HEAT

ASIA LOW CARBON BUILDINGS TRANSITION PROJECT

Life Cycle Assessment for Transitioning to a Low-Carbon Economy

Building Emission Assessment Tool (BEAT) Handbook

Part 1: Core Concept Guide

April 2025

GGGI

ASEAN CENTRE FOR ENERGY · ACE

EESL®

Supported by:

Federal Ministry for Economic Affairs and Climate Action

IKI INTERNATIONAL CLIMATE INITIATIVE

on the basis of a decision by the German Bundestag

ASIA LOW CARBON BUILDINGS TRANSITION

Life Cycle Assessment for Transitioning to a Low-Carbon Economy | PROJECT

Global Green Growth Institute
Jeongdong Building 19F
21-15 Jeongdong-gil
Jung-gu, Seoul 04518
Republic of Korea

Authored by: Rohit Nepali, César Jiménez, Dirk Schwede, Dietram Oppelt, Philipp Schreiber

This handbook is the first part of a two-part series. Part 2 will focus on practical examples of how to use BEAT for assessing the overall carbon impact of buildings, including a walkthrough of all its features.

This report is part of the Asia Low Carbon Buildings Transition (ALCBT) Project, funded by the Government of Germany through its Federal Ministry for Economic Affairs and Climate Action (BMWK) via the International Climate Initiative (IKI).

ACRONYMS & ABBREVIATIONS

AC	Air Conditioning/Conditioner
ACE	ASEAN Center for Energy
AHU	Air Handling Unit
ALCBT	Asia Low Carbon Buildings Transition
AMS	ASEAN Member States
ASEAN	Association of Southeast Asian Nations
BEAT	Building Emission Assessment Tool
BMWK	Federal Ministry for Economic Affairs and Climate Action (Germany)
BoQ	Bill of Quantities
CFL	Compact Fluorescent Lamp
COP	Coefficient of Performance
DOAS	Dedicated Outdoor Air System
DX	Direct Expansion
ECBC	Energy Conservation Building Code (India)
ECM	Electronically Commutated Motor
EDGE	Excellence in Design for Greater Efficiencies
EERs	Energy Efficiency Ratio(s)
EESL	Energy Efficiency Services Limited
EN	European Norm (Standard)
EPD	Environmental Product Declaration
ESCO	Energy Service Company
GDP	Gross Domestic Product
GGGI	Global Green Growth Institute
GWP	Global Warming Potential
HEAT	HEAT International GmbH
HVAC	Heating, Ventilation, and Air Conditioning

IEA	International Energy Agency
IFC	International Finance Corporation
IKI	International Climate Initiative
ISO	International Organization for Standardization
$kgCO_2e$	Kilograms of CO_2 (carbon dioxide) equivalent
kW	Kilowatt
LCA	Life cycle assessment
LCI	Life Cycle Inventory
LED	Light Emitting Diode
lm	Lumens
LPG	Liquefied Petroleum Gas
m^2	Square Meter
m^3/h	Cubic Meter per Hour
NDC	Nationally Determined Contribution
ÖKOBAUDAT	German Building Material Database (Ökologisch orientierte Bauproduktdatenbank)
VAV	Variable Air Volume
VRF	Variable Refrigerant Flow
W	Watt

TABLE OF CONTENTS

List of Figures

List of Tables

Executive Summary

This handbook, as Part I of the BEAT (Building Emission Assessment Tool) documentation, provides a comprehensive foundation for understanding the terminology, definitions, and methodology underlying the BEAT tool. Developed under the Asia Low Carbon Buildings Transition (ALCBT) Project, funded by the German Federal Ministry for Economic Affairs and Climate Action (BMWK) via the International Climate Initiative (IKI), BEAT is designed to empower practitioners, policymakers, and stakeholders in five rapidly developing Asian countries—Cambodia, India, Indonesia, Thailand, and Vietnam—to quantify and reduce both embodied and operational carbon emissions in the building sector.

Key Highlights of This Handbook:

- **Terminology and Definitions:** The document establishes clear definitions for essential terms such as embodied carbon, operational carbon, life cycle assessment (LCA), and other core concepts. It also provides a detailed glossary of acronyms and abbreviations to ensure consistent understanding across diverse user groups.
- **Methodological Framework:** The handbook outlines the LCA methodology employed by BEAT, including the boundaries and scope based on the European Standard EN 15978.
- **Building Typologies and Climate Parameters:** BEAT's classification system, adapted from the IFC EDGE framework, is explained in depth for both data entry and analysis. The document also describes the climate zone mapping used to ensure regionally appropriate assessments, reflecting the diverse climatic conditions across the ALCBT countries.
- **User Guidance and Data Requirements:** Practical instructions are provided for getting started with BEAT, including user interface navigation, project setup, and the specific input data required for accurate assessments. The handbook details the options for entering building component and material data, as well as the approach for handling energy carriers and emission factors.
- **Environmental Product Declarations (EPDs):** The role of EPDs in BEAT is described, including the integration of official, generic, and (in future releases) user-specific EPDs to address data gaps and support robust carbon modelling in diverse markets.

