Embodied Carbon One-Pager

Definition

Whole Life embodied carbon emissions are those associated with materials and construction processes throughout the whole life cycle of an asset. Embodied emissions therefore include A1-A5, B1-B5 and C1-C4.

Hierarchy for Embodied Carbon Reduction

1 Build Less
- Re-use existing, where possible
- Carry out audit of materials on site for Circular Economy purposes
- Challenge the client brief for spatial efficiency

2 Build Light
- Quantity before coefficient
- Structural requirements and utilization
- Consider whole life aspects – replacements and maintenance

3 Build Wise
- Identify big ticket items/know where your carbon is
- Refrigerant leaking/services WLC

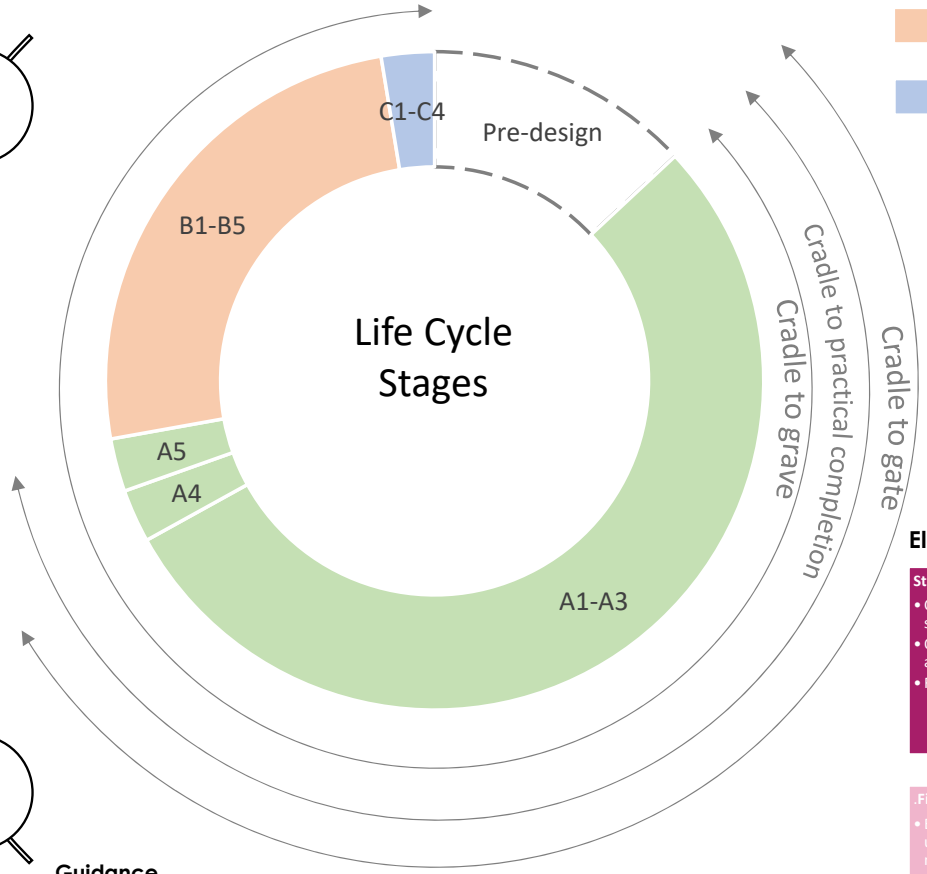
4 Build low carbon
- Ethical and responsible sourcing of materials
- Role of specifications
- Awareness of uncertainty/variability in data

5 Build for the future
- Design building for disassembly and circular economy

6 Build collaboratively
- Measurement and verification
- Share knowledge

Whole Life embodied carbon emissions

This diagram is structured by the BS EN 15978 life cycle stages, which in turn define the reporting metrics. The circular form and proposal to integrate a pre-design period at the start emphasises the opportunities available to reduce the upfront carbon emissions associated with Life Cycle Stages A1-A5.



