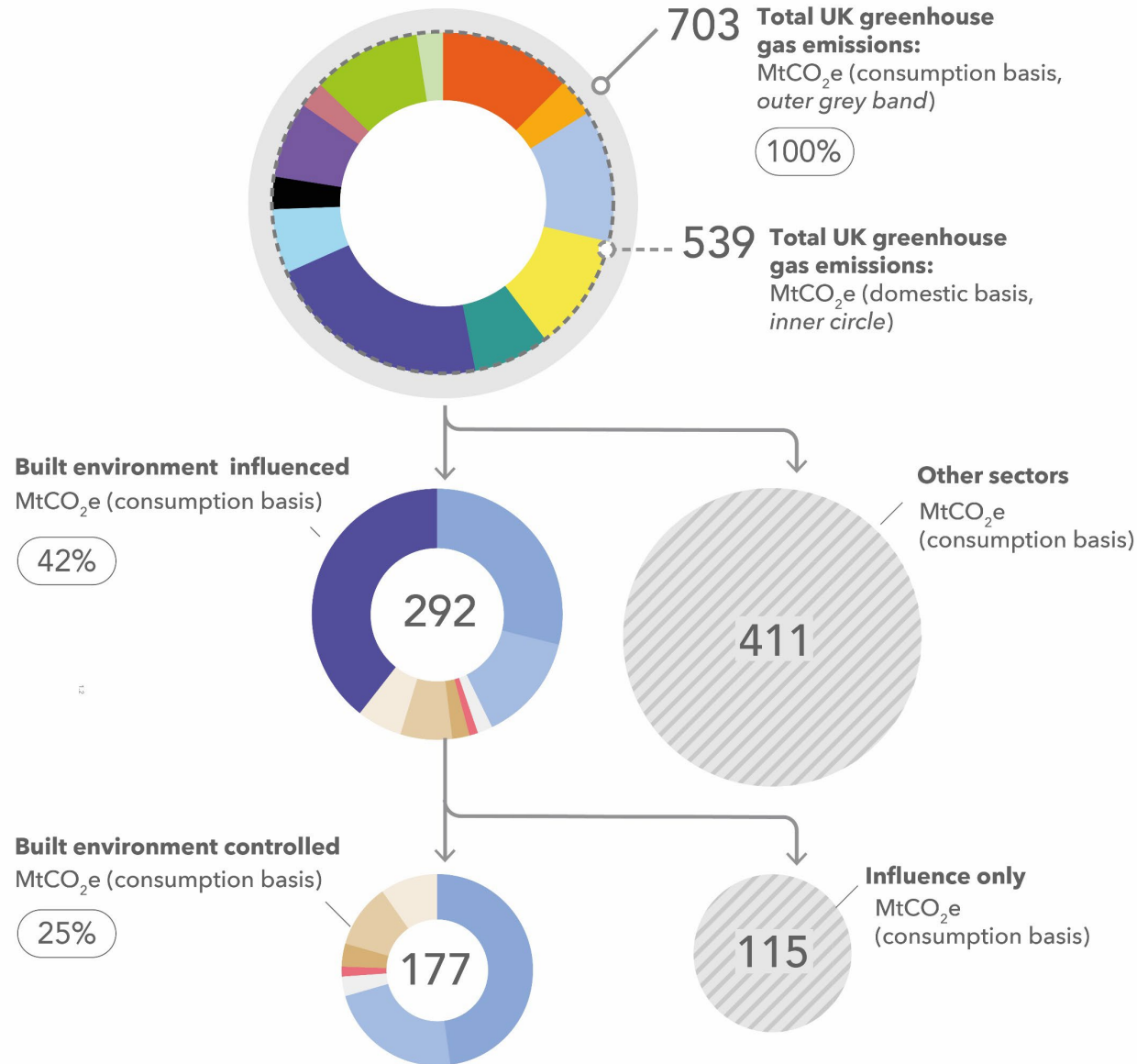


# Embodied carbon is ~9% of UK emissions



Territorial emissions from DESNZ's March 2024 provisional national statistics to 2023 & consumption-based emissions from Defra's May 2024 release of UK's Carbon Footprint.  
 \*Embodied carbon of built environment from UKGBC 2023 Whole life carbon roadmap progress report.  
 \*\*Buildings operational carbon from CCC 2024 Progress report to Parliament.

# Total UK GHG emissions (2018 CCC Data) showing proportion of Built Environment emissions



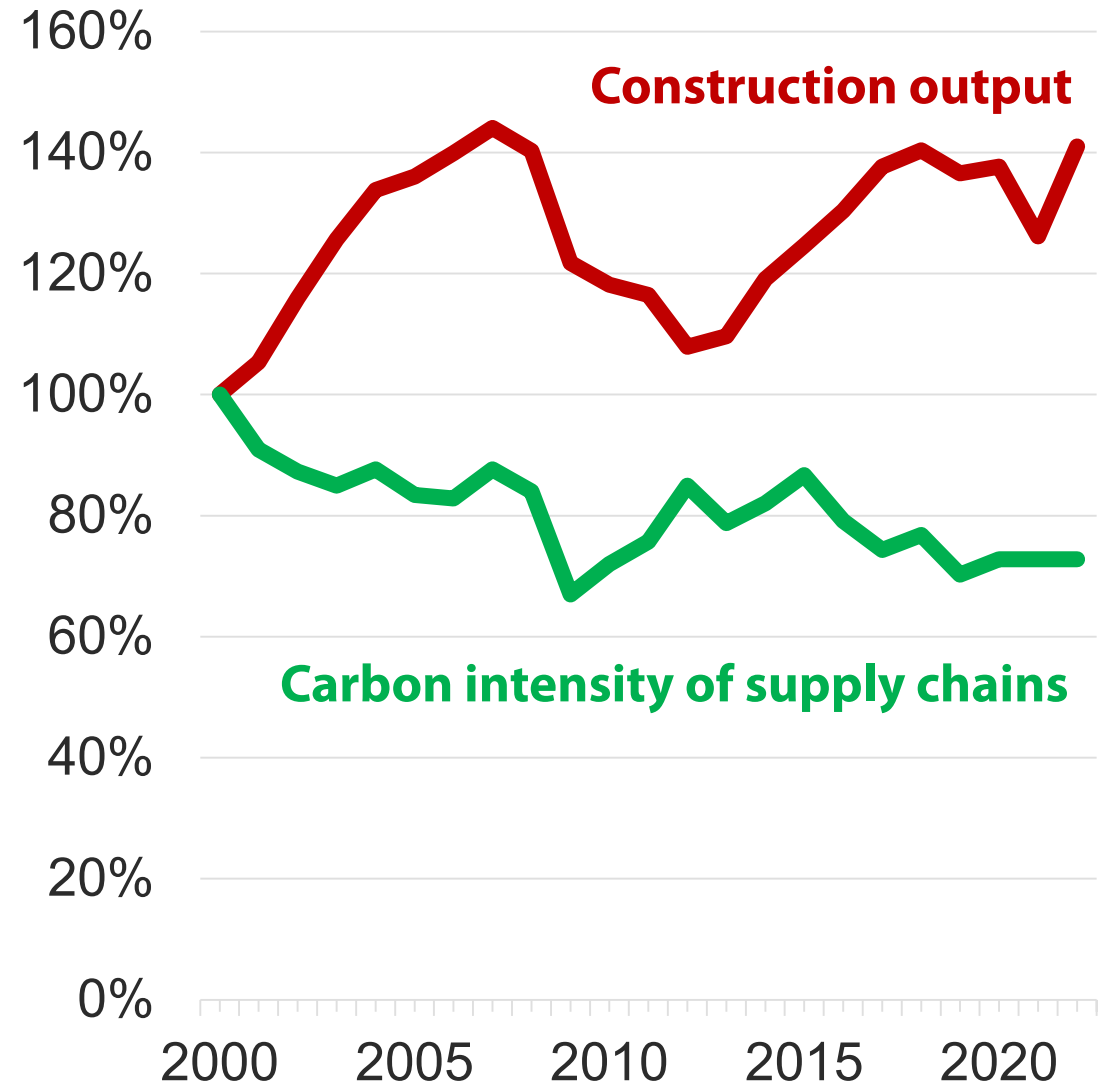
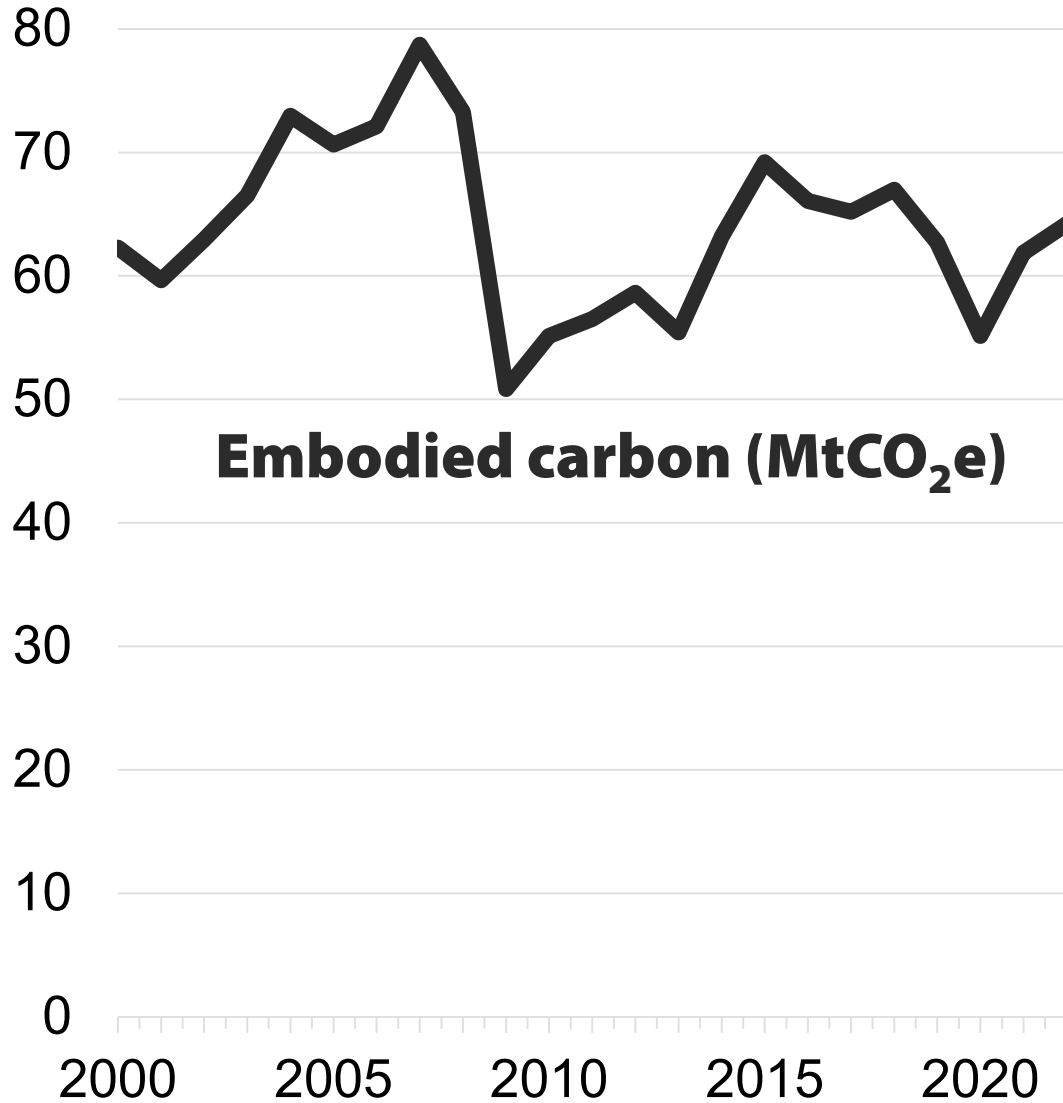
## CCC SECTORS (TOP CIRCLE)

- Residential buildings
- Non-residential buildings
- Manufacturing & construction
- Electricity supply
- Fuel supply
- Surface transport
- Waste
- F-gases
- Aviation
- Shipping
- Agriculture
- Land Use, Land-Use Change & Forestry

## BUILT ENVIRONMENT SECTORS

- Buildings (Non Domestic) Embodied Carbon
- Buildings (Domestic) Embodied Carbon
- Infrastructure Embodied Carbon
- Infrastructure Operational carbon
- Buildings F-Gas
- Buildings (Non-domestic) Operational Carbon
- Buildings (Domestic) Operational Carbon
- Surface transport

# UK built environment trends



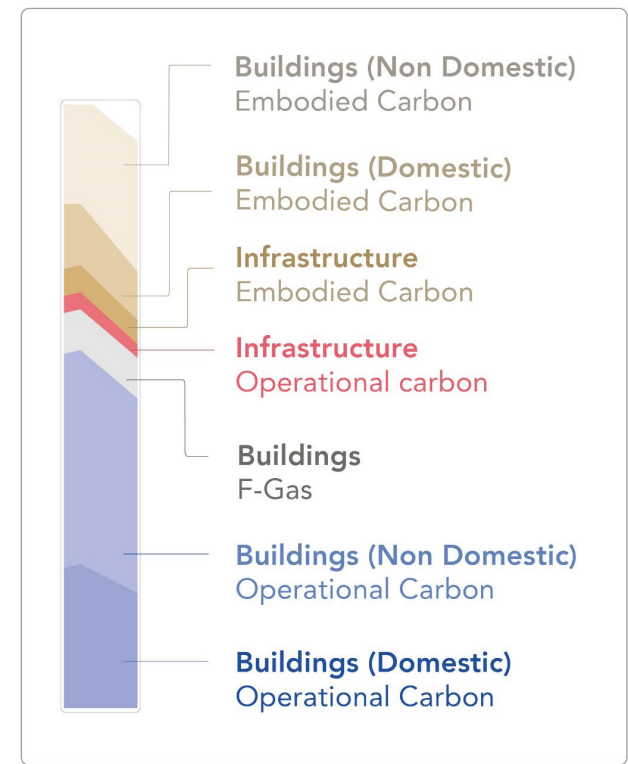
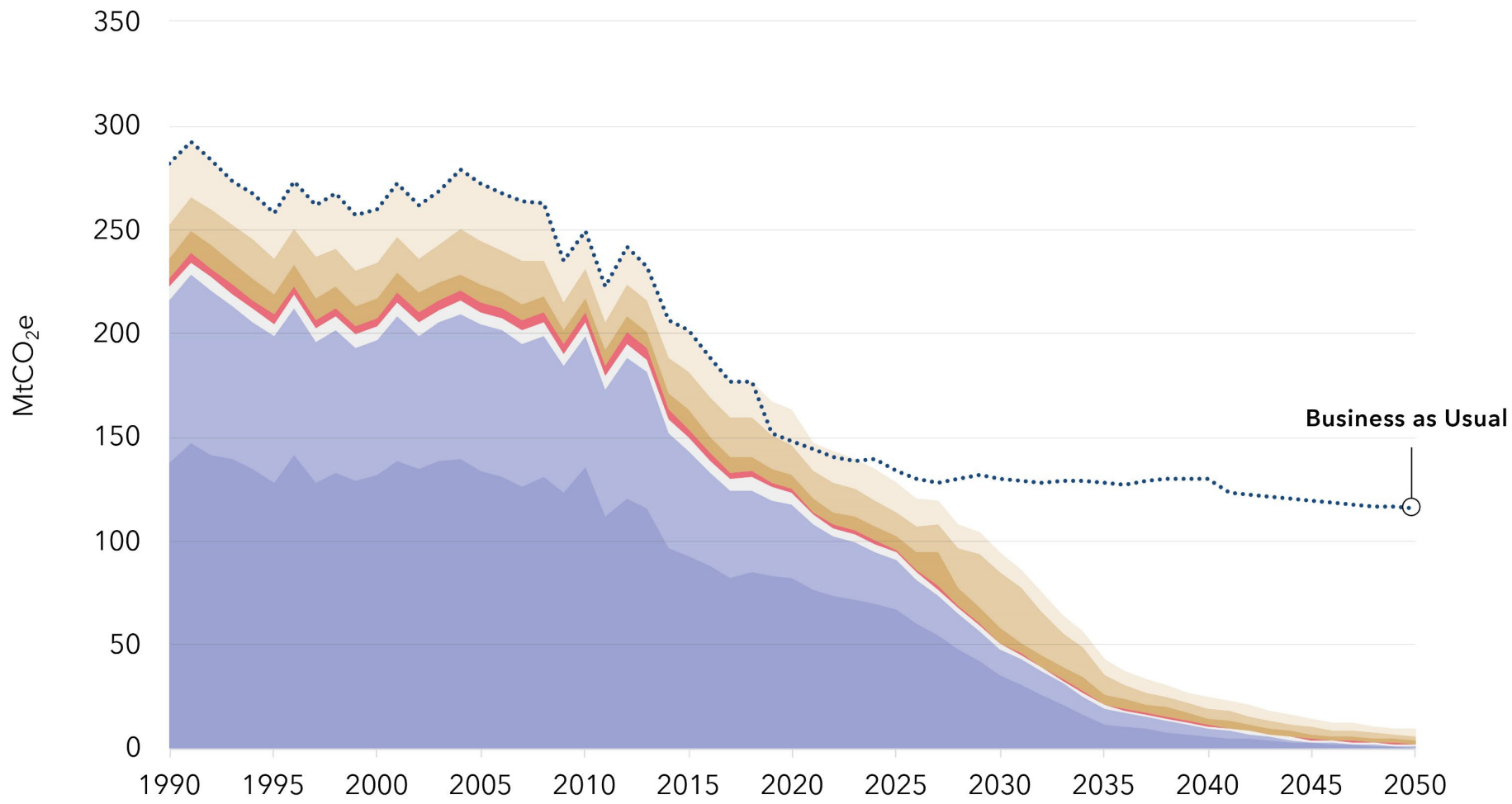


# Net Zero Roadmap

Outlines a common vision & industry-wide actions for achieving net zero carbon in the construction, operation, & demolition of buildings & infrastructure in the UK.