Looking Ahead: The forthcoming BEAT Handbook Part II will provide a deeper dive into interpreting results, using the results dashboard, conducting analysis and reporting, exploring advanced features, comparing scenarios, and reviewing case studies and practical examples.

1. Introduction to BEAT

1.1 What is BEAT?

The Building Emission Assessment Tool (BEAT) is a web-based platform developed by HEAT GmbH for IKI- Asia Low Carbon Buildings Transition (ALCBT) project. BEAT provides a comprehensive solution for quantifying both embodied and Operational Carbon throughout a building's life cycle in five ALCBT countries: India, Indonesia, Thailand, Cambodia, and Vietnam.

The tool represents a significant advancement in bringing sophisticated Life Cycle Assessment (LCA) methodologies to building practitioners in India, Indonesia, Thailand, Cambodia, and Vietnam—regions experiencing rapid construction growth and urbanization. Where previous assessment tools have often focused exclusively on Operational Carbon or provided only partial analysis, BEAT delivers a holistic approach that captures the complete carbon footprint of buildings. The applicability of the tool can be expanded to additional countries beyond the ALCBT initiative by further developing and extending its underlying database.

BEAT bridges critical gaps in technical capacity by offering:

a. Comprehensive carbon assessment covering both construction materials (Embodied Carbon) and energy use (Operational Carbon).
b. User-friendly interfaces designed for practitioners with varying levels of technical expertise.
c. Availability of generic data for individual ALCBT countries to allow modelling today. BEAT offers functions to add local LCA data in future once it becomes available. The generation of local data is encouraged and thereby the development of local markets for low-carbon materials and energy carriers are incentivized.
d. Alignment with international standards while accommodating local requirements.

As an open-source, web-based tool, BEAT eliminates barriers to adoption such as specialized software requirements or complex installation processes. It guides users through a structured data input workflow and generates clear, actionable output that communicates carbon impacts and reduction opportunities.

1.2 BEAT's Strategic Importance

The global construction sector currently contributes approximately **37%** of energy- and process-related carbon emissions, making it a critical focus for climate action[1]. In rapidly developing Asian economies, decisions made today about building design, materials, and construction techniques will lock in emissions for decades to come. BEAT matters because it addresses several urgent challenges:

Climate Imperative: Buildings constructed in the next decade will significantly impact our ability to meet climate goals. BEAT enables the quantification and reduction of both embodied and Operational Carbon emissions, directly supporting national climate commitments (NDCs) in target countries and aligning with global temperature targets.

---

[1] UN Environment Programme & Global Alliance for Buildings and Construction. (2024). Global Status Report for Buildings and Construction 2024/2025. https://www.unep.org/resources/report/global-status-report-buildings-and-construction-20242025

Decision-Making Gap: Until now, stakeholders have lacked accessible tools to measure the carbon implications of building choices. BEAT empowers architects, engineers, developers, and policymakers to make informed decisions based on comprehensive carbon data, transforming sustainable building from an aspirational concept to a measurable practice.

Policy Development: Governments across Asia are seeking evidence-based approaches to regulate building emissions. BEAT provides the quantitative foundation for effective policy development, supporting initiatives from building codes and standards to green procurement guidelines and carbon intensity limits.

Market Transformation: BEAT has a particular focus on Embodied Carbon, that enables the shift toward low-carbon materials and construction practices by making carbon impacts visible and comparable. This transparency creates market incentives for innovation in building products and design approaches, driving industry-wide transformation.

In the chapters that follow, we will walk you through the methodology behind BEAT's development and implementation. You'll become familiar with the essential terms and technical concepts necessary for effectively using the tool. Each section has been designed to build your understanding progressively, from fundamental carbon assessment principles to the practical application of BEAT in your building projects.

1.3 What are the outputs BEAT is delivering

Building Emission Assessment Tool (BEAT) provides key outputs that will support evidence-based decarbonization of the building sector:

Whole Life Carbon Assessment: BEAT quantifies **embodied carbon** and **operational carbon** from a building, expressed in **$kgCO_2e/m^2$**, offering a complete lifecycle-based building carbon emissions.

Benchmarking by Building Type: BEAT will use data from **300 real buildings per ALCBT country** to generate benchmark values for different building typologies.

Component-Level Design Simulations: BEAT allows users to evaluate differences on embodied carbon brought by **alternative material choices** making up their building components.

2. LCA Methodology for BEAT

First and foremost, it is fundamental for the user to understand the definitions of and differences between Embodied and Operational Carbon:

Embodied Carbon: Embodied Carbon refers to the greenhouse gas emissions produced during the extraction, manufacturing, and transport of building materials. It represents the carbon footprint of a building before it is even used. Unlike Operational Carbon, Embodied Carbon is "locked in" once construction is complete and cannot be reduced at a later stage.

Operational Carbon: Operational Carbon encompasses all greenhouse gas emissions from energy used to operate a building throughout its life cycle. This includes emissions from heating, cooling, lighting, ventilation, and running appliances or equipment. Operational Carbon continues to accumulate over the building's entire lifespan and can be reduced through efficiency improvements.

