

## Embodied Carbon Workstream

How to calculate the embodied carbon of facades:  
A methodology



Anna Wendt / Teni Ladipo

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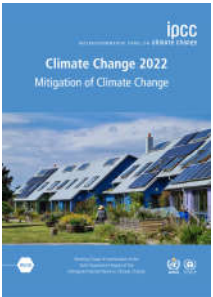
## Presentation Structure

- ▶ Context
- ▶ The Committee
- ▶ Development roadmap
- ▶ Document structure and points of interest
- ▶ Peer review process
- ▶ Case study update
- ▶ Launch of the methodology!
- ▶ Next steps
- ▶ We want to hear from you

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## Why do we need this document?



“Based on central estimates only, cumulative net CO<sub>2</sub> emissions between 2010-2019 compare to about **four fifths of the size of the remaining carbon budget** from 2020 onwards for a 50% probability of limiting global warming to 1.5°C...”

Summary for policy makers (p. 6)

“In 2019, [the building sector emissions reached] equivalent to **21% of global GHG emissions that year**, of which 57% were indirect CO<sub>2</sub> emissions from offsite generation of electricity and heat, followed by 24% of direct CO<sub>2</sub> emissions produced on-site and 18% from the production of cement and steel used for construction and/or refurbishment of buildings.”

Chapter 9.1 (p. 1509)

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## Standards

### Framework level



**BS EN 15643:2021**  
Sustainability of construction works –  
Framework for assessment of  
buildings and civil engineering  
works

### Building level



**BS EN 15978:2011**  
Sustainability of construction works –  
Assessment of environmental  
performance of buildings – calculation  
method

### Product level



**BS EN 15804:2012+A2:2019**  
Sustainability of construction works –  
Environmental product declarations –  
Core rules for the product category of  
construction products

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Industry guidance

**RICS**  
Whole life carbon assessment for the built environment Sustainability of construction works.

**IstructE**  
How to calculate embodied carbon (2<sup>nd</sup> Edition)

**CIBSE**  
Embodied carbon in building services: a calculation methodology

**CWCT**  
How to calculate the embodied carbon of facades: A methodology

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The committee

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Anna Wendt, Partner, Global Director Facades, Buro Happold

Duncan Cox, Senior Associate, Sustainability, Thornton Tomasetti

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Key objectives

- ▶ Develop consistent methodology for calculating embodied carbon in façade systems.
- ▶ Enable calculation of embodied carbon to be carried out on all projects.
- ▶ Encourage review of carbon impact in individual projects against industry targets.
- ▶ Ensure industry targets are stretching, realistic and developed from accurate data sets relating to façade systems.
- ▶ Enable evaluation of design decisions and comparison of material and system choices.
- ▶ Achieve net zero carbon on all building projects.
- ▶ Develop, or contribute to, database of carbon assessments for façade systems.

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Development roadmap

**Embodied Carbon Sub-committee timeline**

July: CWCT propose set up of sub-committee and invitation to chair

August: Consultation on formulating TOR and committee

September: Convening of the group and carrying out case study exercise

October: Template for document with contents + draft text against key sections

November: Workthrough remaining key focus topics. Engage with suppliers/industry

December: Draft document for consultation (end of March)

Fortnightly meetings: OCT, NOV, DEC, JAN, FEB, MARCH

Additional events: CWCT sustainability engineer appointed (OCT), Presentation at CWCT AGM (NOV)

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Workstream process

Approach

All committee members are required to:

1. Work towards the common goal of the group to achieve the vision statement and key objectives set out

2. Prepare a personal statement outlining their commitment and aspirations for their involvement in the committee

3. Ensure agreement and commitment from their employer to engage in the working group with allocated time to carry out key assigned tasks

4. Attend minimum fortnightly meetings with the committee as well as other ad hoc progress meetings as required

5. All members are expected to be active participants contributing to the preparation of the calculation methodology.

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Initial Case Study

► **First sub-committee task:** for a case study building in London, calculate the embodied carbon of the facade for all life cycle stages

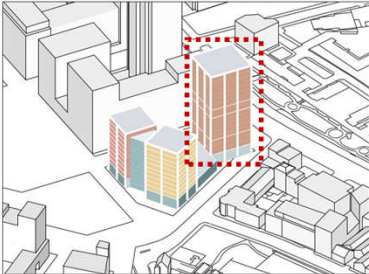
• Product stage (A1 – A3)

• Construction process stage (A4 – A5)

• Use stage (B1 – B7)

• End of life stage (C1 – C4)

• Benefits and loads beyond the system boundary (D)



Concept Sketch demarcating residential tower

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VARIATION (COV) BY LIFECYCLE STAGE

Case study results pre-methodology

VARIATION (COV) BY LIFECYCLE STAGE

Aspirational case study results post-methodology  
(example values only)

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Some points of Interest

- ▶ Balance of prescriptiveness
- ▶ Limitations of data
- ▶ Glazing specific guidance
- ▶ Future work required

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How prescriptive should we be?

"Not very prescriptive"

+ Increased flexibility  
- More complexity

"Very prescriptive"

+ Easier to apply  
- Lack of flexibility

Depends on:  
- Availability of data,  
- Sensitivity of EC to results

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How prescriptive should we be?

"Not very prescriptive"

"Very prescriptive"

1 TON

Material quantities

This data is accessible on project (albeit sometimes time-consuming).