Based on input from >100 stakeholders across industry

# UK Built Environment GHG Emissions 1990-2050

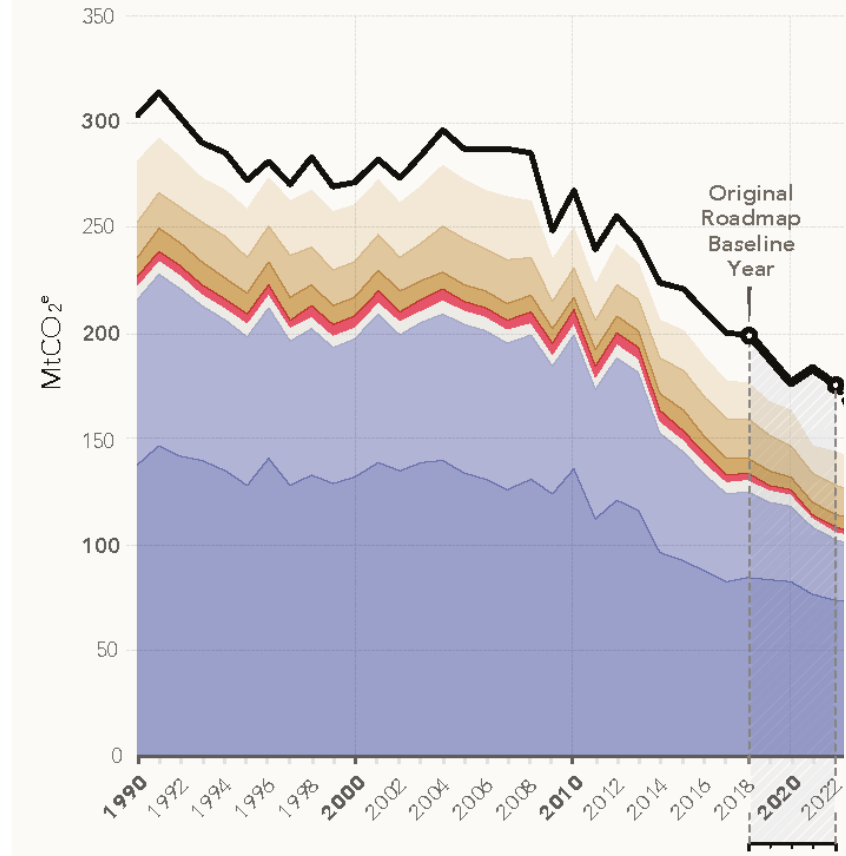


# Roadmap progress update

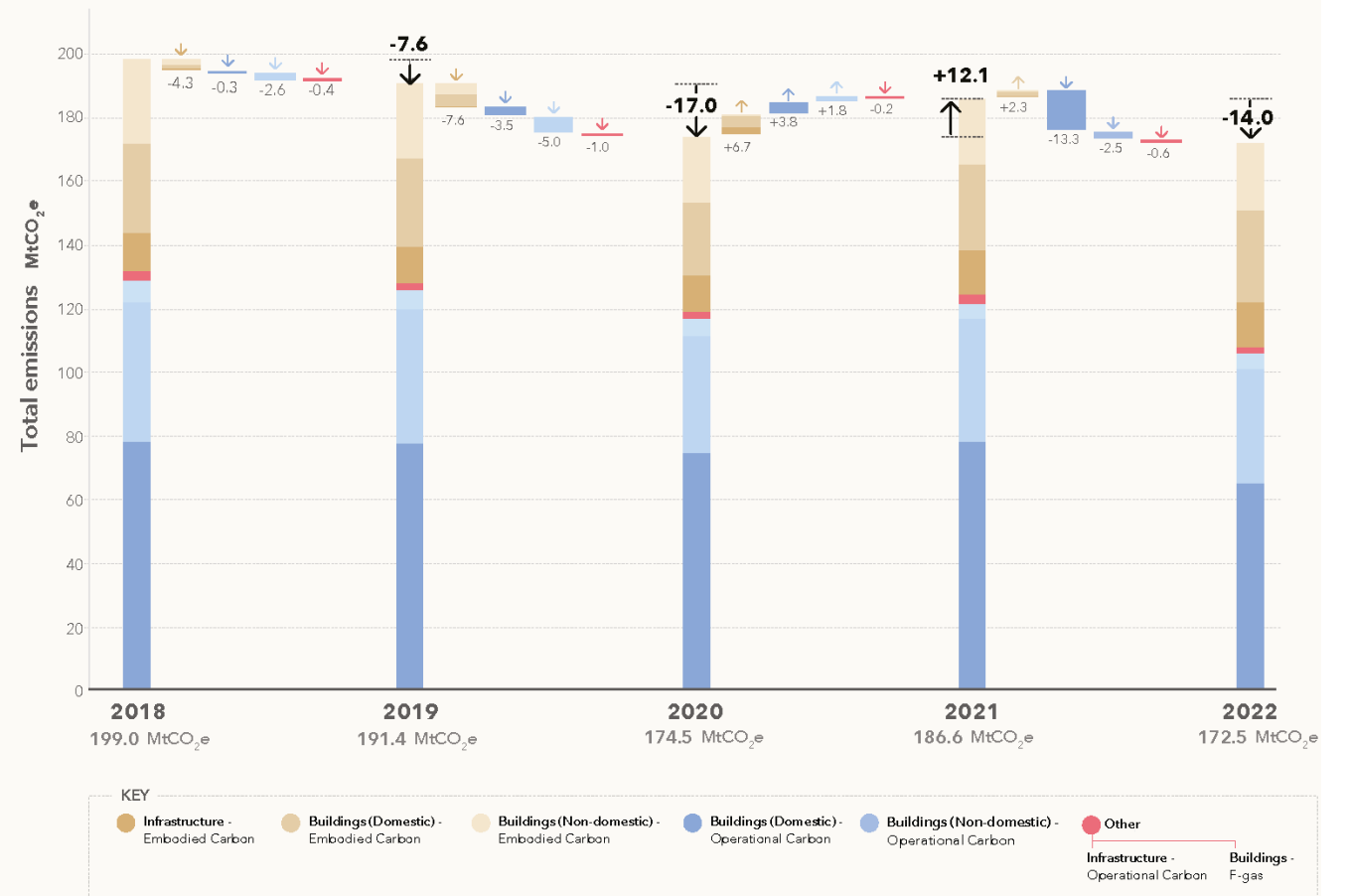


**FIGURE 1: HISTORIC BUILT ENVIRONMENT EMISSIONS (1990-2022)**

Excluding Transport, with Business as Usual Projections Overlaid onto the 2021 UKGBC Net Zero Whole Life Carbon Roadmap Data.



**FIGURE 4 EMISSIONS CHANGES PER SECTOR FOR EACH YEAR 2019 - 2022**



# Typical housing project split

## Embodied carbon



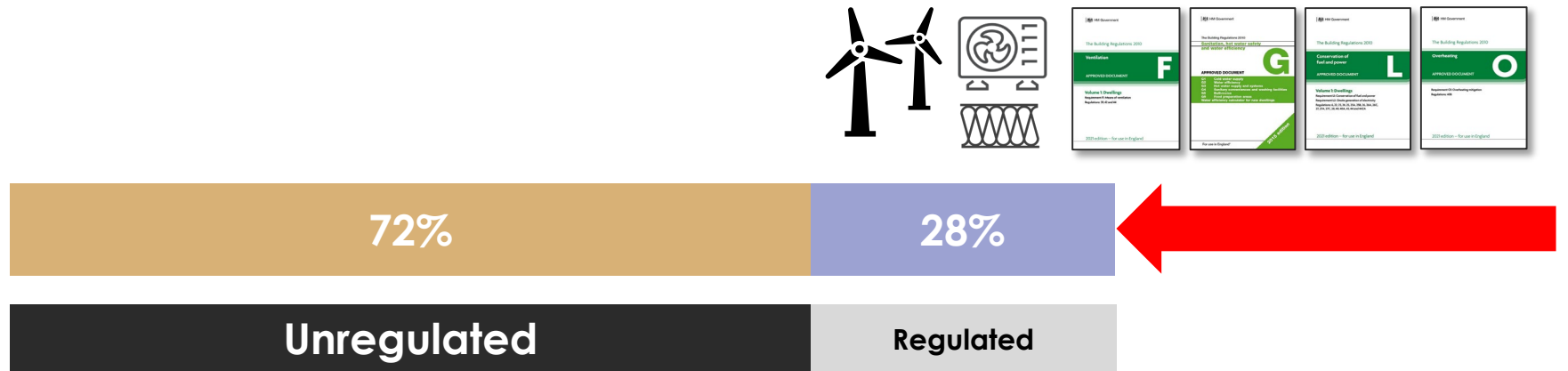
## Operational carbon



Current mass housebuilder designs that just meet regs

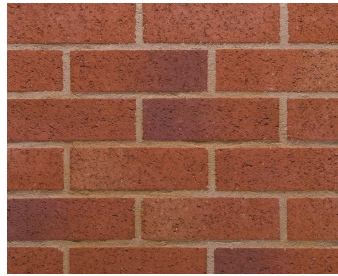


Modern, low-energy design that meets Future Homes Standard



# Scale – buildings

1t



**4x brick pallets**

*~1 tCO<sub>2</sub>*

At 232 kgCO<sub>2</sub>e/t brick (A1-A5) from UK clay brick EPD

10t



**King's Cross Sports Hall**

*709 tCO<sub>2</sub>e*

2000m<sup>2</sup> facility, LETI B-rated for embodied carbon & sequesters 638 tCO<sub>2</sub>

100t

1kt



**5 Broadgate**

*46,324 tCO<sub>2</sub>e*

13 storeys, 65,300m<sup>2</sup> of office space to practical completion

10kt

100kt



**Development Pipeline**

*209,051 tCO<sub>2</sub>e*

Forecasted total embodied carbon in 2021 Sustainability Report



# Scale – infrastructure



**M54-M6 Link Road**  
*81,890 tCO<sub>2</sub>e*  
1.6 miles new road  
2 new junctions  
& some realignment



**A14 extension**  
*981,432 tCO<sub>2</sub>e*  
23 miles of upgrades  
7 miles widening  
new bypass  
& local modifications



**HS2**  
*13.3 MtCO<sub>2</sub>e*

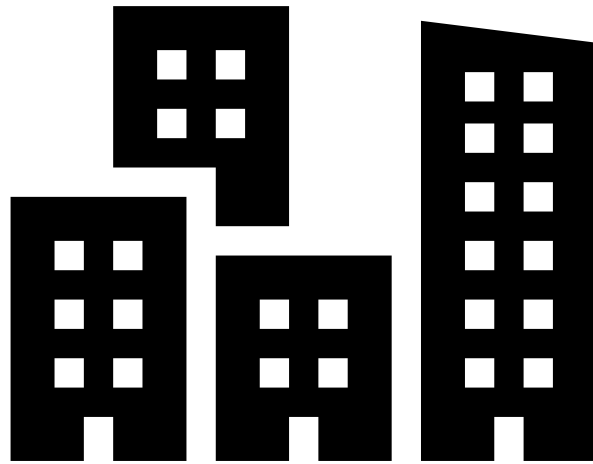


**Heathrow 3rd runway**  
*3.6 MtCO<sub>2</sub>e*

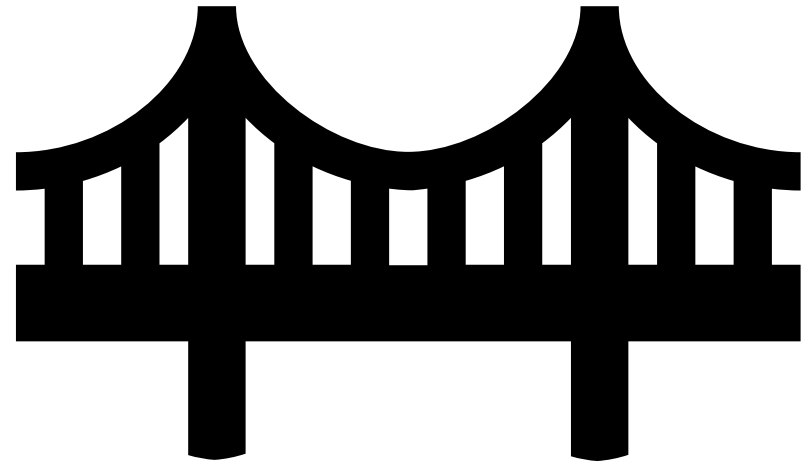
# **HOW DO YOU ASSESS IT?**

## Standards, tools & data

# Differences in terminology & standards



**Buildings**  
e.g. BS EN 15978



**Infrastructure**  
e.g. BS EN 17472

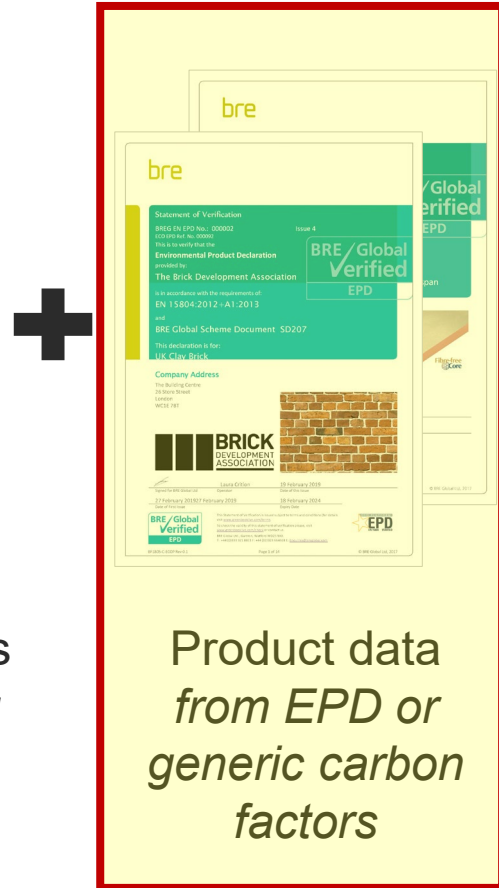
# Basic calculation

$$\text{Embodied carbon (kgCO}_2\text{e)} = \sum_{\text{Sum for all materials}} \left( \text{Quantity (kg)} \times \text{Carbon factor (kgCO}_2\text{e/kg)} \right)$$

# Typical assessment of a building



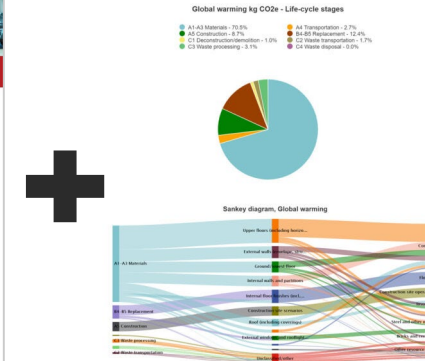
Material quantities  
*e.g. from building model or BoQ*



Product data  
*from EPD or generic carbon factors*



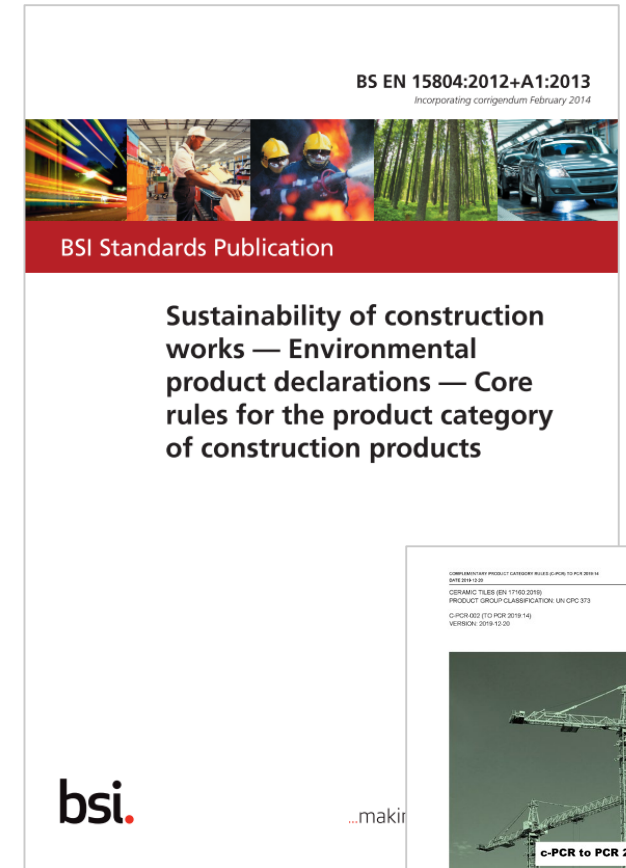
Assessment standards  
*e.g. BS EN 15978 + RICS PS*



Software tool  
*e.g. OneClickLCA*

# What is an EPD?

- An Environmental Product Declaration provides environmental information from a LCA in a standardised format using a consistent methodology
- Based on standards combined with Product Category Rules (PCR) and independently verified
- Basically  $LCA+PCR = EPD$



BS EN 15804  
Core EPD rules  
+  
Product Category Rules





## Statement of Verification

BREG EN EPD No.: 000311

Issue 02

This is to verify that the

### Environmental Product Declaration

provided by:

**Kingspan Insulation Ltd**

is in accordance with the requirements of:

**EN 15804:2012+A1:2013**

and

**BRE Global Scheme Document SD207**

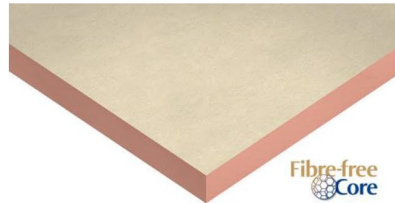
This declaration is for:

**Kingspan Kooltherm K5 External Wallboard, Kingspan Kooltherm K20 Concrete Sandwich Board**



### Company Address

Kingspan Insulation Limited  
Pembridge  
Herefordshire  
HR6 9LA



Fibre-free  
Core



*Emma Baker*

Emma Baker

07 April 2022

Signed for BRE Global Ltd

Operator

Date of this issue

21 January 2021

Date of First Issue

20 January 2026

Expiry Date



This Statement of Verification is issued subject to terms and conditions (for details visit [www.greenbooklive.com/terms](http://www.greenbooklive.com/terms)).  
To check the validity of this statement of verification please, visit [www.greenbooklive.com/check](http://www.greenbooklive.com/check) or contact us.  
BRE Global Ltd., Garston, Watford WD25 9XX.  
T: +44 (0)333 321 8811 F: +44 (0)1923 664603 E: [Enquiries@breglobal.com](mailto:Enquiries@breglobal.com)



## Environmental Product Declaration

**EPD Number: 000311**

### General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013
Commissioner of LCA study	LCA consultant/Tool
Kingspan Insulation Limited Pembridge Herefordshire HR6 9LA	BRE LINA Tool v2.07
Declared Unit	Applicability/Coverage
1m <sup>2</sup> of insulation at a thickness that gives an R-value of 2.857m <sup>2</sup> .K/W (60mm)	Product Specific
EPD Type	Background database
Cradle to Gate with options	Ecoinvent 3.2

### Demonstration of Verification

CEN standard EN 15804 serves as the core PCR <sup>a</sup>

Independent verification of the declaration and data according to EN ISO 14025:2010

Internal  External

(Where appropriate <sup>b</sup>)Third party verifier:  
Nigel Jones

a: Product category rules

b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

### Comparability

Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A1:2013. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A1:2013 for further guidance



Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
A4 – Transport to the building site	Description of scenario		
	Fuel type / Vehicle type	Litre of fuel type per distance or vehicle type	Lorry >32 metric tons
	Distance	km	523
	Capacity utilisation (incl. empty returns)	%	86
	Bulk density of transported products	kg/m <sup>3</sup>	35
A5 – Installation in the building	Description of scenario		
	Installation wastage rate	% of product	2
	Installation waste sent to landfill	kg	0.042
C1 to C4 End of life,	Description of scenario		
	Transport type	Vehicle type	Lorry >32 metric tons
	Distance	km	523
	Crushing and compacting of waste into briquettes	MJ	9.48e-8
	Waste for energy recovery	kg	1.87
	Waste to landfill	kg	0.19



LCA Results

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts			GWP	ODP	AP	EP	POCP	ADPE	ADPF
			kg CO <sub>2</sub> equiv.	kg CFC 11 equiv.	kg SO <sub>2</sub> equiv.	kg (PO <sub>4</sub> ) <sub>3</sub> equiv.	kg C <sub>2</sub> H <sub>4</sub> equiv.	kg Sb equiv.	MJ, net calorific value.
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	3.98e+0	4.83e-7	2.30e-2	5.14e-3	3.92e-3	3.07e-5	1.32e+2
Construction process stage	Transport	A4	1.00e-1	1.90e-8	3.43e-4	9.04e-5	7.10e-5	1.68e-7	1.56e+0
	Construction	A5	8.21e-2	1.02e-8	4.69e-4	1.06e-4	8.03e-5	6.19e-7	2.69e+0
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND	MND
End of life	Operational water use	B7	MND	MND	MND	MND	MND	MND	MND
	Deconstruction, demolition	C1	MND	MND	MND	MND	MND	MND	MND
	Transport	C2	1.00e-1	1.90e-8	3.43e-4	9.04e-5	7.10e-5	1.68e-7	1.56e+0
	Waste processing	C3	1.58e-8	1.02e-15	8.58e-11	1.97e-11	4.88e-12	1.91e-14	2.44e-7
Potential benefits and loads beyond the system boundaries	Disposal	C4	1.97e-3	5.18e-10	1.38e-5	4.52e-6	2.29e-6	1.79e-9	4.83e-2
	Reuse, recovery, recycling potential	D	MND	MND	MND	MND	MND	MND	MND

GWP = Global Warming Potential;  
 ODP = Ozone Depletion Potential;  
 AP = Acidification Potential for Soil and Water;  
 EP = Eutrophication Potential;

POCP = Formation potential of tropospheric Ozone;  
 ADPE = Abiotic Depletion Potential – Elements;  
 ADPF = Abiotic Depletion Potential – Fossil Fuels;



# Types of EPD

EPD Owner	Product type	Site type	Example EPD
<b>Manufacturer specific</b>	Product Specific EPD	Site specific EPD	<a href="#">Kingspan – EPD for Benchmark Quadcore Evolution Insulated Panel manufactured at Holywell the UK</a>
		Average site EPD	<a href="#">British Gypsum Saint Gobain – EPD for 12.5mm Gyproc WallBoard – based on 4 sites in the UK</a>
	Average Product EPD	Site specific EPD	<a href="#">Aggregate Industries – EPD for average granite aggregate produced at the Glensanda Quarry in the UK</a>
		Average site EPD	<a href="#">Etex Building Performance – EPD for average GTEC Plasterboard products produced at 2 sites in the UK</a>
	Representative Product EPD	Site specific EPD	No example found
		Average site EPD	<a href="#">Hanson UK – EPD for UK Average Ready Mix Concrete – based on a theoretical mix of Hanson Concrete at 167 plants in the UK</a>
<b>Collective</b>	Product Specific EPD	Average site EPD	<a href="#">British Precast Drainage Association – EPD for UK Manufactured DN600 Concrete Pipe with Class B Bedding – data from 3 member companies</a> <a href="#">Cembureau – EPD for Portland Cement (CEM I) – data provided by the national cement associations in France, Germany, Italy, Poland, Spain, the United Kingdom and Turkey covering 74% of production in Cembureau countries.</a>
	Average Product EPD	Average site EPD	<a href="#">Brick Development Association – EPD for average UK produced brick - members of the BDA covering 46 UK manufacturing sites and representing 99% of UK brick production.</a>
	Representative Product EPD	Average site EPD	<a href="#">British Ready-mixed Concrete Association – EPD for UK manufactured generic ready-mixed concrete - manufacturing data covering 93% of production from member companies of the British Ready-Mixed Concrete Association and a defined mix design</a>
	Worst Case EPD		<a href="#">Association for the European Adhesive and Sealant Industry (FEICA) – Model EPD for silicone-based construction sealants</a>

# EPD sources

- [Digital EPD](#)
- [Ecoplatform](#) (umbrella for European programme operators)
- See [this briefing](#) for a list and links to all European programme operator databases
- [Environdec](#) library (International EPD)
- [EPD Registry](#)

# UK product summaries

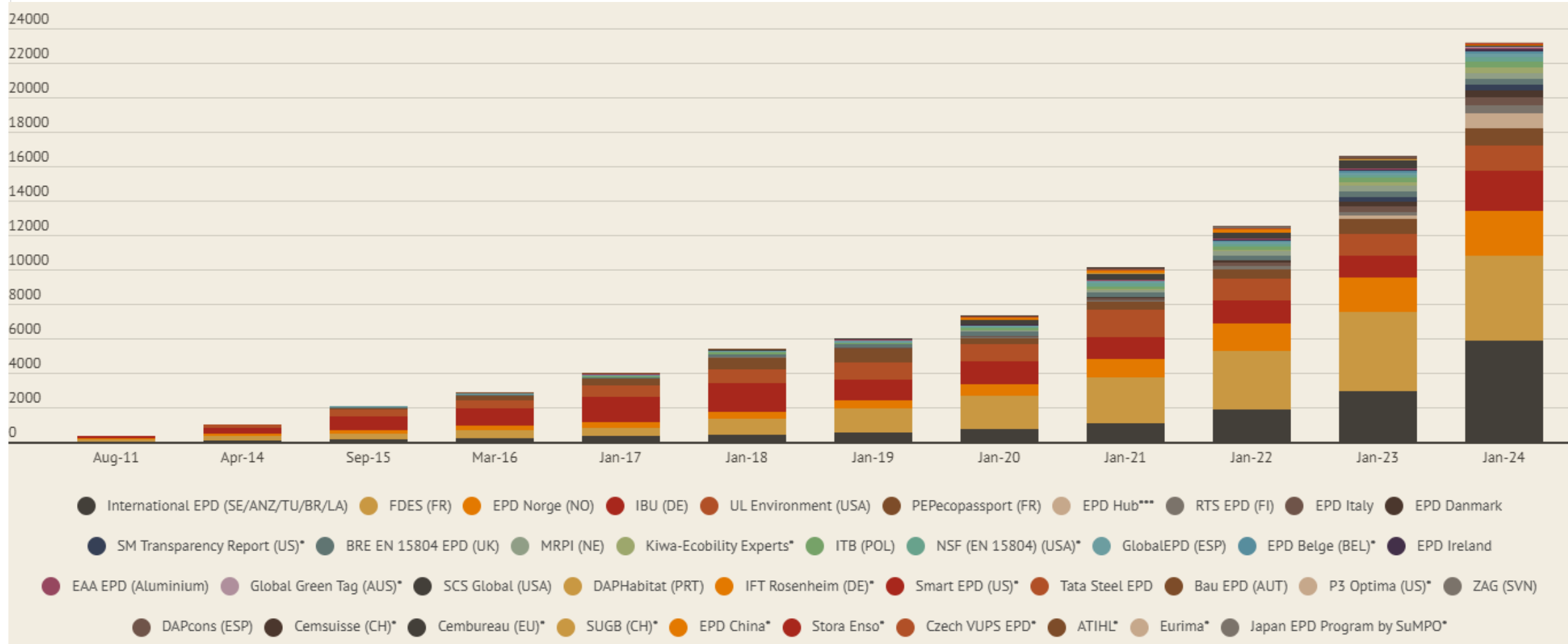
- BRE verified UK EPD
- ASBP members (lots of sustainable products)
- Concrete sector EPD
- For timber, steel etc. see individual suppliers

# Common questions on EPD

- What are the different types of EPD?
- Is carbon content the same as embodied carbon?
- How is biogenic carbon treated in EPD?



# Growth in EPD to EN15804



# Built Environment Carbon Database

Single location for *product* data & *asset* data

(launched on 5<sup>th</sup> October 2023)

Collaborators



Home

My Profile

Asset database

My assets

Export a sample of assessments

Export all assessments

Product database

Search product LCA

Submit new product LCA

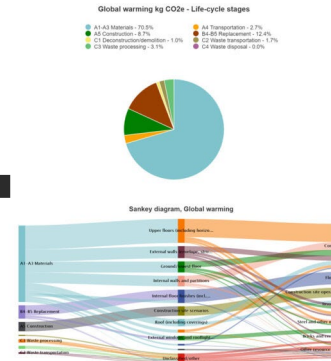
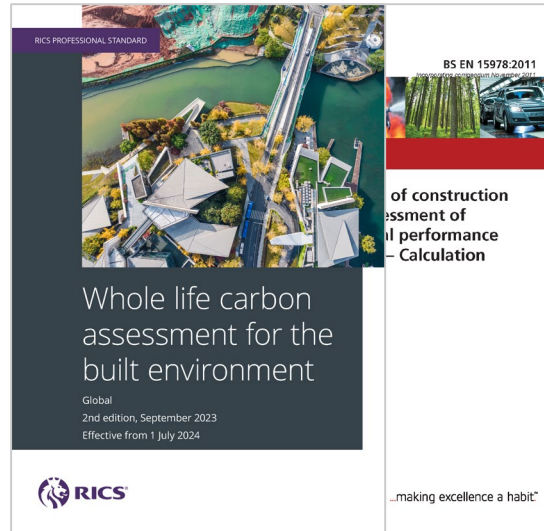
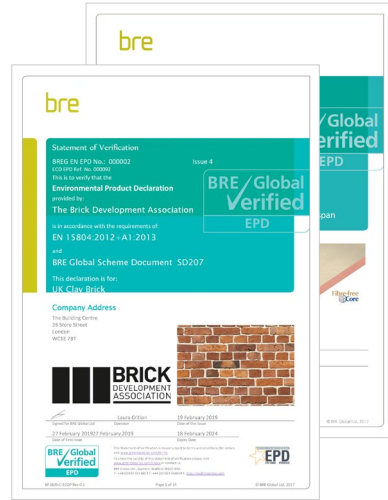
Info



## Welcome to the Built Environment Carbon Database

Version 1.0.0

# Typical assessment of a building



Material quantities  
*e.g. from building model or BoQ*

Product data  
*from EPD or generic carbon factors*

Assessment standards  
*e.g. BS EN 15978 + RICS PS*

Software tool  
*e.g. OneClickLCA*

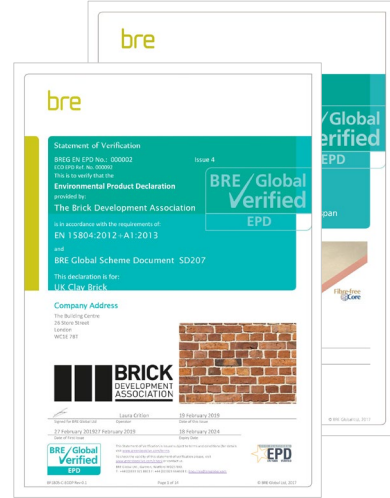


Built Environment Carbon Database

# Typical assessment of a building



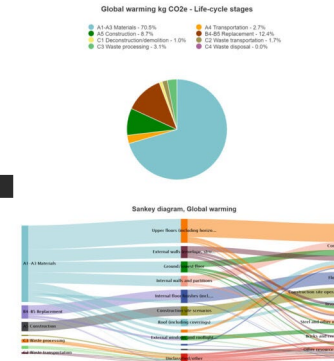
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Assessment standards  
*e.g. BS EN 15978 + RICS PS*




Software tool  
*e.g. OneClickLCA*





# Standards for calculations + products

BS EN 15978:2011  
Incorporating corrigendum November 2011




BSI Standards Publication

**Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method**

**bsi.** ...making excellence a habit™

BS EN 15978  
for buildings

BS EN 17472:2022



BSI Standards Publication

**Sustainability of construction works — Sustainability assessment of civil engineering works — Calculation methods**

**bsi.**

BS EN 17472  
for civil engineering works



BS EN 15804:2012+A1:2013  
Incorporating corrigendum February 2014



BSI Standards Publication

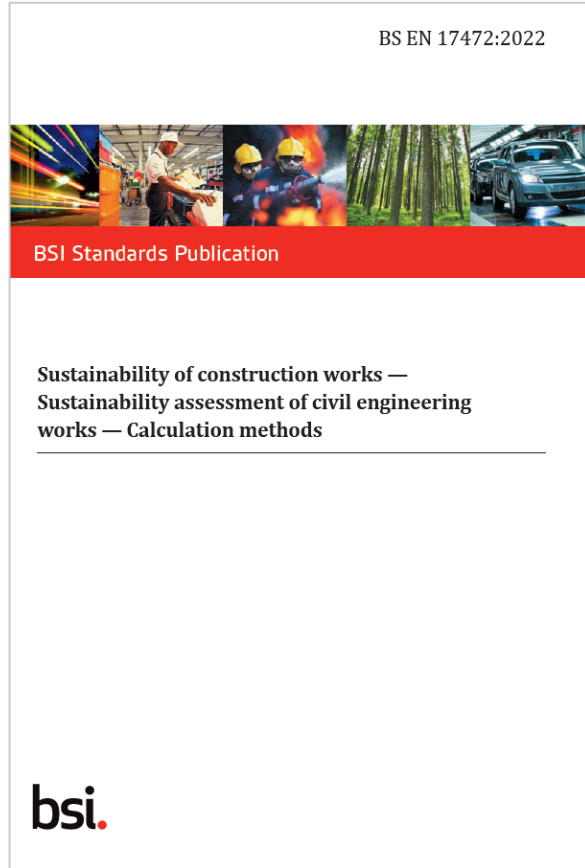
**Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products**