2.1 LCA Boundaries and Scope

Life Cycle Assessment (LCA) provides a structured framework for evaluating environmental impacts throughout a building's entire existence. The European Standard EN 15978 establishes a comprehensive methodology that divides a building's life cycle into distinct modules, creating clear boundaries for assessment as shown in Figure 1.

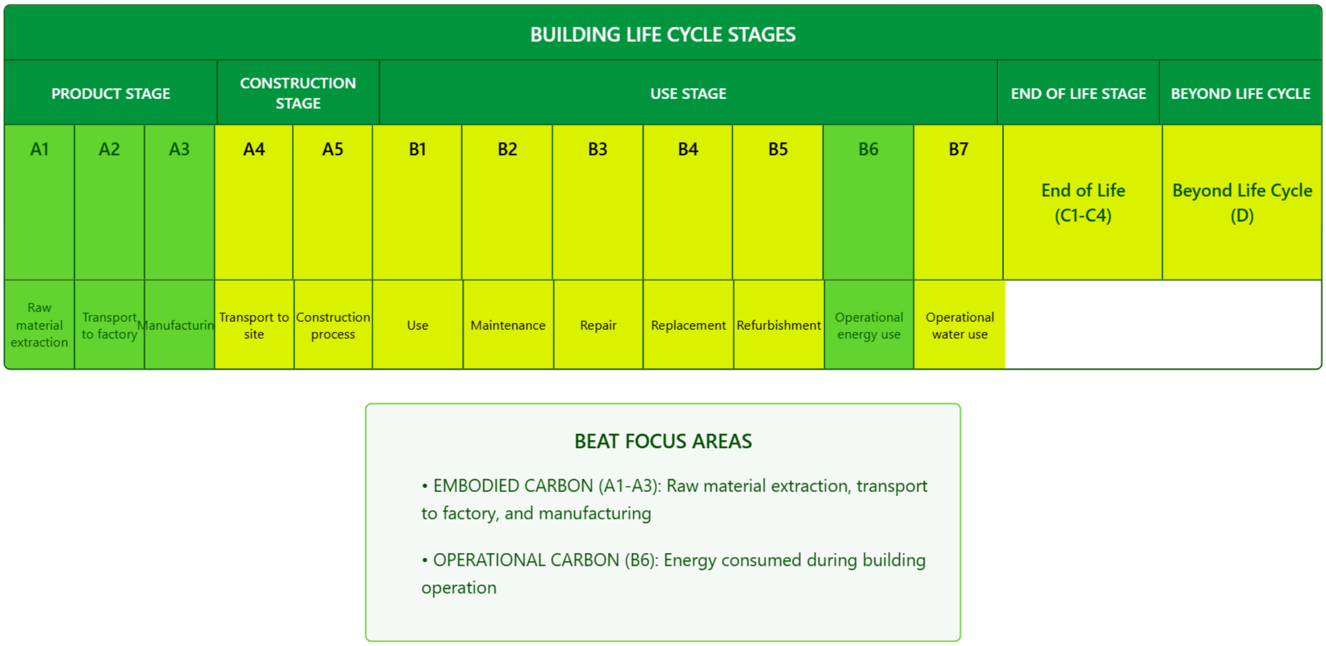

Figure 1 Building life cycle stages as per EN 15978

Understanding BEAT LCA Boundaries

LCA boundaries define which life cycle stages are included in an assessment. While the EN 15978 standard covers the entire building life cycle, BEAT strategically focuses on two key modules with the following scope:

1. **Embodied Carbon (A1-A3) during product stage**: These "cradle-to-gate" stages represent the carbon emissions associated with:
    - A1: Raw material extraction (mining, harvesting)
    - A2: Transportation to manufacturing facilities
    - A3: Manufacturing processes for building materials
2. **Operational Carbon (B6)**: This module covers emissions from energy consumed during the building's operational life, including:
    - Heating and cooling
    - Ventilation
    - Lighting
    - Equipment and appliances

This focused approach allows BEAT to address the life cycle stages with the most significant carbon impact and the most reliable available data, while providing a practical balance between thoroughness and feasibility given data limitations in the target ALCBT countries.

2.2 Embodied Carbon Calculation

This diagram Figure 2 illustrates how BEAT calculates Embodied Carbon by progressing from building components through material composites to individual materials, where Greenhouse Warming Potential (GWP) values are applied to calculate the final Embodied Carbon result. The formula shows that Embodied Carbon is the sum of material quantities multiplied by their respective GWP values.

The hierarchical approach reflects how buildings are decomposed in the BEAT methodology:

a. Building Components: The major functional elements of a building
b. Material Composites: How components are constructed as assemblies of materials
c. Individual Materials: The basic materials with their environmental impact data
d. Embodied Carbon Calculation: The mathematical process that combines quantities with impact factors

This approach allows users to understand both the structural hierarchy and calculation methodology in a single comprehensive visualization.