Key

Pre-design period
Encompassing Embodied Carbon Reduction strategies numbers 1-4 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/ Refurbishment/ Replacement

C1-C4 – End of life carbon emissions
C1-C2 Deconstruction & demolition/ Transport
C3-C4 Waste processing/ Disposal

D – (Reported separately) Reuse, Recovery, Recycling

Breakdown by building element

Elemental Reduction Strategies

Structure
- Compare options at an early stage. Lighter super structure, saves on sub-structure.
- Omit basements (sometimes basements are positive in certain ground conditions).
- Review loadings and rationalise grids.

Façade and roof
- Compare options at an early stage.
- Use metals sparingly. It is often the hidden parts of the build up that have the most effect so include all framing elements in the assessment.

.Finishes, furniture and fittings
- Eliminate materials where possible and utilise self finishing surfaces with low maintenance.
- Ensure replacement cycles are considered, especially on loose items and high foot fall areas.

Mechanical, Electrical and Plumbing (MEP)
Interrogate comfort metrics. Avoid over-provision of plant. Typically fewer and simpler systems are preferable. Reduce duct-runs. Specify refrigerants with low GWP and ensure leakage is considered in the analysis. Design for recycling and deconstruction as MEP is regularly replaced

Guidance

This summary document should be read with the EN 15978:2011 and RICS Professional Statement. An embodied carbon analysis must include all elements within the cost plan for the project. When done during the design stages, the data can be used to make design decisions. It is best practice to include the embodied carbon analysis in tender information and track the as built information against this during construction. An analysis should also be carried out post-completion based on as built products

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Net Zero Whole Life Carbon

Importance

We have to reduce carbon emissions now, but Whole Life Carbon (WLC) is the only metric that allows the emissions of an asset or building to be considered holistically over its lifespan.

- Integrating the Circular Economy(CE) before considering new build and at each replacement cycle will reduce the use of virgin materials and upfront carbon emissions.
- Optimising embodied carbon with operational savings over the lifetime of the asset will minimise offsetting over the long term.

Definition

True zero Whole Life Carbon (WLC) emissions:
A + B + C = 0 kgCO2e
Although conceptually true, it is considered net zero WLC can only be achieved through the use of offsets. Therefore:
Net zero Whole Life Carbon (WLC) emissions:
A + B + C + Offsets = 0 kgCO2e
Upfront + In Use + End of life + offsets = 0 kgCO2e

Module D is reported separately - any benefit accrued from Benefits and Loads should not be applied directly as a discount.

Guidance

This summary document should be read with the EN 15978:2011, RICS Professional Statement, UKGBC Net Zero Framework.

Targets and reporting

- The targets below must be met without offsetting, which must provide verified carbon removal.
- This includes Energy Use Intensity targets.
- The targets do not include sequestration, which can be reported separately.

	2030	2050
A		
A - C (exc B6/B7)		
A - C	(targets will be kgCO2e/m2 against GIA)	
D		
B6	(maintain EUI targets, follow LETI defn and procure renewable energy)	