**bsi.** ...making

BS EN 15804  
Core EPD rules  
+  
Product Category Rules



# For infrastructure



BS EN 17472



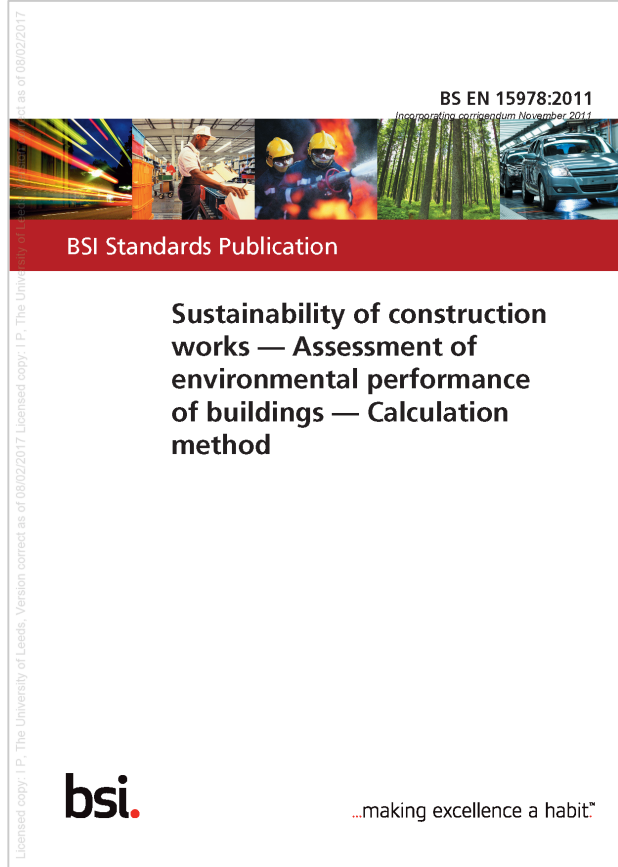
Department  
for Transport

HS2



Guidance or standards by asset type/client

# For buildings



BS EN 15978

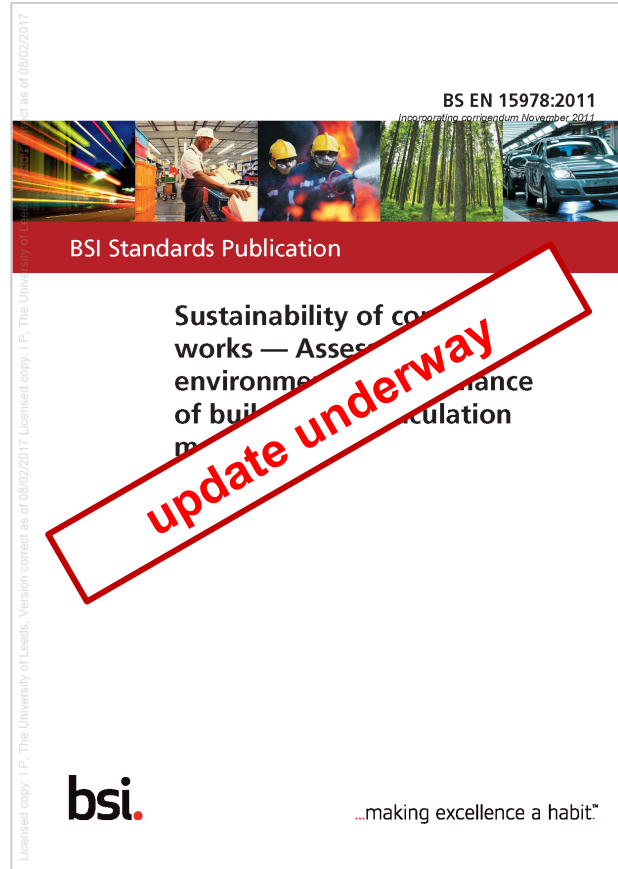


RICS PS



BECD

# Evolution of reporting standards



BS EN 15978

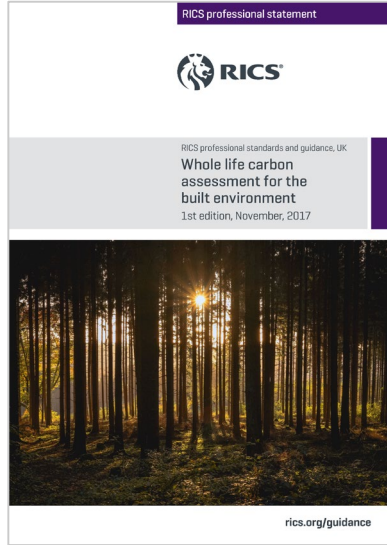


RICS PS



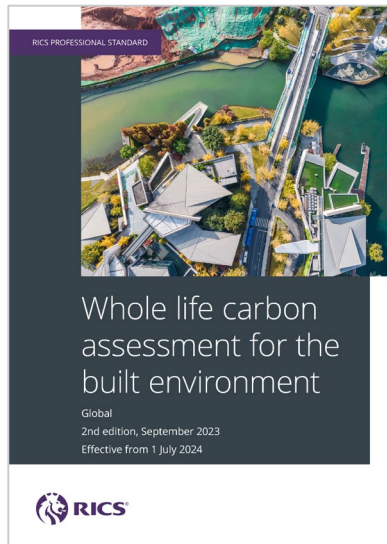
BECD

# RICS PS Whole life carbon assessment



1<sup>st</sup> edition published in 2017

31 pages plus 3 appendices



2<sup>nd</sup> edition published in September 2023

Effective from 1<sup>st</sup> July 2024

137 pages plus 17 appendices & 6 templates

# Steps in whole life carbon assessment

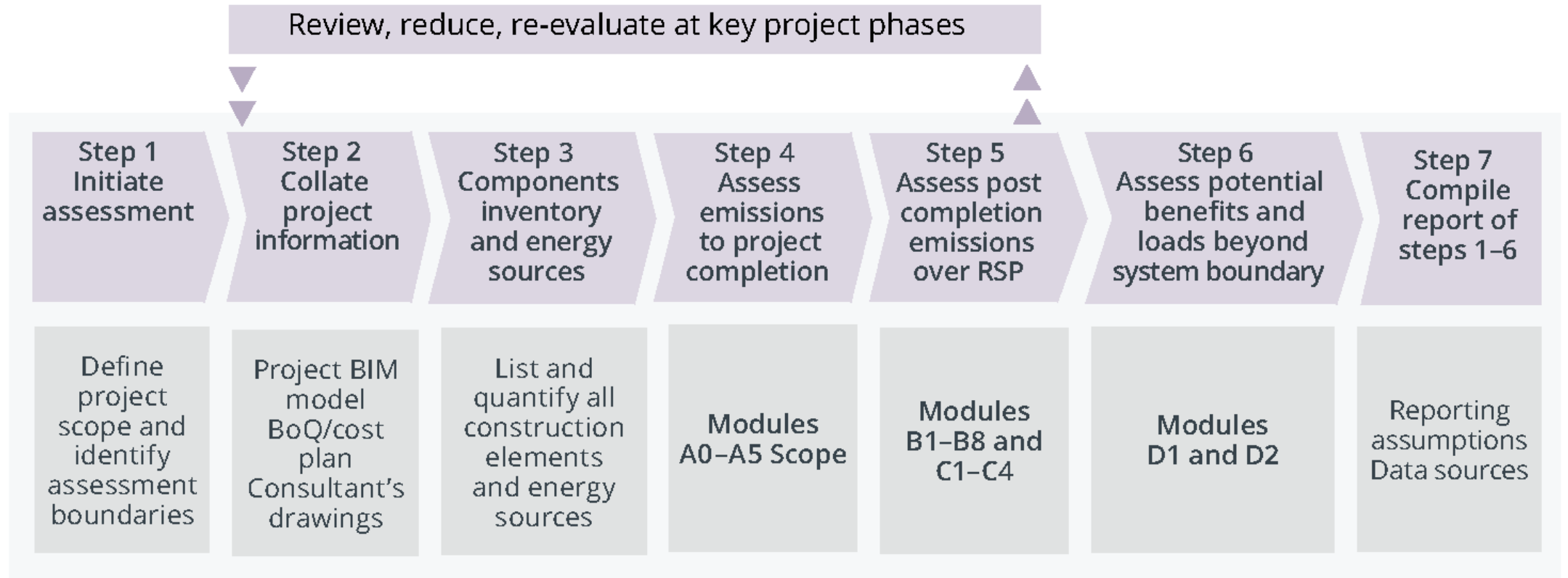


Figure 1 from [RICS PS Whole life carbon assessment for the built environment 2<sup>nd</sup> edition](#)

# UK ecosystem

**International standards**  
 ISO 14040, ISO 14044  
 BS EN 15978, BS EN 17472

**Local planning requirements**

**Public procurement standards**

**Assessment standard**

**UK Net Zero Carbon Buildings Standard**  
 Voluntary standard

**BECD**  
 Built Environment Carbon Database  
 Product & asset databases

**PART Z**  
 An industry-proposed amendment to UK Building Regulations 2010  
 Industry-proposed regulation

--- proposal

**Guidance, supplementary standards & benchmarks**

RICS

RIBA

CIBSE

IStructE

LETI

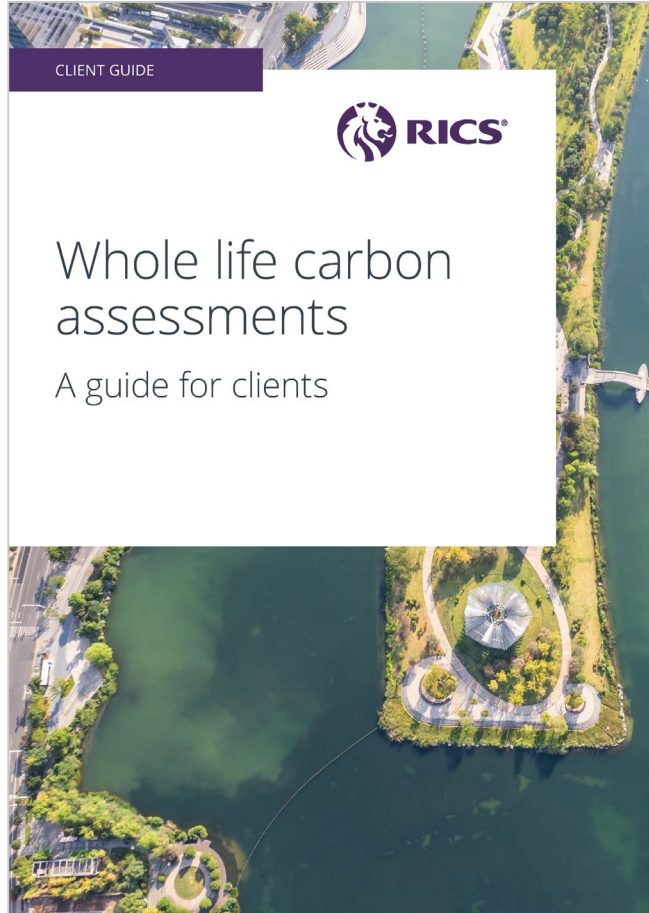
PAS2080

UKGBC

WLCN

**Tools**

# Introductory guidance



RICS Client Guide



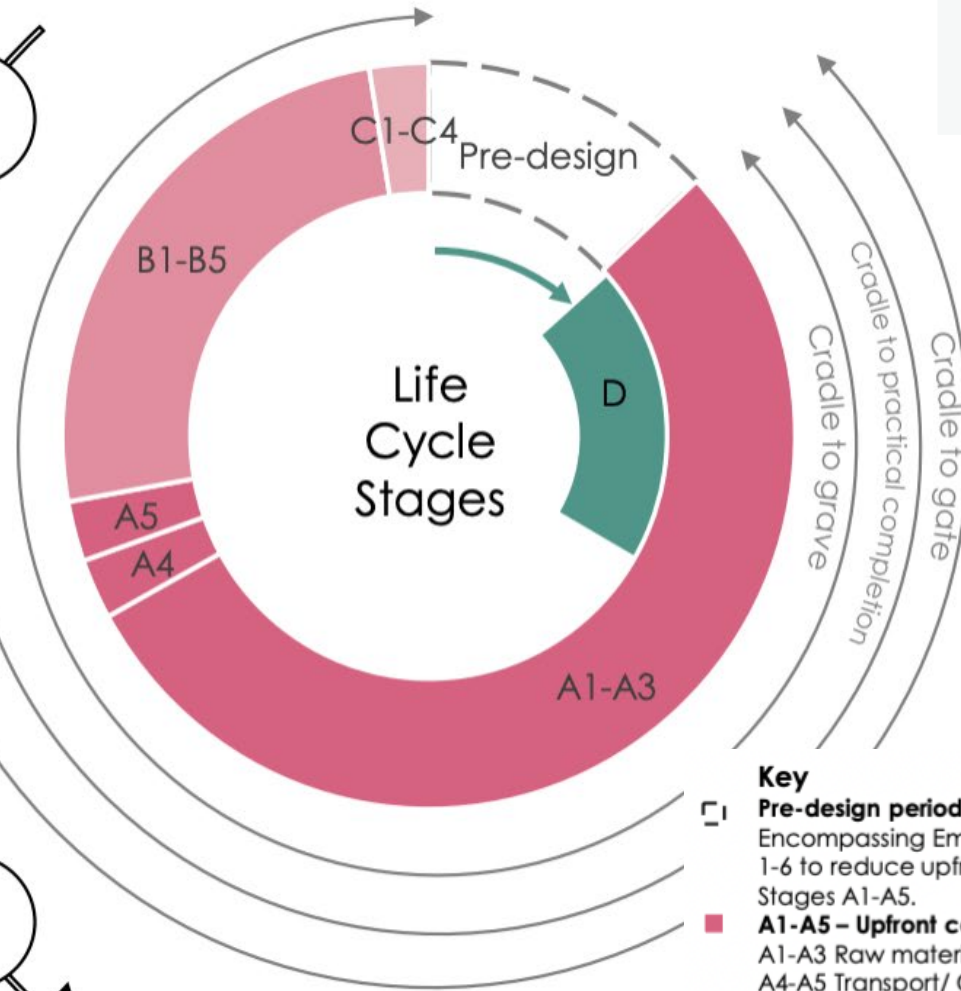
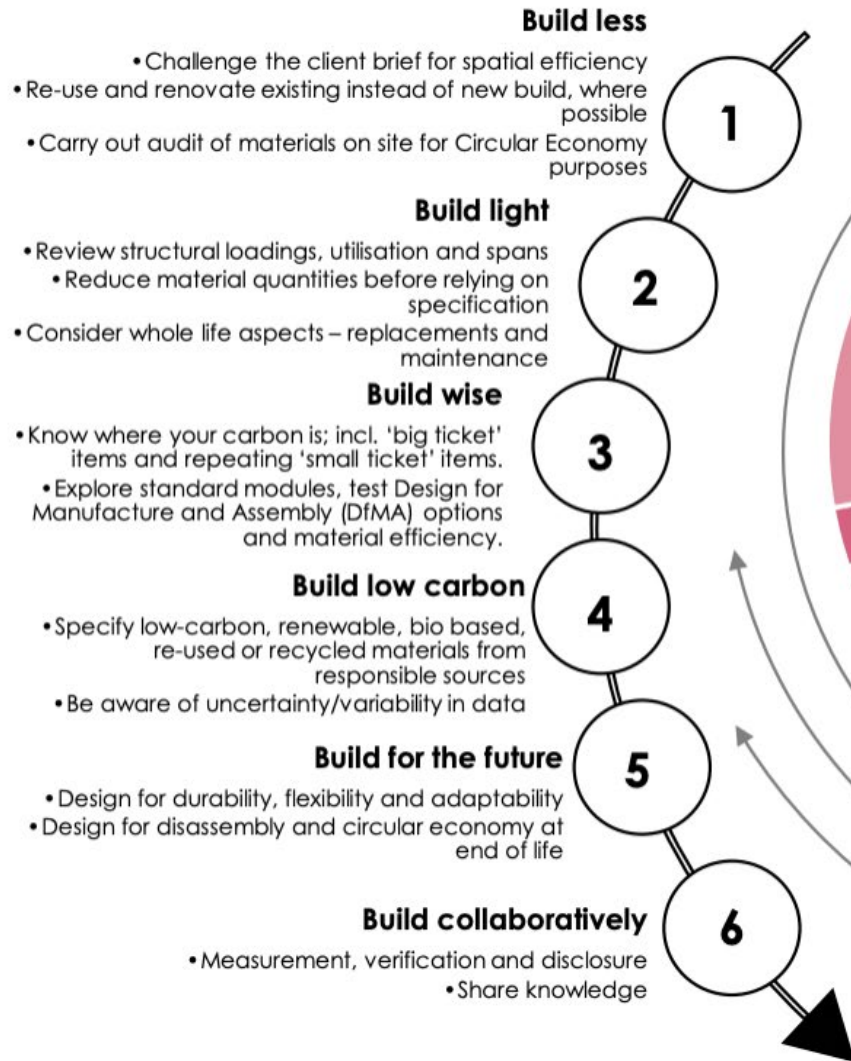
RIBA guide for architects