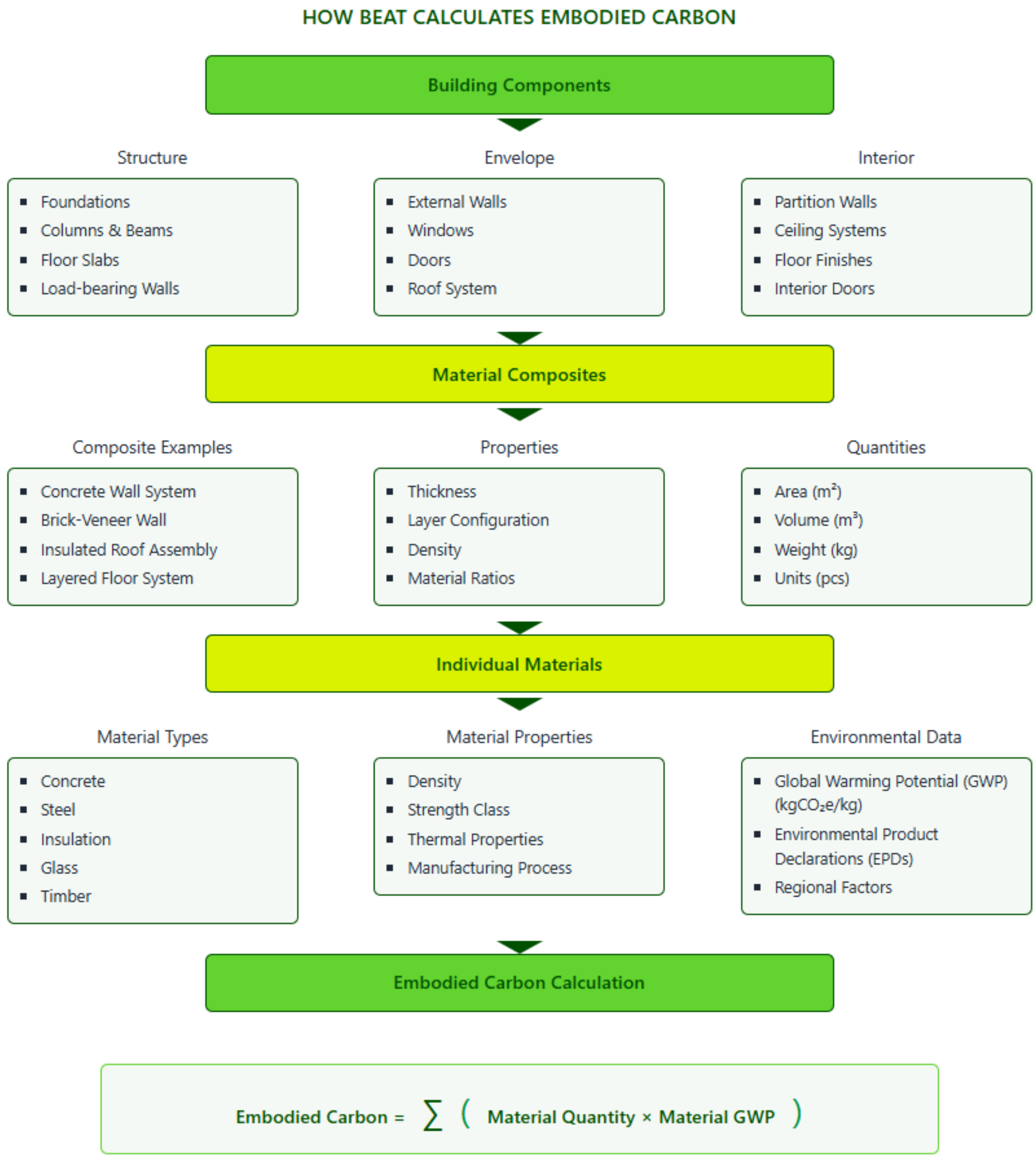

Figure 2 Steps to calculate Embodied Carbon from a building

2.3 Operational Carbon Calculation

This diagram Figure 3 illustrates how BEAT calculates Operational Carbon emissions from buildings, following a hierarchical approach from energy uses through energy carriers to the final carbon calculation.

