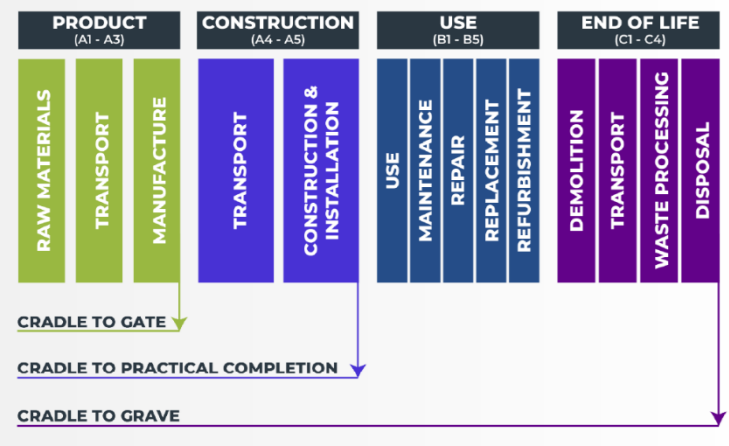
Life Cycle Analysis Tool

Introduction

Life Cycle Analysis (LCA) of buildings is systematic method used to evaluate the environmental impacts associated with all the stages of a building's life, from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling.



Cradle-to-Gate

An assessment of a partial product life cycle from resource extraction (cradle) to the factory gate (i.e., before it is transported to the consumer) - life cycle stages A1-A3

Cradle-to-Gate with Options/ Cradle to Practical Completion

An assessment of a partial product life cycle from resources extraction to the gate – life cycle stages A1-A3 with transportation to construction site -life cycle stage A4 and installation – life cycle stage A5

Cradle-to-Grave

An assessment of a full product life cycle from resource extraction (cradle) to the end of useful life (grave). Life cycle stages A1-C4.

Baseline Building & Assumptions

- The LCA analysis included the building's structure and enclosure, all interior finishes on the structure and envelope walls, structural floors and ceilings, and building foundations.
- Specifically excluded were MEP elements, landscape elements, fire detection, alarm systems, elevators, parking lots, site improvements.
- The scope of this assessment includes **cradle-to-grave** impacts for a building life of **60 years**.
- Assumed travel distance of **900 kms** between production and installation of elements and all EPDS are based on data from **EC3** by buildingtransparency.org

PowerBI Dashboard Explanation

Please find a description and explanation of what can be found on each page, below.

Dashboard

This page provides a comprehensive analysis of emissions across various building models. It focuses on key metrics such as:

1. **Total Emissions**
2. **Emissions per Gross Floor Area (GFA)**
3. **Emissions Percentage by Category** (e.g., Claddings, Floors, Foundations).

Total Emissions

This page offers a detailed **breakdown of emissions** for a single building model. It focuses on:

1. **Built Categories**: Emissions contributions segmented by Architecture, Structure, and other major building components.
2. **Building Categories**: Further breakdowns into specific elements like:
    - Claddings
    - Floors
    - Foundations
    - Walls, etc.
3. **Material Quantity**: Displays the amount of material used in each category.
4. **Emissions Contribution**: Quantifies emissions based on materials used, allowing a deeper understanding of the model's environmental impact.

Elevation Style

This page facilitates a **comparative analysis of different elevation styles** for a building model with a side-by-side comparisons of emissions impact for each style.

Emissions by Material

This page dissects **total emissions** based on the materials used across the building model.

1. **Material-Specific Emissions:**
    - Displays the total carbon emissions attributed to each material (e.g., concrete, steel, wood).
2. **Category-Wise Breakdown:**
    - Groups materials into broader categories (e.g., structural materials, finishes) to show their relative impact on emissions.