LETI primer

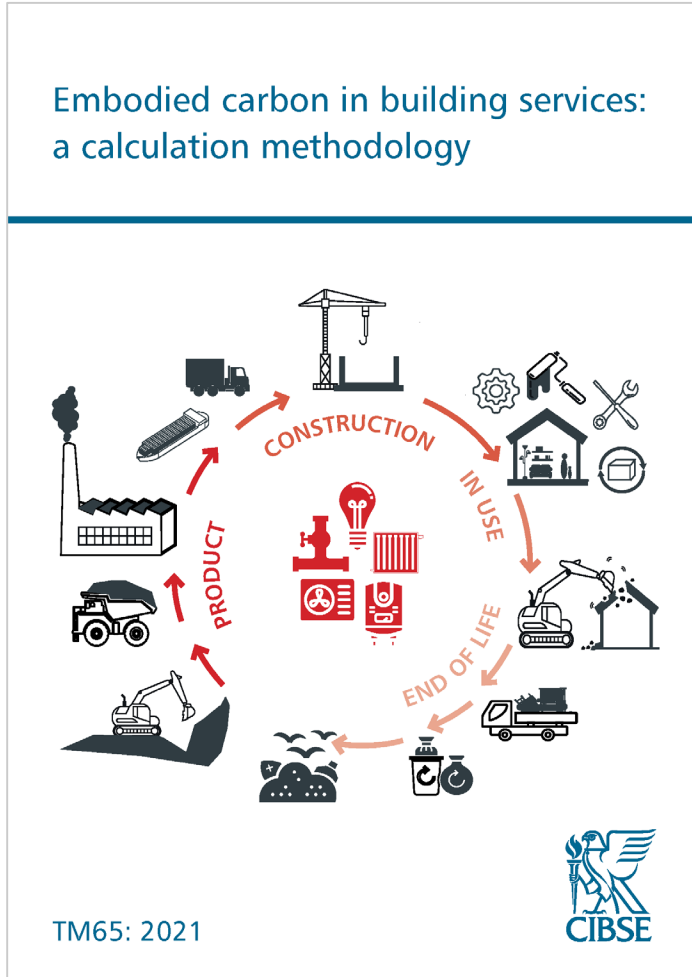


## Hierarchy for Embodied Carbon Reduction

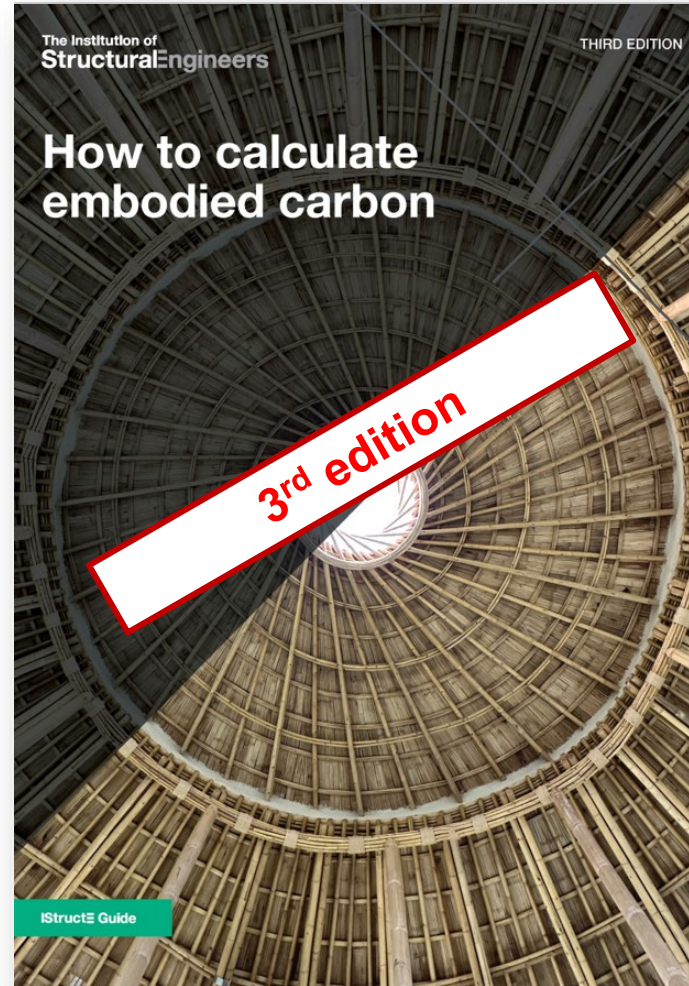


- Key**
- **Pre-design period**  
Encompassing Embodied Carbon Reduction strategies nos. 1-6 to reduce upfront carbon emissions in Life Cycle Stages A1-A5.
  - **A1-A5 – Upfront carbon emissions in product and construction**  
A1-A3 Raw material supply/ Transport/ Manufacturing  
A4-A5 Transport/ Construction & installation processes
  - **B1-B5 – In use carbon emissions**  
B1-B5 Use/ Maintenance/ Repair/ Replacement/ Refurbishment
  - **C1-C4 – End of life carbon emissions**  
C1-C2 Deconstruction & demolition/ Transport  
C3-C4 Waste processing/ Disposal
  - **D – Beyond building life boundary**  
Reuse, Recovery, Recycling (reported separately but Circular Economy principles can be used to reduce upfront carbon).

# Other key UK guidance



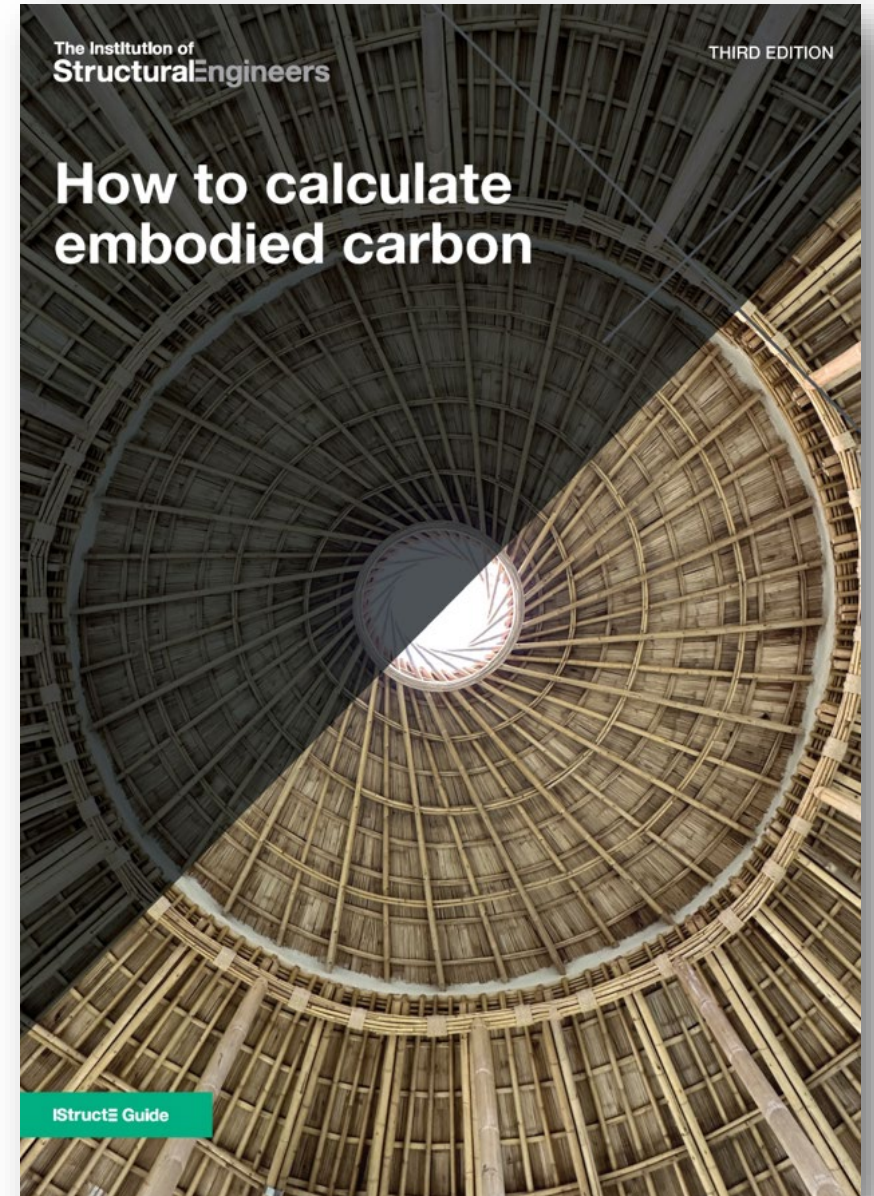
CIBSE TM65



IStructE methodology

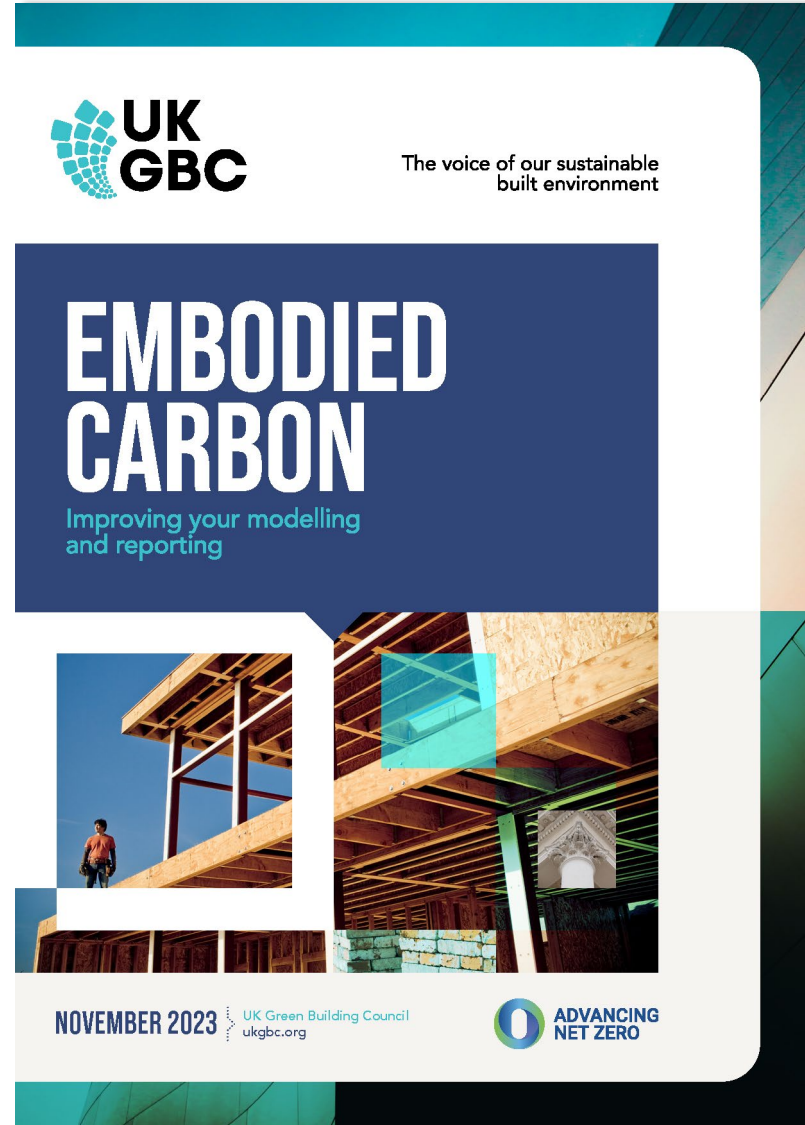
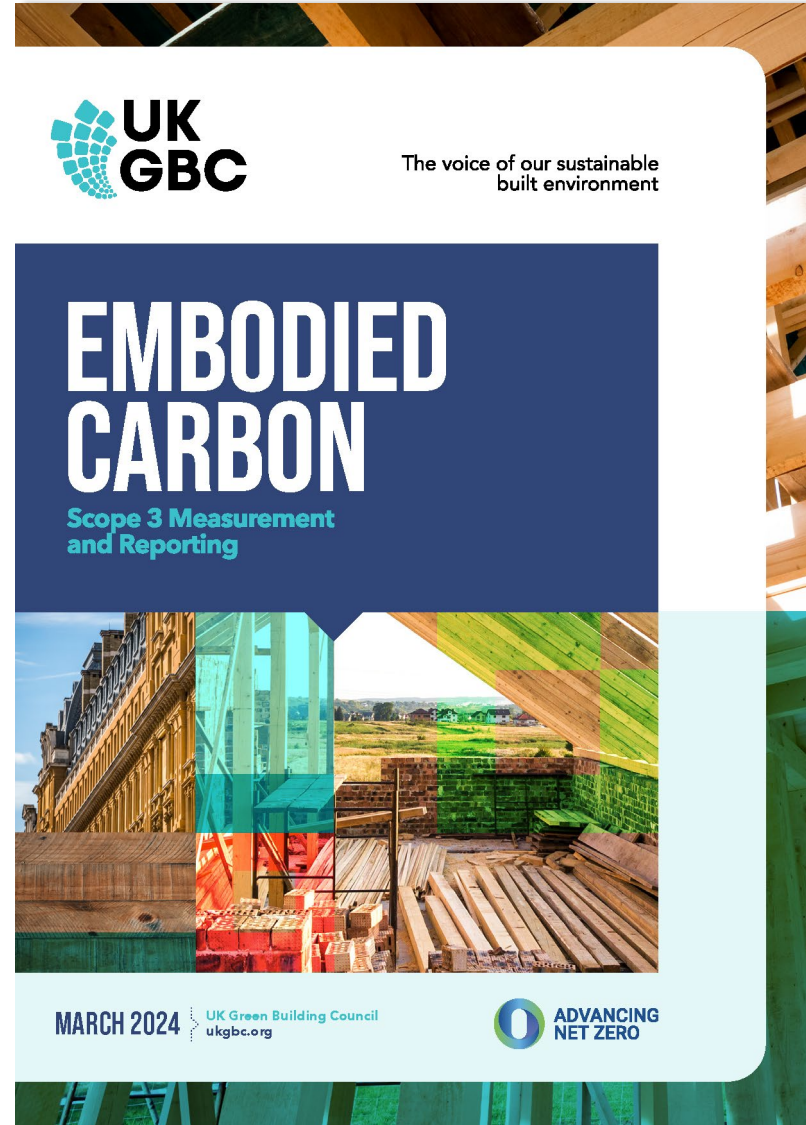
# Updates in third edition

- Lifecycle modules updates
  - Concrete, steel & timber guidance
  - Carbon factors
  - Building elements scope
  - Default material quantity allowances
  - Bridges guidance
  - Notable references to RICS PS guidance
- ... and more!



Slide courtesy of Orlando Gibbons (co-author of guidance)

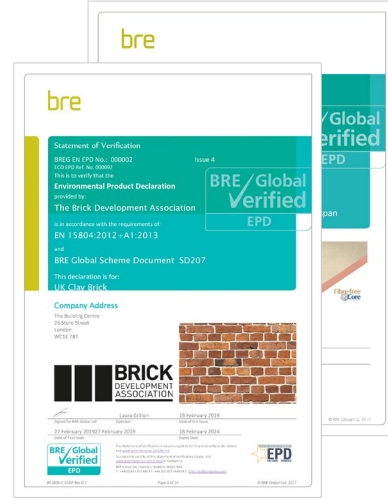
# UKGBC guidance



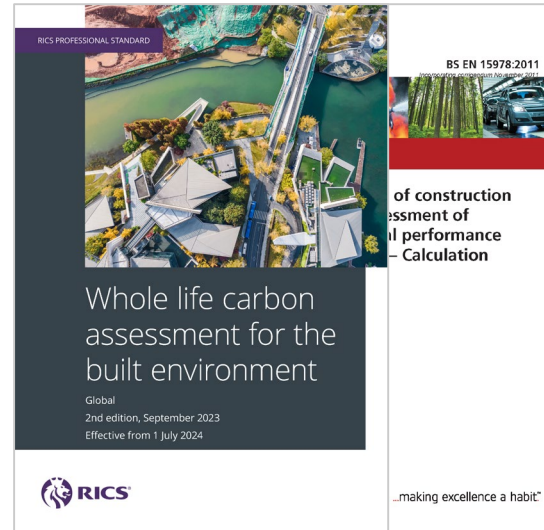
# Typical assessment of a building



Material quantities  
*e.g. from building model or BoQ*



Product data  
*from EPD or generic carbon factors*

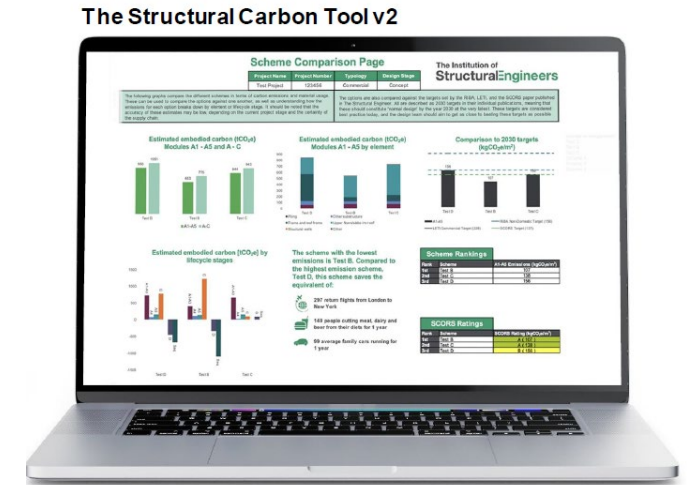


Assessment standards  
*e.g. BS EN 15978 + RICS PS*



Software tool  
*e.g. OneClickLCA*

# Calculation tools



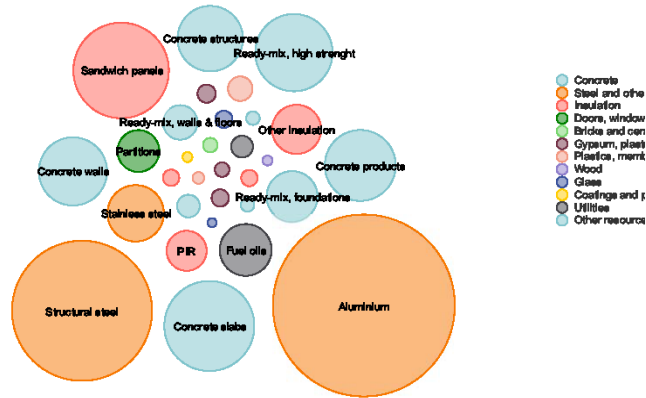
# + many more!