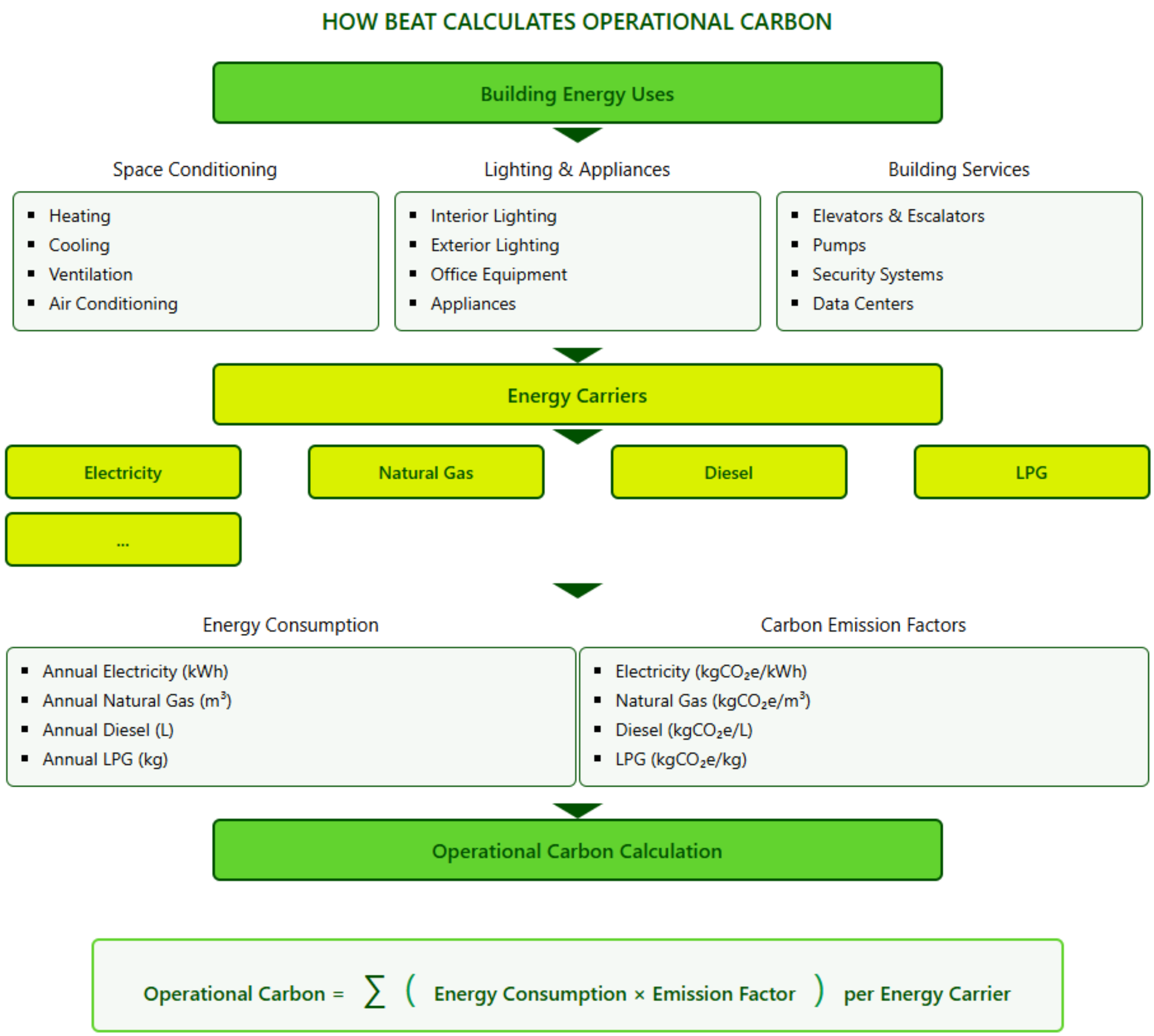

Figure 3 Steps to calculate Operational Carbon from a building

The structure shows:

a. Building Energy Uses: The primary categories of energy consumption in buildings, divided into:
   i. Space conditioning (heating, cooling, ventilation)
   ii. Lighting and appliances
   iii. Building services (elevators, pumps, etc.)
b. Energy Carriers: The different forms of energy that power these uses:
   i. Electricity
   ii. Natural Gas
   iii. Diesel
   iv. LPG, others...
c. Energy Consumption & Carbon Factors:

    i. Quantified annual energy use for each carrier keeping in mind seasonal variations and operational schedules
    ii. Corresponding emission factors that convert energy use to carbon emissions

d. Operational Carbon Calculation: The mathematical process that combines consumption with emission factors

The formula demonstrates that Operational Carbon is calculated by multiplying the consumption of each energy carrier by its specific emission factor, then summing these products across all carriers.

3. BEAT Fundamentals

3.1 Building Classification System

BEAT uses the IFC EDGE classification system for initial data entry and building characterization, providing a comprehensive framework that captures the detailed attributes of diverse building types. This detailed EDGE classification is then mapped into four broader categories (Residential, Commercial, Public/Institutional and Mixed-Use) for analysis purposes at later stages of the BEAT evaluation. This dual approach allows for detailed data collection while facilitating streamlined analysis and benchmarking.[2]

A. Building Type Definition and Classification (EDGE Classification for Data Entry)

BEAT adopts the IFC EDGE classification system, which categorizes buildings based on their function, quality level, and specific operational characteristics. This comprehensive classification ensures precise emissions benchmarking across diverse building portfolios throughout the ALCBT program countries.

1.1 Homes

Definition: Typically used for a single building for one family unit. Examples include single-family homes, villas, and townhouses. They can be single unit sub-projects or multiple units that are part of a development.

Classification Criteria: Income level based on socio-economic classifications.

Sub-categories:

- **Low Income Homes:** According to the socio-economic classifications of each country, determined by housing price and/or targeted audience. Any home that obtains any type of subsidy or is part of a social housing program may be considered low income.
- **Middle Income Homes:** Standard housing based on local socio-economic classifications, targeting average income households.
- **High Income Homes:** Premium housing based on local socio-economic classifications, targeting affluent households.

[2] International Finance Corporation. (2024, May 15). *EDGE user guide part 1 - Using the Design Tab* (Version 3, Revision 1). https://edge.gbci.org/

Key Differentiation Factors (country-specifically defined): Floor area per occupant, construction quality, appliance density, and energy service expectations.

