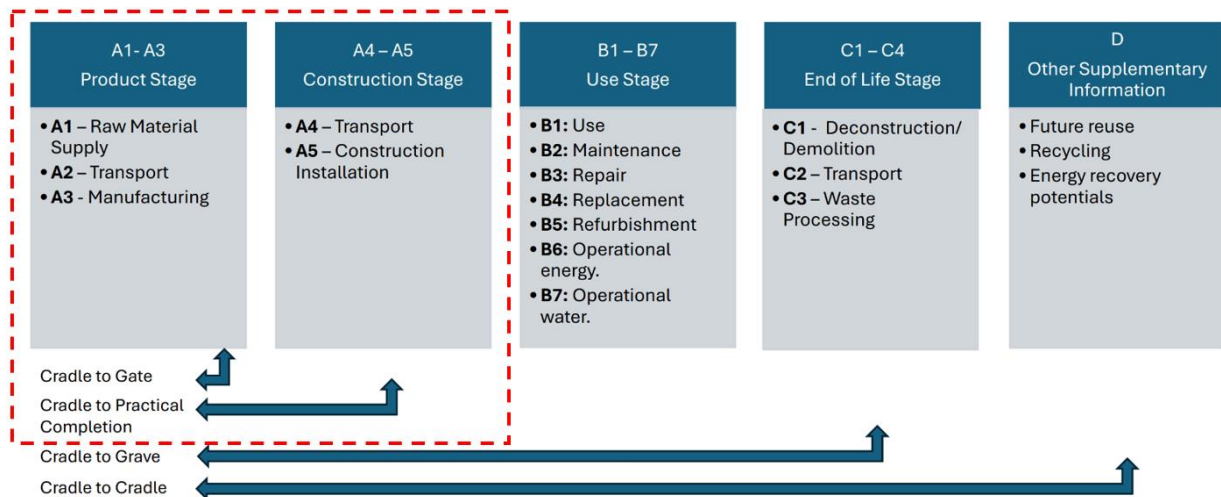




Introduction to Embodied Carbon

Embodied carbon is the total greenhouse gas (GHG) emissions, expressed as embodied carbon dioxide equivalent (ECO_{2e}), that are associated with the materials, products, and processes used throughout the life cycle of a product—excluding its operational use. In terms of Life Cycle stages, this document covers A1 to A5 inclusive.



In contrast to **operational carbon** (emissions from energy used during the use phase—heating, cooling, lighting, etc.), embodied carbon focuses on the *locked-in* emissions from making and delivering the product or building.

- Why is it needed?
 - Statutory legislation – EU, UK & Global Policies
 - Requirements for businesses to be Net Zero, circular economy
 - Climate Impact – Benefits to planet & future generations
 - Commercial – Market competition, non-compliance penalties

Definitions

Greenhouse Gases (GHGs)	• Definition: Gaseous substances (e.g. CO₂, CH₄, N₂O, HFCs) that trap heat in the atmosphere by absorbing infrared radiation. • Sources: Both natural (e.g. water vapor, volcanic activity) and anthropogenic (e.g. fossil fuel combustion, industrial processes). • Relevance: GHG emissions are the core metric in carbon accounting, typically expressed as CO₂ equivalent (CO₂e).
Life Cycle Assessment (LCA)	• Standard: ISO 14040/44. • Purpose: Quantifies environmental impacts across all stages of a product's life: ○ A1–A3: Raw material extraction & manufacturing ○ A4–A5: Transport & installation ○ B1–B7: Use phase (including energy/water use, maintenance) ○ C1–C4: End-of-life (deconstruction, disposal) • D: Reuse/recycling potential (optional) • Output: Often forms the basis for EPDs, TM65 assessments, and whole life carbon calculations.
Environmental Product Declaration (EPD)	• Purpose: Transparent, third-party verified documentation of a product's environmental impact across its lifecycle. • Scope: Typically includes stages A1–A3 (product), A4–A5 (transport & installation), B1–B7 (use phase), C1–C4 (end-of-life), and optionally D (reuse/recycling benefits). • Use: Enables comparison between products for sustainable design and procurement.
Product Environmental Passport (PEP ecopassport®)	• EPD Variant: Tailored for electrical, electronic, and HVAC products. • Industry-Specific: Recognizes the unique lifecycle and material composition of building services equipment. • Standardized Format: Facilitates consistent reporting and comparison within these sectors.
CIBSE TM65	• Why It Exists: Many building services products lack full EPDs. • Methodology: Uses manufacturer-supplied data + default emission factors to estimate embodied carbon. • Stages Covered: A1–A3 (product), A4 (transport), A5 (installation), B2–B5 (maintenance/replacement), C1–C4 (end-of-life). • Note: TM65 requires explicit stage identification, not just general lifecycle descriptions.
Embodied Carbon	• Definition: GHG emissions from material extraction, manufacturing, transport, installation, maintenance, and disposal. • Stages: A1–A5, B2–B5, C1–C4.
Operational Carbon	• Definition: GHG emissions from energy (B6) and water (B7) use during the building's operation. • Includes: Heating, cooling, lighting, equipment, water supply/treatment.
Whole Life Carbon (WLC)	• Definition: Sum of embodied carbon + operational carbon + end-of-life benefits/loads (D). • Goal: Minimize total CO₂e over the product/building's entire lifecycle. • Also Known As: "Cradle to cradle" approach.

Introduction to TM65

CIBSE TM65 provides a methodology for calculating the embodied carbon of building services products, particularly where full EPDs are unavailable. It covers lifecycle stages A1–A3 (product), A4 (transport), A5 (installation), B1–B3 (use, maintenance, repair), and C1–C4 (end-of-life). Calculations are based on manufacturer-supplied data and CIBSE default emission factors. Unlike the FETA definition, TM65 explicitly includes stages B2–B5, requiring detailed stage identification rather than general lifecycle descriptions.

Introduction to Environmental Product Declarations (EPDs)

An Environmental Product Declaration (EPD) is a standardized, third-party verified document that quantifies the environmental impact of a product across its lifecycle. Based on Life Cycle Assessment (LCA) in accordance with ISO 14040/44 and EN 15804, EPDs cover stages from raw material extraction (A1–A3) through transport, installation, use, and end-of-life (A4–C4), with optional inclusion of reuse/recycling benefits (D). EPDs enable transparent comparison of products and support sustainable decision-making in design and procurement.

<i>EPD Preferred When:</i>	<i>TM65 Preferred When:</i>
• A full, third-party verified LCA is available for the product. • You need to compare products across manufacturers or systems using standardized data. • The project requires compliance with EN 15804, ISO 14025, or other formal sustainability frameworks. • You're working on construction materials or systems with established EPDs. • The client or regulatory body demands transparent, externally verified documentation.	• The product does not have a full EPD. • You need a quick, indicative estimate of embodied carbon for building services equipment. • You're assessing HVAC, electrical, or specialist systems where EPDs are uncommon. • Manufacturer data is available but not in EPD format. • You're working within the CIBSE framework or UK-specific carbon reporting.

References

CIBSE TM65 v1 / v1.1

ISO 14040 / ISO 14044 (LCA)

EN 15804 (construction product EPDs)

ISO 14025 (Type III environmental declarations)

PEP ecopassport® programme