# Example – One Click LCA

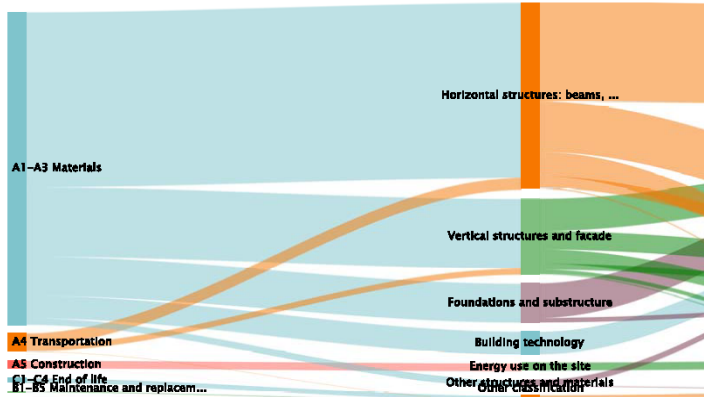


Bubble chart, total life-cycle impact by resource type and subtype, Global warming

Hover your mouse over legends or the chart to highlight impacts. Bubble minimum and maximum sizes constrained for readability



Sankey diagram, Global warming



Main > CL9XX Test Project > Design option 1 > Whole life carbon assessment, GLA / RICS / Green Mark including EN15804 +A2 data > Input data : Building materials

## Design option 1

Building materials > Energy consumption, annual > Water consumption, annual > Construction site operations > Emissions and removals > Maintenance, annual > Calculation period > Discounting scenario

Material: Foundation constructions x6

Country: Filter: Data source: Filter: Type: Filter: Upstream: Filter: CO2e: Filter: Unit: Filter: Standard: Filter:

Fill in the material consumptions by material type. You may fill in all materials lumped together, or on separate rows for example by type of structure. Unless instructed otherwise, use gross amounts (incl. losses). Materials can be added in any

### > Completeness (%) and plausibility checker (-)

#### 1. Foundations and substructure

Materials in the foundations will never be replaced, no matter assessment period length (except for RE2020 and FEC tools). For BREEAM UK Mat 1 IMPACT equivalent provide the data for site excavation fuel use here, choose resource Excavation works.

Foundation, sub-surface, basement and retaining walls [Compare answers](#) [Create a group](#) [Move materials](#) [Add to compare](#)

- Start typing or click the arrow
- Hammered concrete piling foundation for hard soils for m2 GFA, model: P270, pile length: 20 m, depth 1 - One Click LCA
  - Rammed concrete piling foundation for hard soils for m2 GFA, model: P270, pile length: 25 m, depth 1 - One Click LCA
  - Rammed concrete piling foundation for hard soils for m2 GFA, model: P270, pile length: 25 m, depth 1 - One Click LCA

## Life-cycle assessment results

Sector	Global warming kg CO2e	Acidification kg SO2e	Eutrophication kg PO4e	Ozone depletion potential kg CFC11e	Formation of ozone of lower atmosphere kg Ethene	Primary energy MJ	
A1-A3 Construction Materials	1.58E7	5.32E4	1.37E4	9.83E-1	6.33E3	2.52E6	<a href="#">Details</a>
A4 Transportation to site	9.22E5	3.28E3	5.91E2	1.15E-1	1.39E2	1.69E6	<a href="#">Details</a>
A5 Construction/Installation process	4E5	1.12E3	1.64E2	7.61E-2	5.95E1	6.81E6	<a href="#">Details</a>
B1-B5 Maintenance and material replacement	2.75E4	1.07E2	1.6E3	1.07E-3	9.92E0	3.46E5	<a href="#">Details</a>
B6 Energy use	0E0	0E0	0E0	0E0	0E0	0E0	<a href="#">Details</a>
B7 Water use							<a href="#">Hide empty</a>
C1-C4 Deconstruction	2.41E5	7.51E2	1.68E2	2.92E-2	3.78E1	4.49E6	<a href="#">Details</a>
D External Impacts (not included in totals)	-6.83E6	-2.47E4	-2.6E3	-3.92E-2	-1.85E3	-1.12E6	<a href="#">Details</a>
<b>Total</b>	<b>1.75E7</b>	<b>5.65E4</b>	<b>1.62E4</b>	<b>1.2E0</b>	<b>6.59E3</b>	<b>2.95E6</b>	





# Future Homes Hub Conventions & Tool

Launched in 2024:

- **Whole Life Carbon Conventions for New Homes** to help the sector consistently measure & share
- **Future Homes Carbon Assessment Tool** accessible to SMEs & others starting on this topic





# RIBA & LETI targets for buildings



RIBA  
2030  
CLIMATE  
CHALLENGE  
VERSION 2 (2021)

Sign up to join the RIBA  
2030 Climate Challenge at  
[www.architecture.com/2030challenge](http://www.architecture.com/2030challenge)

RIBA Architecture.com

## Upfront Carbon, A1-5 (exc. sequestration)

LETI 2030  
Design Target

LETI 2020  
Design Target

Band	Office	Residential	Education	Retail
A++	<100	<100	<100	<100
A+	<225	<200	<200	<200
A	<350	<300	<300	<300
B	<475	<400	<400	<425
C	<600	<500	<500	<550
D	<775	<675	<625	<700
E	<950	<850	<750	<850
F	<1100	<1000	<875	<1000
G	<1300	<1200	<1100	<1200

## Embodied Carbon, A1-5, B1-5, C1-4 (inc. sequestration)

RIBA 2030  
Built Target

Band	Office	Residential	Education	Retail
A++	<150	<150	<125	<125
A+	<345	<300	<260	<250
A	<530	<450	<400	<380
B	<750	<625	<540	<535
C	<970	<800	<675	<690
D	<1180	<1000	<835	<870
E	<1400	<1200	<1000	<1050
F	<1625	<1400	<1175	<1250
G	<1900	<1600	<1350	<1450

All values in kgCO<sub>2</sub>e/m<sup>2</sup> (GIA)

# LETI grades – King’s Cross Sports Hall

## Embodied Carbon Target Alignment

### Introduction

This document has been produced to provide alignment in Embodied Carbon measurement and comparisons. The industry needs to standardise performance and reporting scopes to meet IPCC recommendations for urgent emissions reductions. LETI have worked with RIBA, the GLA, StrucE and the UKGBC to produce this document.

A key issue the industry faces is the lack of consistent measurement, leading to mis-aligned benchmarks, project targets and claims.

Alignment in methodology is considered the interim step towards developing net zero carbon targets that reflect the UK's carbon budget. Targets will only be useful once measurement is consistent. The UKGBC's 2021 Whole Life Carbon Net Zero Roadmap project will generate sectoral carbon budget estimates, which will assist in future more detailed building-level target setting.

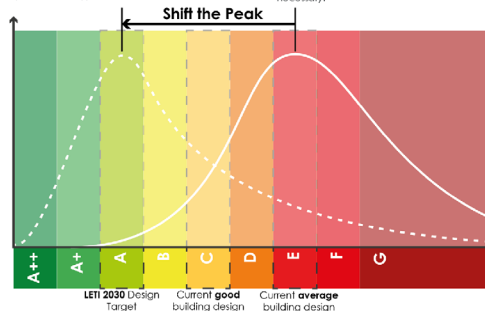
This paper summarises the following key points:

- The industry must push for Embodied Carbon reporting on all projects.
- A rating system should be introduced to allow quick comparison of ambition across various typologies and portfolios.
- Total embodied carbon targets have been introduced.
- Targets for retrofit have been developed.
- LETI and RIBA now have consistent embodied carbon target.
- Data disclosure and breakdowns are key to ensuring reporting is valid and comparable.
- There are two scopes that should be reported against: Upfront Carbon (modules A1-5, excluding sequestration), and total Embodied Carbon (A1-5, B1-5, C1-4, including sequestration).

### The Case for Letter Bandings

It is suggested that a rating system that allows comparison of embodied carbon ambition across typologies and facilitates of conversations about embodied carbon with key decision makers. Using a letter rating system, which is already familiar in the context of Display Energy Certificates will allow industry professionals to talk about an "A rated" building and know that they are talking about the same level of ambition regardless of the project. A rating system can support competition across various levels of ambition, something which is particularly useful in portfolio reporting (either for building owners or in schemes like the RIBA practice survey).

Current best-practice performance is considered to be a C rating, while a B and above is considered a robust stretch target. Though only 4 typology rating bands are provided currently, the methodology can be repeated for other typologies or scopes of work as more data becomes available. The bandings do not currently differentiate between new build or refurbishment. Part of the rationale for this is that refurbishment projects will find it easier to achieve good performances and this provides an incentive for retrofit. It is expected that as more data is collected for ranges of retrofit, the bandings could be adapted if necessary.



### Using the ratings

The LETI position is that for buildings that are currently in the design stages:

- Average design achieves an E
- Good design achieves a C (LETI 2020 target)
- LETI 2030 design target achieves an A

The RIBA 2030 Climate Challenge built performance is equivalent of a B rating (note that this assumes practical completion in 2030, so designed earlier).

### Signposting

This document is designed to be read with other LETI documents including file:

- LETI Embodied Carbon Primer
- Whole Life Carbon and Embodied Carbon One Pages
- Net Zero Carbon Definitions
- Reporting templates on the LETI website
- FAQs available on the LETI website

Project Name	Design Stage	Upfront Embodied Carbon (kgCO <sub>2</sub> e/m <sup>2</sup> )	Life Cycle Embodied Carbon (kgCO <sub>2</sub> e/m <sup>2</sup> )
Project Name	Design Stage	A1-5	A1-5, B1-5, C1-4
Assessment By	Company	all	all
To be used for: all cases			
A++	< 100	< 100	< 100
A+	100 - 200	100 - 200	100 - 200
A	200 - 300	200 - 300	200 - 300
B	300 - 400	300 - 400	300 - 400
C	400 - 500	400 - 500	400 - 500
D	500 - 625	500 - 625	500 - 625
E	625 - 750	625 - 750	625 - 750
F	750 - 875	750 - 875	750 - 875
G	> 875	> 875	> 875
Non-Listed Typology:			
Sequestered Carbon		kgCO <sub>2</sub> e/m <sup>2</sup>	kgCO <sub>2</sub> e/m <sup>2</sup>
Module D		kgCO <sub>2</sub> e/m <sup>2</sup>	kgCO <sub>2</sub> e/m <sup>2</sup>

Proposed rating 'badges'



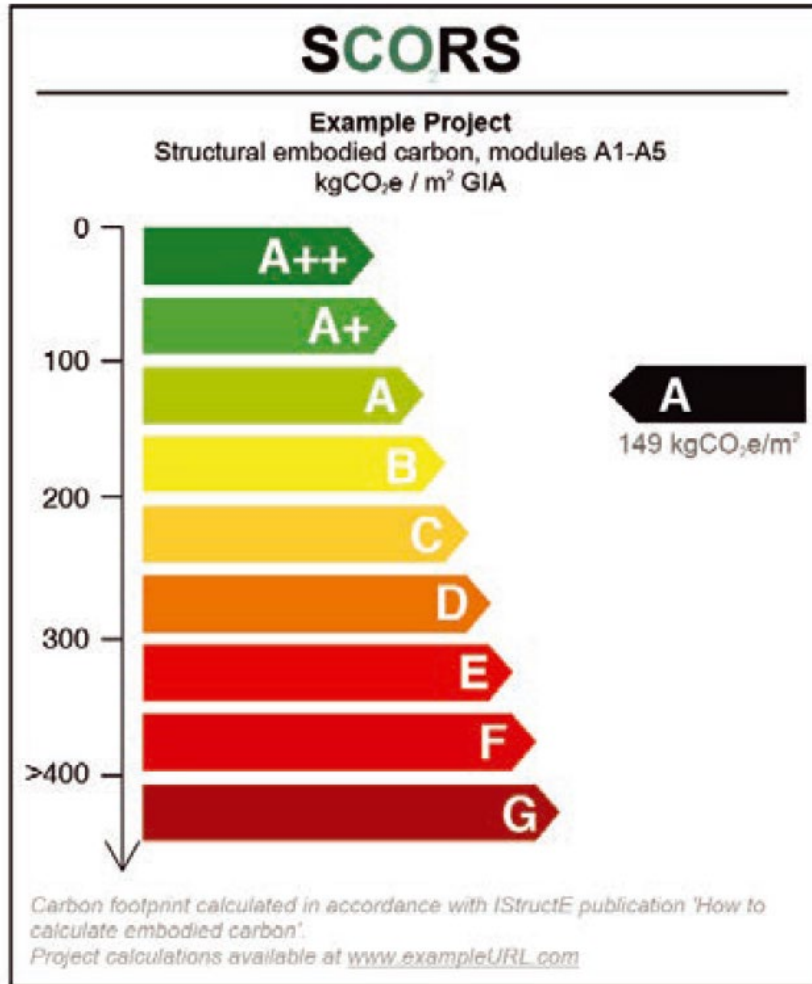
Graphic showing the range of performance based on benchmarked projects, and the need to improve the average



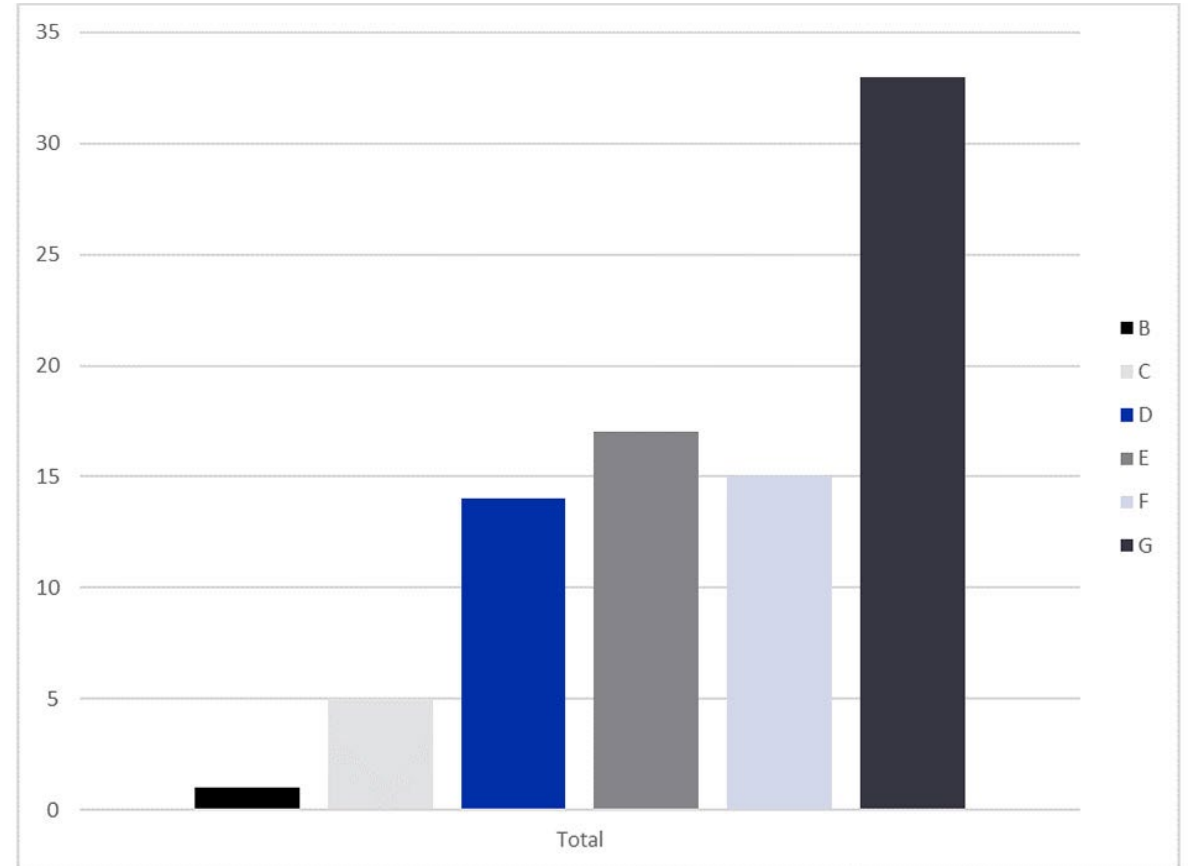
Project Name Sports Hall, King's Cross		Upfront Carbon	Embodied Carbon
Project Sector Education		A1-5	A1-5, B1-5, C1-4
Assessment Date 31/12/2020		exc. sequestration	(kgCO <sub>2</sub> e/m <sup>2</sup> )
Assessment By (company) BAM		(kgCO <sub>2</sub> e/m <sup>2</sup> )	(kgCO <sub>2</sub> e/m <sup>2</sup> )
Location of Data https://bit.ly/3fXAmD4			
A++	100	125	
A+	200	260	A+ 201.8
A	300	400	
B	400	540	B 352.7
C	500	675	
D	625	835	
E	750	1000	Current Average Design
F	875	1175	
G			
Non-Listed Typology:			
Sequestered Carbon:		-314 kgCO <sub>2</sub> e/m <sup>2</sup>	
Module D:			-186 kgCO <sub>2</sub> e/m <sup>2</sup>

LETI have published a great series of case studies including [this example here](#)

# SCORS example



## Price & Myers 2021 projects dataset SCORS



Graph showing the number of designs in each SCORS category

Find out [more about SCORS](#) or view the [latest Price & Myers dataset \(v3 2023\)](#)

# **HOW IS THE ECOSYSTEM EVOLVING?**

Voluntary standards, public procurement requirements, regulations etc.