1.2 Apartments

Definition: Typically used for a single building with multiple family units.

Classification Criteria: Income level based on socio-economic classifications

Sub-categories:

- **Low Income Apartments:** Multi-family buildings for lower-income households, often part of affordable housing programs. Similar to homes typology, determined by local socio-economic classifications.
- **Middle Income Apartments:** Standard multi-family buildings targeting average income households.
- **High Income Apartments:** Luxury multi-family buildings with premium amenities.

Key Differentiation Factors (country-specifically defined): Floor area per unit, common area facilities, construction quality, and energy service expectations.

1.3 Serviced Apartments

Definition: Typically used for projects with non-residential long-term stay. Hostels for long-term stays (e.g., student accommodations) can be considered under this typology.

Sub-categories:

- **Serviced Apartment:** Fully furnished units with hotel-like services for non-residential long-term stays.

Key Differentiation Factors (country-specifically defined): Occupancy patterns, service level, common facilities, and cleaning frequency.

1.4 Hotels

Definition: Typically used for projects with non-residential short-term stay such as tourist hotel accommodations.

Classification Criteria: Quality level based on star rating.

Sub-categories:

- **1-Star Hotels:** Basic accommodation with minimal services. Any hostels using the 'Hotel' typology shall select 1-star as a sub-typology.
- **2-Star Hotels:** Limited services, modest amenities.
- **3-Star Hotels:** Mid-range amenities, restaurant facilities, business services.
- **4-Star Hotels:** Full-service establishments with multiple restaurants, pools, fitness centers.
- **5-Star Hotels:** Luxury establishments with extensive amenities, fine dining, premium services.

Key Differentiation Factors: Occupancy patterns, hot water demand, guest services, HVAC operation hours, and auxiliary service requirements.

1.5 Resorts

Definition: Typically refers to a hotel with facilities including full-service accommodations and amenities that is spread across multiple buildings.

Classification Criteria: Quality level based on star rating.

Sub-categories:

- **1-Star Resorts:** Basic multi-building accommodation with minimal recreational amenities.
- **2-Star Resorts:** Limited recreational services and amenities.
- **3-Star Resorts:** Mid-range recreational amenities and facilities.
- **4-Star Resorts:** Extensive recreational facilities with multiple amenities.
- **5-Star Resorts:** Luxury multi-building establishments with premium recreational amenities.

Key Differentiation Factors: Outdoor/indoor facility ratio, recreational facility energy intensity, spread of buildings, and land use patterns.

1.6 Retail Buildings

Classification Criteria: Merchandise type, size, and operational model.

Sub-categories:

- **Department Store:** Retail project predominantly with a major store carrying a range of merchandise/lines of products.
- **Shopping mall:** Retail building comprising multiple tenant types such as anchor tenants, line stores, restaurants, food court, etc.
- **Supermarket:** Retail project with a supermarket/grocery store.
- **Small Food Retail:** Retail project specifically meant for food and/or beverages.
- **Non-food Big Box Retail:** Retail project that has a large footprint, similar to a department store, but sells a limited range of products (e.g., furniture store, hardware store).

Key Differentiation Factors: Operating hours, refrigeration requirements, lighting intensity, occupant density, and display energy requirements.

1.7 Industrial Buildings

Classification Criteria: Production intensity and storage functions.

Sub-categories:

- **Light Industry:** Manufacturing facilities with small scale operations requiring less intensive equipment energy usage.

- **Warehouse:** Storage facilities for goods, may include refrigerated storage areas.

Key Differentiation Factors: Process energy requirements, equipment density, temperature control requirements, and occupancy patterns.

1.8 Office Buildings

Classification Criteria: Quality grade based on location, amenities, and specifications.

Sub-categories:

- **Grade A Office:** Premium quality buildings in prime locations with state-of-the-art systems, top-notch professional management, and best-in-class amenities. Newest construction or recently renovated with high-quality materials and advanced technological features.
- **Grade B Office:** Good quality buildings in somewhat well-located areas (though not as prime as Grade A), with decent management and a fair amount of amenities. Typically, 10-20 years old with functional systems and fair to good visual appeal.
- **Grade C Office:** Basic functional space with limited amenities and management. Often 20+ years old, may lack modern features, and located in less desirable areas. These buildings often need substantial renovation and appeal to cost-conscious tenants.

Key Differentiation Factors: Age, location quality, building systems' technology, amenity level, management quality, and tenant profile.

1.9 Healthcare Buildings

Classification Criteria: Medical specialty, ownership type, and service complexity.

Sub-categories:

- **Nursing Homes:** Residential care facilities with 24-hour supervised nursing care.
- **Private Hospital:** Hospital facility that is privately funded.
- **Public Hospital:** Hospital facility that is government funded.
- **Multi-specialty Hospital:** Hospital facility that offers a wide range of medical services.
- **Clinics:** Medical facility that sees patients who would not require overnight stays.
- **Diagnostic Center:** Medical facility with specialized equipment for diagnostic services.
- **Teaching Hospital:** Hospital facility or medical center that provides medical education and training.
- **Eye Hospital:** Hospital facility specializing in disorders of the eye.
- **Dental Hospital:** Hospital facility specializing in dental services.