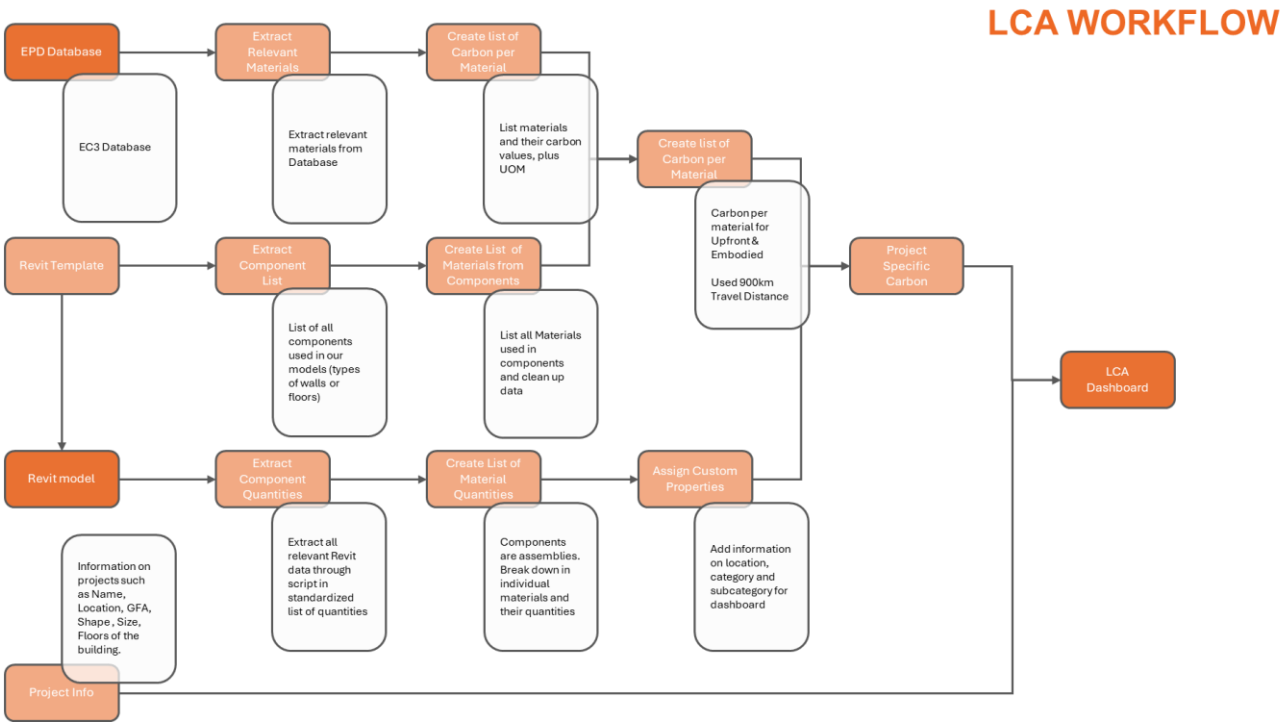
Emission Benchmarks

To provide context and highlight efficiency opportunities, emissions are benchmarked against three key metrics:

1. **Baseline Emissions**
    - Represents the **average emissions of the top 80%** of Environmental Product Declarations (EPDs) within a material category.
    - It reflects typical emissions performance for most materials in the market.

2. **Industry Average**
    - Represents the **average emissions across all available EPDs** for a specific material category.
    - This provides a broader market view and sets a standard benchmark for comparison.
3. **Achievable Emissions**
    - Represents the **average emissions of the bottom 20%** of EPDs within a material category.
    - It showcases the **best-in-class performance** achievable by selecting low-emission materials.

Revit Workflow



Data Sources

1. EPD Database & EC3 Database: These provide environmental product declarations (EPDs) and carbon data for materials.
2. Revit Model & Template: These represent the digital model of the building and its components, containing project-specific information.

Steps

3. Extract Relevant Materials: Materials are sourced from the databases, focusing on those relevant to the project.
4. Extract Component List: A list of components (e.g., walls, floors) used in the model is generated from the Revit Template.
5. Create Database of Materials from Components: Materials used in the components are identified and organized, ensuring the data is clean.
6. Extract Component Quantities: Quantities of components are pulled from the Revit Model using scripting and standardized processes.
7. Create Database of Material Quantities: Components are broken into their materials and their respective quantities.
8. Assign Custom Properties: Additional information (e.g., location, category, and subcategory) is assigned for visualization in the dashboard.
9. Create List of Carbon per Material: Each material is associated with its carbon value (both upfront and embodied carbon), factoring in transportation (900 km travel distance is mentioned).

10. Project-Specific Carbon: Combines carbon data from materials and project specifications to calculate the total carbon impact for the project.

Name	Layer / Material	Thickness (mm)	Materials	Distance	Weight	A1 – A3	A4 – A5	B1 – C4	A1 – C4	UOM	Total
Int - Bulkhead - 41mm C Stud - 1/2" GWB (1+0) - 54mm	Metal Stud	41.30	Metal Stud - 41.3 - 24 OC	900.00	3.00	3.12	0.15	0.00	3.27	Area	14.59
	Gypsum Wall board Typical	12.70	Gypsum - Wallboard - 12.7mm	900.00	20.30	2.93	0.99	2.93	6.85	Area	
			Paint - Interior	900.00	1.75	2.19	0.09	2.19	4.47	Area	