Embodied Carbon Assessment

Embodied carbon refers to the greenhouse gas emissions associated with the extraction, manufacture, transport, and installation of construction materials, as well as emissions during the construction process itself. Unlike operational carbon, which arises from a building's energy use over its lifetime, embodied carbon is largely locked in during the design and construction phase and cannot be recovered once materials are specified and procurement decisions are made.

For the real estate sector, embodied carbon typically represents 20-50% of a building's total lifecycle carbon footprint. As operational emissions continue to decline through renewable energy adoption and efficiency improvements, embodied carbon's relative share will grow, making early-stage intervention in material choices increasingly critical to meeting decarbonisation goals.

We initiated its embodied carbon programme with an assessment at Birla Niyaara in FY 2024-25. In FY 2025-26, the programme was expanded to the remaining residential project sites, achieving 100% coverage across all active Birla Estates projects. This document records the methodology, system boundary, calculation approach, initiative outcomes, and forward plans for the programme.

2. Assessment Methodology

2.1 Tool: Carbon Calculator tool

To calculate embodied carbon across projects, a comprehensive carbon calculator tool was developed. The tool is designed to:

- Catalogue major construction material categories across the project scope
- Incorporate emission factors from trusted industry databases including the Inventory of Carbon and Energy (ICE) and Environmental Product Declarations (EPDs)
- Automatically compute total embodied carbon by applying emission factors to material quantities

The core calculation formula is straightforward:

Material Quantity x Embodied Carbon Factor = Total Embodied Carbon

This approach enables consistent benchmarking of embodied carbon intensity (expressed as tCO2e per sq.m.) across projects and reporting periods.

2.2 Data Collection Process

The assessment follows a four-stage data collection process:

Stage	Description
1. Material Inventory	A detailed list of all materials is compiled from project specifications and bills of quantities (BOQ), covering all structural, masonry, and finishing elements within the defined system boundary.
2. Supplier Engagement	Where available, suppliers are engaged to obtain product-specific Environmental Product Declarations (EPDs) or manufacturer data, enabling more accurate emission factor assignment beyond generic industry averages.
3. Industry Databases	For materials without product-specific EPDs, emission and embodied carbon factors are extracted from trusted secondary databases including the ICE database (University of Bath) and available Indian EPD sources.
4. Construction Monitoring	Tracking is implemented for material delivery records and fuel usage during construction activities (DG sets, site machinery), enabling site energy consumption to be quantified and included within the assessment boundary.

2.3 Lifecycle Stages Covered (A1 to A5)

The Excel-based tool covers embodied carbon from lifecycle stages A1 to A5, as defined under the EN 15978 standard and referenced in IGBC and LEED methodologies:

Stage	Name	Description
A1-A3	Cradle-to-Gate	Extraction of raw materials, processing, and manufacturing of construction products up to the factory gate. This is the primary driver of embodied carbon for structural materials such as concrete, steel, and masonry.
A4	Transport to Site	Transportation emissions from the manufacturing facility to the construction site. Secondary steel procured within 100 km actively reduces this component.
A5	Construction / Installation	Emissions from the installation process at site, including energy consumed by construction machinery and DG sets. Site energy tracking through Construction Monitoring feeds this stage.

2.4 System Boundary

The system boundary for the current assessment is defined as the Core and Shell (C&S) scope, plus energy consumed during construction site operations. This boundary has been intentionally adopted for the following reasons:

- Core and Shell elements (concrete, reinforcement steel, masonry, base plaster) are common across all project types and least influenced by tenant-specific or fit-out variations.
- These elements account for the majority of material-related embodied carbon in a residential or commercial building.
- A consistent C&S boundary enables reliable benchmarking of embodied carbon intensity (tCO2e/sq.m.) across projects and across reporting periods.

As of FY 2025-26, Core and Shell material quantities and site energy consumption have been quantified for all assessed projects, establishing a reliable baseline for future comparison. The boundary will be expanded in future

phases to include MEP (Mechanical, Electrical and Plumbing) components, enabling a more comprehensive whole-building lifecycle assessment.

3. FY 2025-26 Programme Coverage and Key Initiatives

3.1 Coverage Expansion

1 Project Assessed FY 2024-25 (Niyaara only)	**100%** Portfolio Coverage Achieved in FY 2025-26

The embodied carbon assessment programme achieved full portfolio coverage in FY 2025-26 with assessments completed across all active Birla Estates projects. The expansion from a single project (Birla Niyaara) to all-projects represents a significant maturation of the programme and establishes a consistent baseline across the portfolio for year-on-year tracking of embodied carbon intensity.