Key Differentiation Factors: Operating hours, specialized medical equipment loads, sterilization requirements, ventilation standards, and patient accommodation requirements.

1.10 Educational Buildings

Classification Criteria: Educational level and specialized function.

Sub-categories:

- **Preschool:** Pre-elementary educational facilities.
- **School:** Education facilities at primary and secondary levels.
- **University:** Higher education institutions.
- **Sports Facilities:** Projects with the primary purpose of being a sports facility.
- **Other Educational Facilities:** Museums, religious places, and other educational venues.

Key Differentiation Factors: Occupancy schedules, specialized equipment needs, space utilization patterns, and seasonal operation variations.

1.11 Mixed-Use Buildings

Classification Criteria: Self-defined proportional allocation of different functional areas.

Sub-categories:

- **Self-defined building:** Custom combination of two or more building types with user-defined proportions.

Key Differentiation Factors: Percentage allocation of floor area to different functions, operational schedule overlaps, and shared system efficiencies.

B. BEAT Typology Classification for Analysis

For BEAT evaluation and analysis, all EDGE building types are mapped into three main building typologies:

2.1 Residential Buildings

A. **Homes** (all income categories)

B. **Apartments** (all income categories)

C. **Serviced Apartments**

2.2 Commercial Buildings

A. **Hotels** (all star ratings)

B. **Resorts** (all star ratings)

C. **Retail Buildings** (all subcategories)

D. **Industrial Buildings** (all subcategories)

E. **Office Buildings** (all grades)

2.3 Public/Institutional Buildings

- **Healthcare Buildings** (all subcategories)

- **Educational Buildings** (all subcategories)
- **Government/Public Buildings** (categorized under institutional types)

2.4 Mixed-Use Buildings

Mixed-use buildings will be evaluated based on the proportional allocation of residential, commercial, and public/institutional components. The predominant use (by floor area) will determine the primary category for BEAT evaluation purposes, while still accounting for the different operational characteristics of each component.

This classification structure ensures BEAT provides tailored whole-life carbon assessments that align with the IFC EDGE system while maintaining practical aggregation for analysis and benchmarking purposes.

3.2 Climate Parameters

Climate parameters in BEAT are critical for accurate assessment of both embodied and Operational Carbon, as they directly influence building design, material selection, energy systems, and operational requirements.

BEAT uses the India ECBC (Energy Conservation Building Code) climate zone equivalent system to map climate zones across ALCBT countries: India, Vietnam, Cambodia, Indonesia, and Thailand.[3] This approach provides a standardized framework for climate-responsive building design across Southeast Asia. While India's climate classification system covers most regional climate variations, it does not fully capture the deep equatorial rainforest zone (Köppen-Geiger Af classification[4]) that dominates Indonesia and southern Vietnam. Therefore, an additional "Tropical Wet" zone has been added to the five traditional Indian climate zones for comprehensive coverage of all ALCBT countries.

A. Climate Zone Descriptions

Tropical Wet Climate Zone: Characterized by consistently high rainfall throughout the year (>2,000mm annually) with no distinct dry season, consistently high temperatures (26-32°C) with minimal seasonal or diurnal variation, and extremely high humidity levels (80-100%) year-round. These equatorial regions support dense rainforest vegetation and require specialized design strategies focused on continuous moisture management, fungal/mold prevention, cross-ventilation, and material durability under constant wet conditions.

Hot-Dry Climate Zone: Characterized by extremely high temperatures (40-45°C) during summer and cold winters (5-25°C), with significant diurnal temperature variation. Features very low relative humidity (20-40%), minimal annual rainfall, and predominantly cloudless skies resulting in intense solar radiation and glare. The landscape typically consists of dry sandy or rocky ground with sparse vegetation. Design strategies focus on thermal mass, minimizing heat gain, and night ventilation.

Warm-Humid Climate Zone: Defined by consistently high temperatures (25-35°C) with minimal seasonal variation, extremely high humidity (70-90%), and substantial annual rainfall (often exceeding 1,200mm). Cloud cover is significant (40-80%), and these regions are typically located near coastal areas or water

[3] The Arch Space. (2022). 5 different climate zones in India and important characteristics. https://thearchspace.com/5-different-climate-zones-in-india-and-their-important-characteristics/

[4] Rubel, F., & Kottek, M. (2024). World Maps of Köppen-Geiger climate classification. https://koeppen-geiger.vu-wien.ac.at/

bodies. Design approaches emphasize maximizing air movement, dehumidification, and shading while managing high moisture levels.

Composite Climate Zone: Exhibits characteristics of both hot-dry and warm-humid zones depending on season, with hot dry summers (32-43°C), mild winters (10-25°C), and variable humidity (20-25% in dry periods, 50-95% in wet periods). Annual rainfall ranges from 500-1,300mm, concentrated primarily during the monsoon season. These regions require adaptive design strategies that respond to stark seasonal differences, combining cooling techniques for summer and heat retention for winter.