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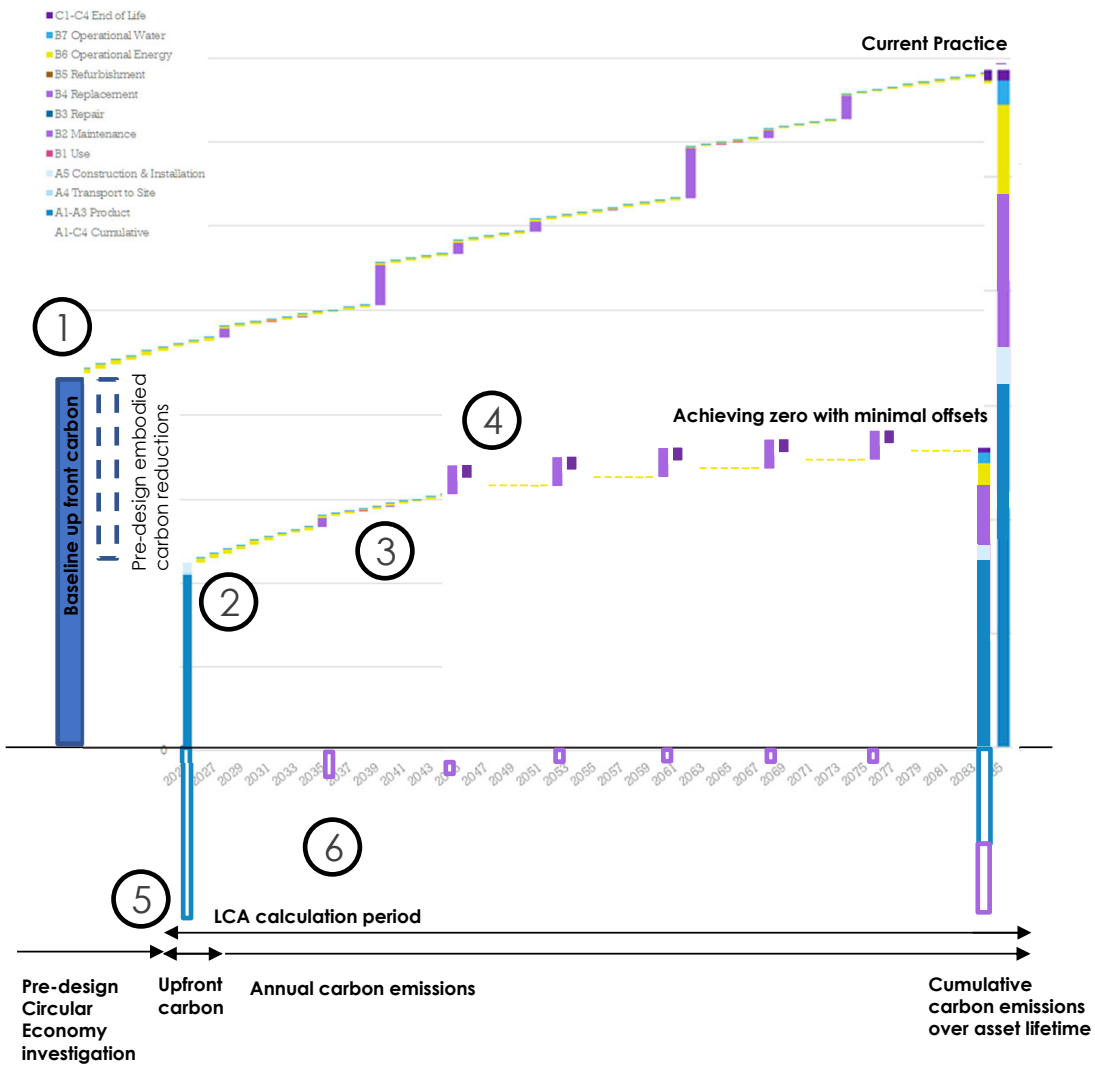

Whole Life Carbon reductions

The diagram shows an example Whole Life Carbon Assessment based on a Life Cycle Assessment (LCA) prediction over time for two scenarios; Current Practice and Net Zero. LCA is proposed as a key design decision making tool to be used through all RIBA design stages. To meet net zero WLC a number of steps must be taken.

Key reduction strategies include:

1. Integration of Embodied Carbon reduction mechanisms and Circular Economy principles at the beginning of the design cycle. This includes retrofit, re-use of materials and recyclability.
2. Ensuring designs to meet robust upfront carbon targets.
3. Operational energy loads to be reduced and meet EUI targets. Conversion of energy in kWh to $kgCO_2e$ using National Grid carbon factors. The emissions from electricity will be zero by 2050.
4. At each replacement cycle the Circular Economy and use of low carbon materials should be employed to reduce emissions.
5. Upfront carbon (A) should be offset at practical completion based on as built information, including any impacts from the disposal of existing structures onsite
6. Annual emissions should be measured and a net zero carbon balance should be demonstrated for operational energy (B6), use-stage embodied carbon (B1-5) and water impacts (B7).