Quantities can vary significantly between façade systems.

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How prescriptive should we be?

"Not very prescriptive"

"Very prescriptive"

Glass ECFs

Very limited data available to assess IGU build-ups meaningfully.

Glass is one of the most significant contributors to the total façade embodied carbon.

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### Limitations of data

- Glazing production
- Factory and site emissions
- Repair and replacement
- Cleaning and maintenance
  - Waste processing
- Supply-chain variations

Designers must examine default assumptions to make project specific adjustments where necessary so they are representative of their project scenarios

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### Glazing build-up methodology

- Appendix C: methodology for calculating ECFs for project specific glazing build-ups
- Why?
  - Glazing's significant contribution to total facade embodied carbon
  - Available EPDs are limited to a specific set of glazing build-ups
  - The complexity of accounting for numerous materials and processes needs dedicated guidance

#### Plans for other product specific guides?



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### Future Work Items

It is intended that this document will be updated over time to reflect the latest knowledge and experience in the field of whole life carbon assessment of façade and cladding systems.

#### Planned and potential future work:

Worked Example – Autumn 2022	Reference database embodied carbon factors
Methodology primer / brief document	Additional product specific guidance
Carbon calculation scale-up factors	Existing facade system guidance
Module D guidance	
New and refined emission factors	

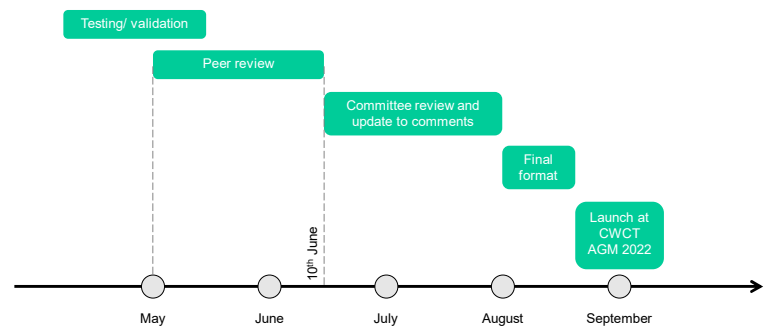
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### Peer Review Timeline



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Peer Reviewers

▶ Allies and Morrison Architects

▶ Alucraft

▶ Arup

▶ Centre for Window and Cladding Technology

▶ Chartered Institution of Building Services Engineers (CIBSE)

▶ Clarke

▶ Council for Aluminium in Building

▶ Cundall

▶ Dane Architectural Systems

▶ Eckersley O'Callaghan

▶ Facade Tectonics Institute

▶ FKN Group

▶ Guardian Glass

▶ Hawkins|Brown

▶ Hydro Building Systems

▶ Laing O'Rourke

▶ Lendlease

▶ Lindner

▶ London Energy Transformation Initiative (LETI)

▶ Mace

▶ Permasteelisa

▶ Pilkington

▶ Royal Institute of British Architects

▶ Royal Institution of Chartered Surveyors

▶ Saint Gobain

▶ Sandberg

▶ Schuco

▶ Skanska

▶ Staticus

▶ The Institution of Structural Engineers (IStructE)

▶ Wicona

▶ Wintech

▶ WSP

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Comments Received

701 total comments

Legend:

Sections with 10+ comments put as priority first due to repetition observed

'priority' comments per document section

No. of comments

Document Section

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Case Study Update

VARIATION (COV) BY LIFECYCLE STAGE

Case study results pre-methodology

A1-A3

AA-A5

B1-B5

C1-C4

TOTAL

VARIATION (COV) BY LIFECYCLE STAGE

In-progress case study results post-methodology

A1-A3

AA-A5

B4

C1-C4

TOTAL

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Case Study Update

Key takeaways so far:

▶ All modules calculated with a consistent approach

▶ COV significantly reduced for all stages

▶ Total result COV significantly reduced

▶ Some variance will remain

VARIATION (COV) BY LIFECYCLE STAGE

In-progress case study results post-methodology

A1-A3

AA-A5

B4

C1-C4

TOTAL

Case study embodied carbon per life cycle module

A1-A3, 83%

A4, 3%

A5, 9%

B4, 10%

C1, 0%

C2, 0%

C3, 1%

C4, 0%

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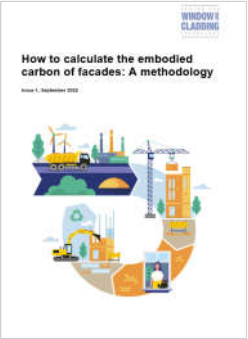
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### Methodology Launch!

How to calculate the embodied carbon of facades: A methodology

Issue 1, September 2022



How to calculate the embodied carbon of facades: Worked example



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### Key objectives achieved

- ✓ Enables calculation of facade embodied carbon
- ✓ Provides a consistent calculation methodology
- ✓ Encourages review of carbon impact against industry targets.
- ✓ Ensures industry targets set from reliable data
- ✓ Enables evaluation of design decisions
- ✓ Promotes contributions to carbon databases

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## So what's next?


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### We want to hear from you!



The CWCT welcome continued feedback from industry on the development of this document in the future.

If you have any comments on the methodology, please email [sustainability@cwct.co.uk](mailto:sustainability@cwct.co.uk)

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