# UK ecosystem

**International standards**  
 ISO 14040, ISO 14044  
 BS EN 15978, BS EN 17472

**Local planning requirements**

**Public procurement standards**

**Assessment standard**

RICS PROFESSIONAL STANDARD  
 Whole life carbon assessment for the built environment  
 Global  
 2nd edition, September 2023  
 Effective from 1 July 2024

**UK Net Zero Carbon Buildings Standard** Voluntary standard

**BECD** Product & asset databases  
 Built Environment Carbon Database

**PART Z** Industry-proposed regulation  
 An industry-proposed amendment to UK Building Regulations 2010

--- proposal


**Guidance, supplementary standards & benchmarks**

RICS RIBA CIBSE IStructE LETI PAS2080 UKGBC WLCN

**Tools**

# UK in 2017

**International standards**  
ISO 14040, ISO 14044  
BS EN 15978




**Assessment standard 1<sup>st</sup> ed**



RICS professional statement  
**RICS**  
RICS professional standards and guidance, UK  
**Whole life carbon assessment for the built environment**  
1st edition, November, 2017  
rics.org/guidance


**Guidance, supplementary standards & benchmarks**



GREEN BUILDING COUNCIL  
**Embodied Carbon: Developing a Client Brief**  
March 2017  
bre | yorlibox | DfE | ENVIRONMENT | The Green Construction Board | WALEX

**UKGBC**

**Tools**

One Click 



# Since 2017...

**International standards**  
 ISO 14040, ISO 14044  
 BS EN 15978, BS EN 17472

**2021** → Local planning requirements

**2020** → Public procurement standards

**2024**  
 Assessment standard 2<sup>nd</sup> ed  
 Whole life carbon assessment for the built environment  
 Global 2<sup>nd</sup> edition, September 2023  
 Effective from 1 July 2024  
 RICS

**Pilot 2024**  
 UK Net Zero Carbon Buildings Standard  
 Voluntary standard

**2023**  
 BECD  
 Built Environment Carbon Database

**Proposal**  
 PART Z Industry-proposed regulation

**Guidance, supplementary standards & benchmarks**

**2018** →

**Tools**

RICS RIBA CIBSE IStructE LETI PAS2080 UKGBC WLCN

# UK ecosystem

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 BS EN 15978, BS EN 17472

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**Guidance, supplementary standards & benchmarks**

**RICS**

**RIBA**

**CIBSE**

**IStructE**

**LETI**

**PAS2080**

**UKGBC**

**WLCN**

**Tools**

The Scottish Government's  
Net Zero Public Sector Buildings Standard

## Requirements

August 2023



SCOTTISH  
FUTURES  
TRUST



# Objective 2: Construction Embodied Carbon



**Targets 600 kgCO<sub>2</sub>e/m<sup>2</sup> for upfront carbon”**  
*(A1-A5 for new build or B4-B5, C1-C4 for existing buildings)*

Alongside range of other related objectives  
e.g. OB.4 on ‘Other whole life carbon’

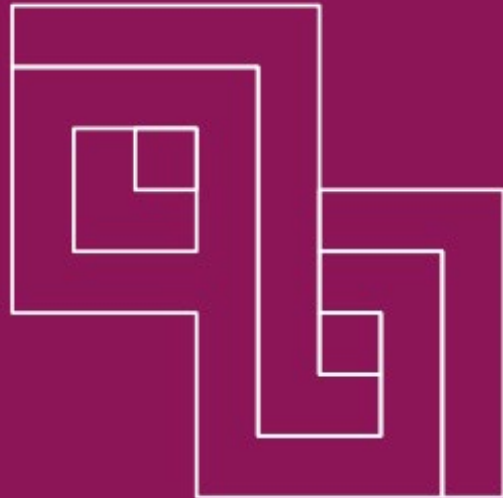


HM Government

# THE CONSTRUCTION PLAYBOOK

## Government Guidance

on sourcing and contracting public works  
projects and programmes



Version 1.0  
December 2020



**Contracting authorities should adopt the use of whole life carbon assessments to understand and minimise the GHG emissions footprint of projects and programmes throughout their lifecycle... Contracting authorities should require that solutions put forward by potential suppliers are accompanied by a whole life carbon assessment.”**



## NHS Net Zero Building Standard



“

**Ensure a WLC assessment is undertaken at each design stage, and used to inform design decisions, with data assessed, captured, and reported for all materials”**  
**“Project bespoke Upfront Carbon Limits must be established by the client and project team...for sub-structure, super structure and facade...all other building components and lifecycle stages must be assessed and reported”**

See Chapters 3-4 & Whole Life Carbon Compliance Tool for further detail



# BUILDINGS SECTOR SCIENCE-BASED TARGET-SETTING CRITERIA

VERSION 1.0

AUGUST 2024

## New SBTi criteria

August 2024 launch of  
buildings sector criteria and  
target setting tool

# UK ecosystem

**International standards**  
 ISO 14040, ISO 14044  
 BS EN 15978, BS EN 17472

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**Tools**

**RICS RIBA CIBSE IStructE LETI PAS2080 UKGBC WLCN**

MAYOR OF LONDON

# THE LONDON PLAN



THE SPATIAL DEVELOPMENT  
STRATEGY FOR GREATER LONDON

**MARCH 2021**

## London Policy SI2

**F Development proposals referable to the Mayor should calculate whole-life cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions**

### **3 stage process**

1. Pre-application
2. Stage 1 submission (i.e. RIBA Stage 2/3)
3. Post-construction

Results submitted using [common template](#)



# B&NES Policy SCR8

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

The B&NES Local Plan Partial Update incorporating the Main Modifications, Additional Minor Modifications and delegated changes

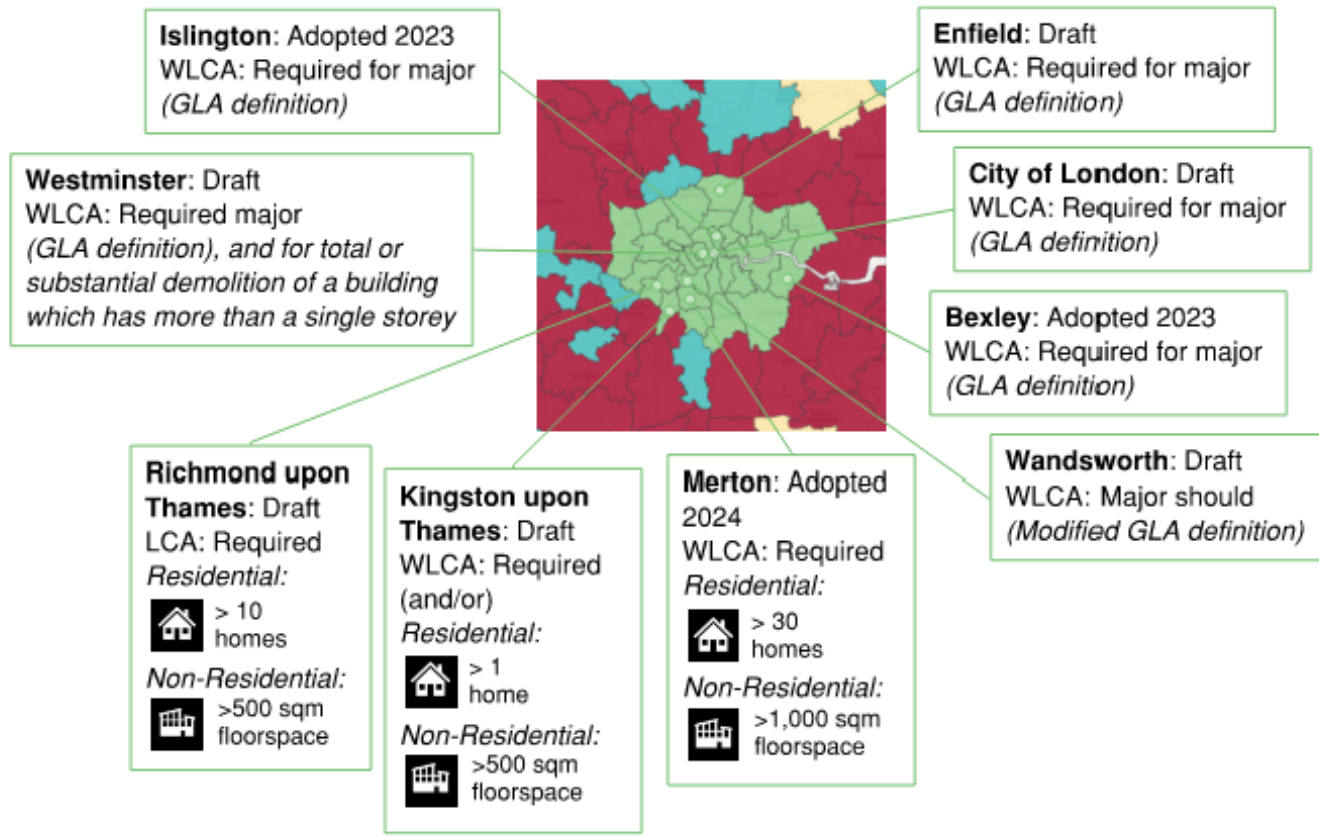
**BATH AND NORTH EAST SOMERSET COUNCIL**

**Local Plan (Core Strategy and Placemaking Plan) Partial Update**

**Adopted by the Council on 19<sup>th</sup> January 2023**

# Proliferation of local requirements

## LPA's within Greater London Authority (GLA)



**Key:**

- neither
- local plan
- supplementary planning document (spd)
- both local plan and spd

**WLCA** Whole Life Carbon Assessment

**ECA** Embodied Carbon Assessment

**GLA definition of major developments:**

**Residential:** > 10 homes or >0.5 ha

**Non-Residential:** > 1,000 sqm floorspace or > 1 ha

**Modified GLA definition of major developments:**

**Residential:** > 10 homes

**Non-Residential:** > 1,000 sqm floorspace

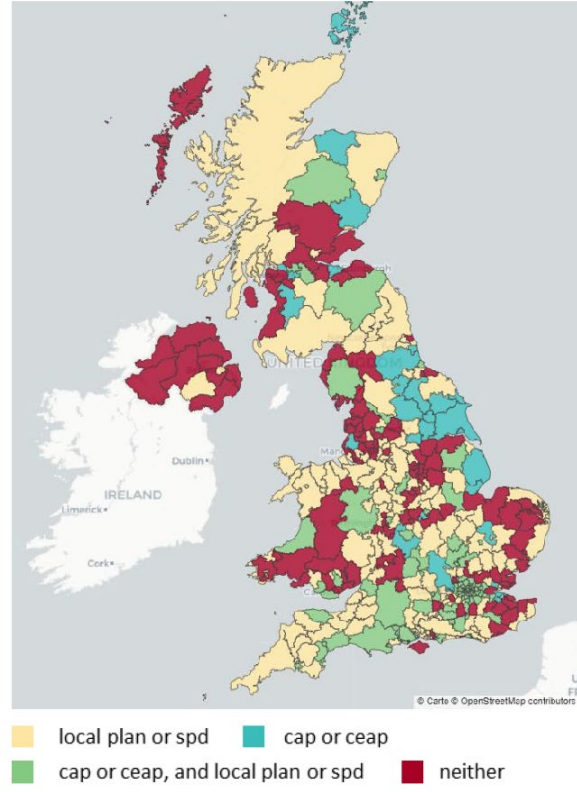


Figure 4: Comparing whether Local Plans or Supplementary Planning Documents and Climate or Circular Economy Action Plans applying to an LPA contain occurrences of 'Embodied Carbon'.

# Requirements beyond London

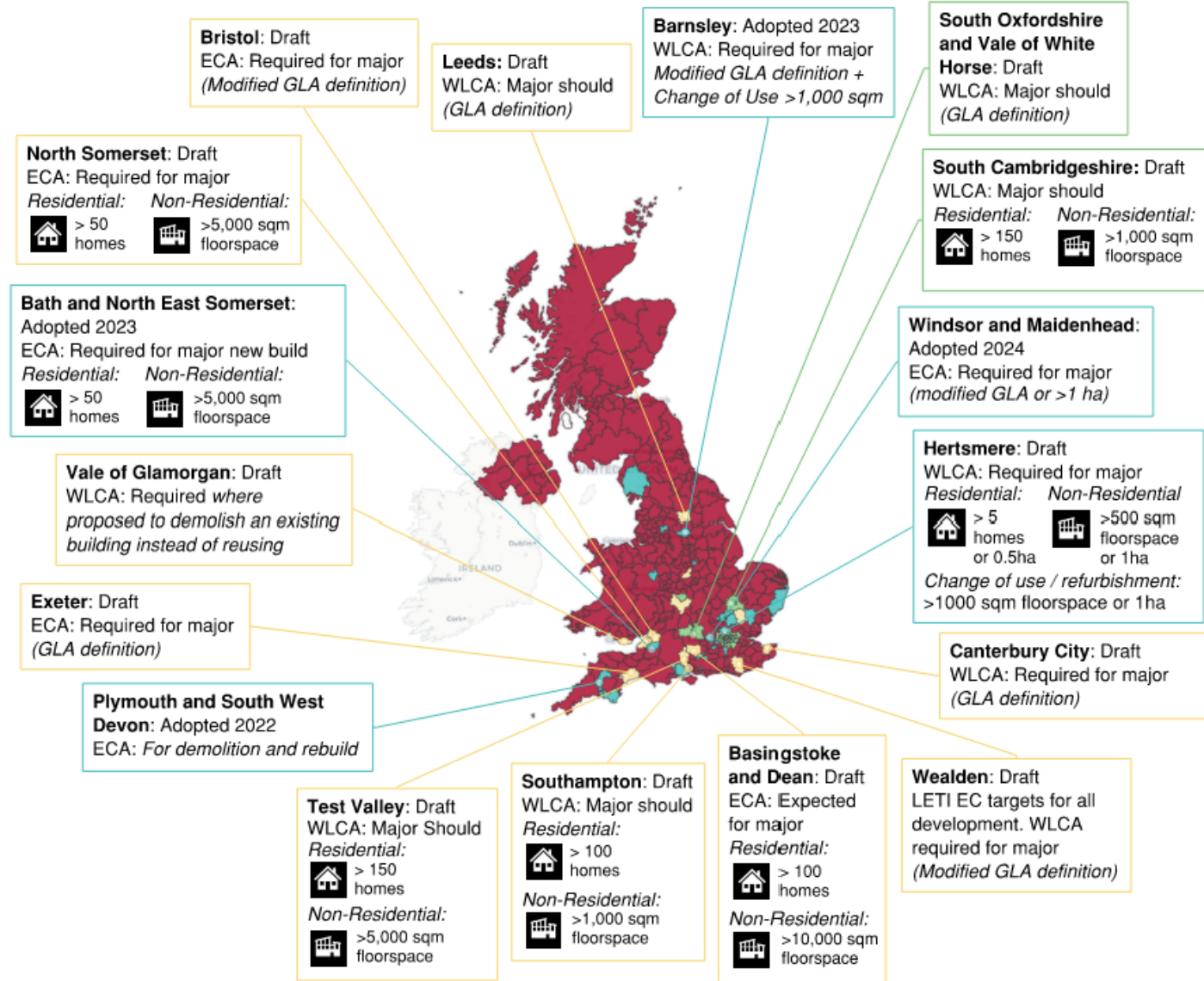
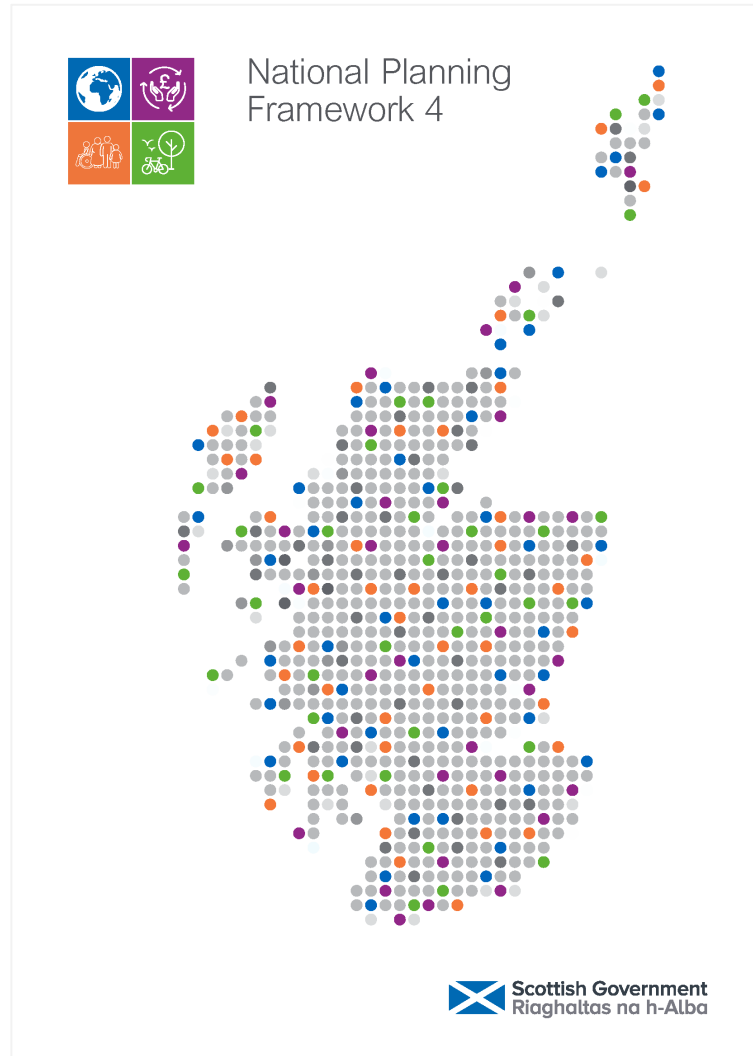


Figure from review by Graham et al. (2024) [Embodied Carbon and the Circular Economy: Analysing UK Planning Systems and Policy](#)

# NPF4



**Development proposals will be sited and designed to minimise lifecycle greenhouse gas emissions as far as possible”**

# Example – Moray

## Moray Council Carbon Guidance for Planning Applications and S36 and S37 consents

### Purpose

To support the development management process to determine planning applications against Policy 2 of National Planning Framework 4, which requires that *“development proposals will be sited and designed to minimise lifecycle greenhouse gas emissions as far as possible”* and *“development proposals will be sited and designed to adapt to current and future risks from climate change”*.

### Threshold

This guidance will apply to:

- residential developments of 10 or more units
- commercial, industrial, retail, leisure, infrastructure developments where floor space is 1,000 square metres or more
- Energy related developments of 5MW or more (including battery storage, grid infrastructure and energy production).

### Requirements

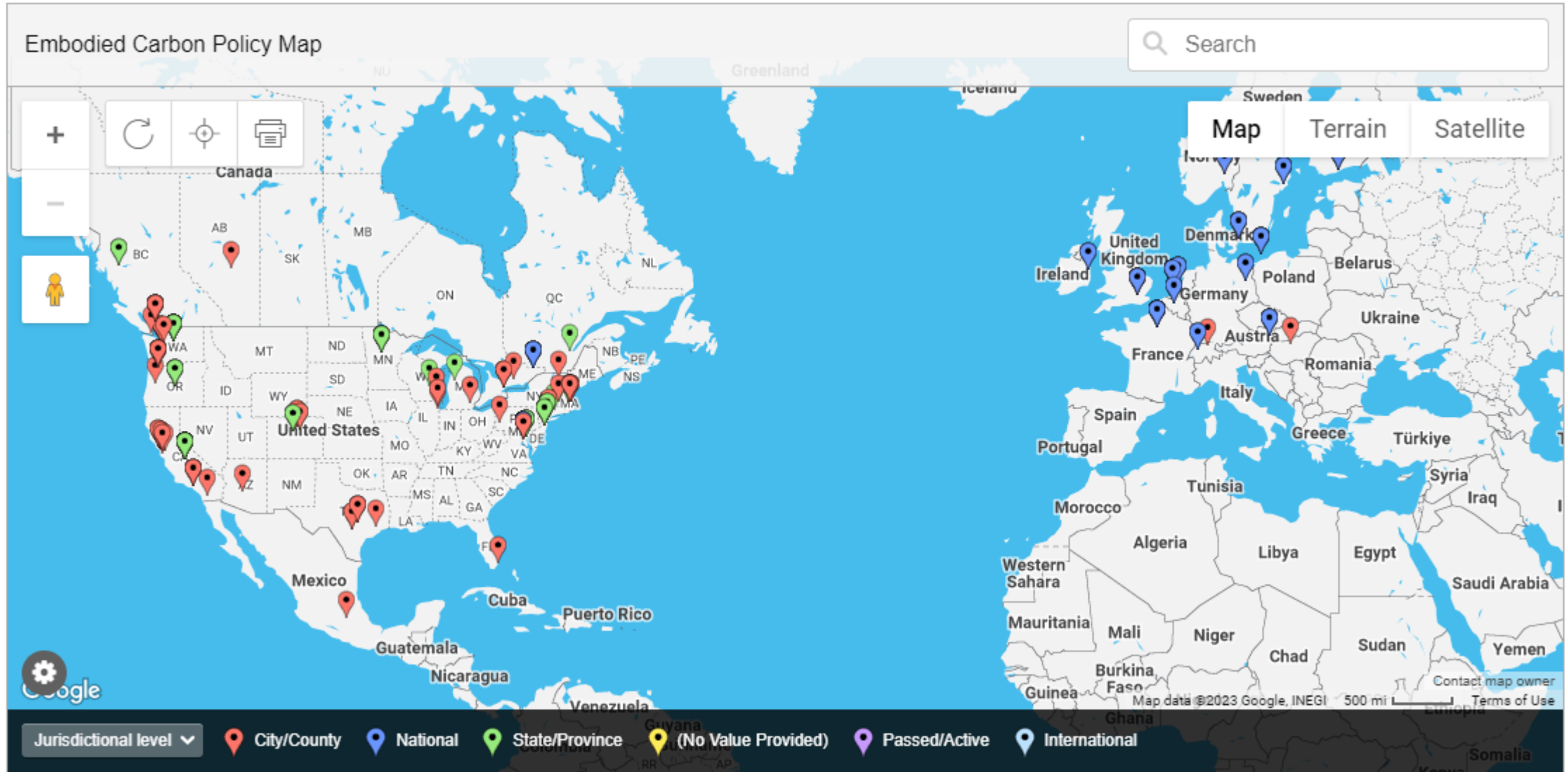
All planning applications within the stated threshold will be required to submit the following information. Submissions should address the questions raised within this guidance, as appropriate to the development:

- **Overview of development and key carbon and climate considerations**
  - Provide a brief overview of the development and the main considerations being given to whole life carbon reduction.
  - How does the development meet the needs of the current climate and future climate scenarios? How is the development designed with future climate risks in mind, or how may it be adapted to suit these changes in the future?
- **Whole life carbon assessment**
  - Which nationally recognised whole life carbon assessment method will be used (e.g. BS EN 15978, with additional guidance from RICS Professional Statement), and why was this method chosen?
  - Where will embodied carbon emissions occur within the proposed development, and how will these be measured and minimised? Provide breakdown of embodied carbon emissions by source and by each stage of the development's life cycle.
  - Where will operational carbon emissions occur within the proposed development, and how will these be measured and minimised through design? Provide a breakdown of operational carbon emissions by source and by development life cycle stage.
  - What does net zero emissions mean in the context of the proposed development and when will it be achieved? How will net zero emissions be achieved on this development, including specific low carbon measures or renewable energy systems that will be implemented?
  - If the proposed development does not achieve net zero emissions, provide an estimate of the annual tonnes of carbon emissions that will require offsetting to achieve net zero (refer to carbon sequestration statement section).

## Carbon Guidance

Sets out range of requirements for developments above a threshold including: breakdown of embodied carbon emissions by source and stage, responses to range of questions about method, strategy, carbon management, reporting etc.

# Interactive global policy map



# International policy reviews

Whole life carbon models for the EU27 to bring down embodied carbon emissions from new buildings

Review of existing national legislative measures

**RAMBOLL** Bright Ideas. Sustainable change.



**KU LEUVEN**

Funded by: 

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## CONSTRUCTION CARBON REGULATIONS IN EUROPE

### REVIEW & BEST PRACTISES

OCTOBER 2022



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 Ympristoministeriö  
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## POLICY BRIEFING

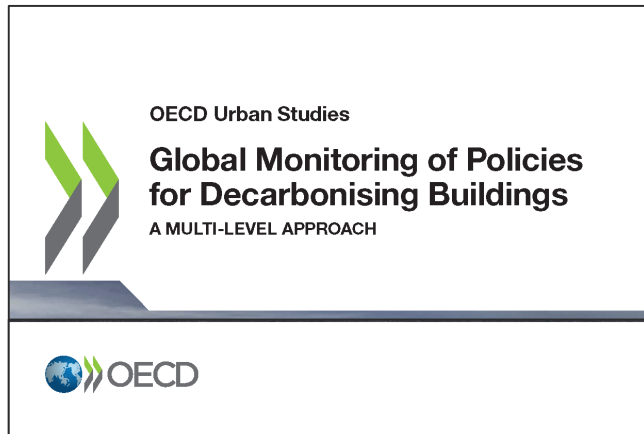
### WHOLE LIFE CARBON REPORTING AND TARGETS

MARCH 2023

VERSION 0.1

**EUROPE REGIONAL NETWORK**  WORLD GREEN BUILDING COUNCIL

# International regulations



11% of respondents: embodied carbon in policy, further 43% of respondents 'future priority'



EU Energy Performance in Buildings Directive: regulating embodied carbon **starting 2028**

- WLC regulation with limit values in force
- WLC disclosure requirements in force
- WLC legislation (disclosure/limit values) proposed
- Other non-legislative requirements in place or preparing for WLC measurement and benchmarking
- ✦ Local jurisdictions with disclosure requirements linked to permits of public procurement

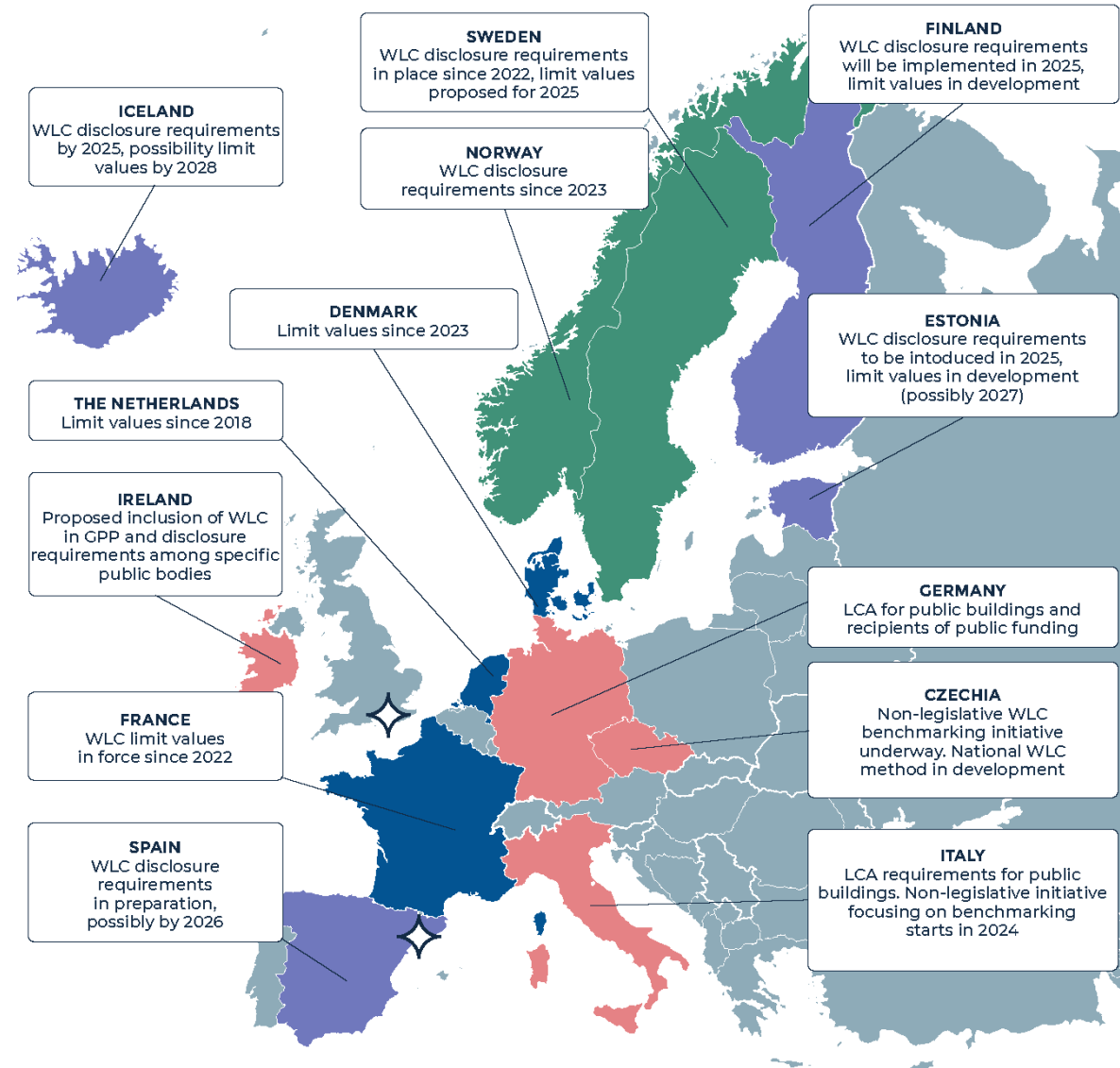


Figure from BPIE (2024) [How to establish whole life carbon benchmarks](#)





## Statement of Requirements (Draft)

## Measurement and Reduction of Embodied Carbon in New Buildings (CPD4124072)

Future Opportunities Notice**1. SCOPE OF REQUIREMENT**

1.1 Through the contracted work, The Authority is seeking to establish detailed baselines on matters regarding WLCAs and reduction of embodied carbon in new buildings to inform policy development. The work has been divided into the below six in-scope areas:

- 1) The robustness of WLCAs, uncertainties in data used and their results and the challenges that creates for decision-making.
- 2) The impacts to business of carrying out WLCAs.
- 3) The supporting structure and data needed for WLCAs.
- 4) The design and construction choices that are made following WLCAs.
- 5) The appropriate and cost-effective areas for carbon savings and the relative savings available.
- 6) The design and material choices that would be encouraged by embodied carbon reduction and the impacts of those choices.

1.2 Across these six areas, the work will need data gathering and analysis, technical and practical modelling, and economic analysis in line with Green Book and related methodology and requirements. Also in scope are the possibilities of support for a public consultation and production of impact assessments.

1.3 **Given the range work required, especially the inclusion of economic analysis, the Authority expects that many bidders will need the support of external contractors or consortium partners to ensure relevant expertise.**

1.4 As this is a developing area of policy the Authority intends for the contract to have a call-off element to allow additional (or changed) work. This could be influenced either by results from earlier work under the contract or policy development by the Authority.

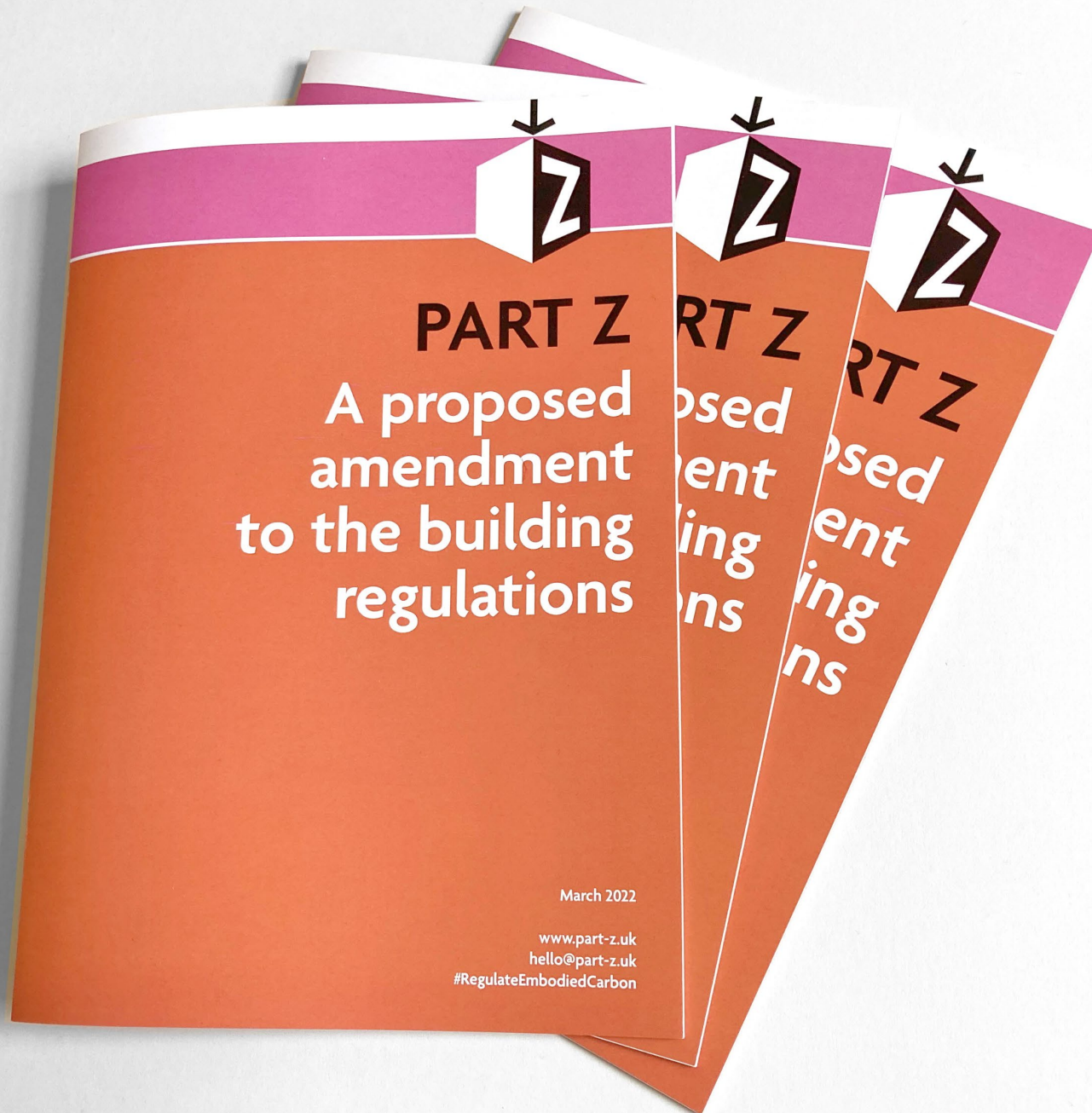
**2. BUDGET AND TIMELINE**

2.1 The maximum budget for the contract will be £250,000 (exc. VAT). Within that budget, the Authority intends that up to £50,000 (exc. VAT) will fund the call-off elements (see para 1.4).

2.2 The contract is likely to begin in March 2023 and run until March 2024.

# MHCLG research

- DLUHC recruited AECOM to deliver 6 outputs staged across FY23/24 Q1-Q4
- Some initial outputs were presented at BE-ST Fest 2023
- Research completed and now awaiting publication



## Part Z

Industry led proposed amendment to Building Regulations in England & Wales and suggested document for approval





## Regulating Embodied Carbon in Scotland's Buildings

Prepared by: Jim Hart, Jannik Gieseke, Francesco Pomponi & Ruth Saint

Date: 31 March 2022

## March 2022 report

- Report sets out **proposals for developing regulation of embodied carbon in Scotland's buildings**
- Reviews equivalent policies in other nations
- Considers the who, what, where, why & how of implementing regulations in Scotland
- Includes suggested timeline & programme of work

**ANY QUESTIONS?**  
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