Temperate/Moderate Climate Zone: Features relatively comfortable temperature ranges throughout the year (30-34°C in summer, 27-33°C in winter) with moderate to high humidity (20-55% in winter/summer, 55-90% during monsoons) and moderate annual rainfall (approximately 1,000mm). Skies are generally clear with occasional dense low clouds in summer. These naturally comfortable regions require less intensive climate modification strategies focusing primarily on passive design techniques.

Cold Climate Zone: Characterized by low temperatures year-round (17-20°C in summer, -7 to 8°C in winter), with humidity varying from low in sunny regions to high in cloudy areas. Annual rainfall is low to moderate (200-1,000mm) with some areas receiving snowfall. Design strategies focus on heat retention, insulation, and solar heat gain utilization to counter the predominantly cold conditions.

B. Climate Zone Mapping Table

Table 1 Simplified zones across ALCBT countries

Climate Zone	India	Indonesia	Thailand	Vietnam	Cambodia
Tropical Wet	Not present (0%)	Dominant climate (60-65%): Central Sumatra, Borneo, Papua lowlands	Not present (0%)	Southern regions (15-20%): Mekong Delta area	Not present (0%)
Hot-Dry	Western regions (15-20%): Rajasthan, Gujarat, parts of Maharashtra	Not present (0%)	Not present (0%)	Not present (0%)	Not present (0%)
Warm-Humid	Coastal areas (20-25%): Kerala, Tamil Nadu, Goa, coastal Andhra Pradesh and Orissa	Secondary climate (20-25%): Coastal areas, parts of Java	Southern peninsula, eastern coast (30-35%)	Central and coastal regions (45-50%)	Southwestern coastal regions (10-15%)
Composite	Central regions (40-45%): Delhi, Kanpur,	Eastern regions (10-15%): Parts of Sulawesi and eastern islands	Central and northern plains (55-60%): Bangkok and	Northern lowlands (25-30%)	Dominant climate (80-85%): Phnom Penh, Siem Reap, central plains

	Allahabad, central plains		northern lowlands		
Temperate	Southern plateau (10-15%): Bangalore, Pune	Highland areas (5%): Mountainous areas of Java, Sumatra, Papua	Northern highlands (10-15%): Mountain areas near Myanmar border	Central highlands (5-10%)	Very limited mountain areas (<5%)
Cold	Northern mountains (5-10%): Shimla, Shillong, Leh, Himalayan regions	Not present (0%)	Not present (0%)	Northern mountains (<5%)	Not present (0%)

This expanded mapping framework as shown in Table 1 enables consistent climate-responsive design strategies across all ALCBT program countries while acknowledging each region's unique characteristics and climate conditions, including the equatorial rainforest zones not represented in India's traditional climate classification.

4. Getting Started with BEAT

4.1 User Interface Overview

Upon launching BEAT, users are presented with a simple registration screen that requires three key inputs. Users must enter their email address to sign up, select their country from a dropdown menu and specify their city (not mandatory). This straightforward process completes the initial setup and allows users to proceed with their building assessment. The clean, intuitive interface ensures users can quickly begin working with the tool after providing this basic information.

4.2 Creating a New Building Assessment

The BEAT main view provides users with a space where multiple building assessments can be saved and organized. To create a new building project, users simply click the "Add building" button and enter basic building general information such as name, type, and location details. Each saved project appears in the dashboard list, displaying key information including building name, building type, city and country. Users can easily access any existing project by selecting it from this list, allowing them to continue previous work, review results, or make modifications. This centralized project management system ensures all building assessments remain organized and readily accessible throughout the design and analysis process.

5. Input Data Requirements

5.1 Building Information Requirements

Location: This is where the building used for BEAT assessment is located.

Example: A new office building is being constructed in Mumbai, India. The "Location" in the BEAT App would be set to "India" and "Mumbai."

Building Name: What the building is called, or the name the user intends to give to its projected building.

Example: The office building in Mumbai is officially named "The Zenith Tower". This is what you'd enter as the "Building Name" in the BEAT App.

Assessment time frame: The number of years for which the building is being assessed.

Example: Let's say users want to assess the carbon footprint of the building for 50 years. Then 50 year is years of building use.

> *Important note to users: Numerous LCA calculations for building certification use 50 years as a standard assessment time frame to allow comparison and benchmarking between buildings. With shorter assessment time frames the Embodied Carbon has a higher weight in the assessment, while with longer assessment time frames Operational Carbon is rated higher in the assessment. It is therefore recommended to use 50 years as standard assessment time frame.*

Total Floor Area: The sum of all usable enclosed areas in the building.

*Example: "The Zenith Tower" has 20 floors. Each floor has an internal area of 1,000 square meters. Therefore, the Total Floor Area of "The Zenith Tower" is 20 floors * 1,000 m²/floor = 20,000 m².*

Construction Year: When the building was finished and ready to be used. This mostly relevant for the existing buildings.

Example: "The Zenith Tower" was completed and received its occupancy permit in 2025. So, the Construction Year would be entered as 2025.

Conditioned Floor Area: The area that is heated or cooled (has HVAC).

Example: In "The Zenith Tower", 18,000 m² is air-conditioned and heated, the remaining 2,000 m² is Indoor Parking. Therefore, the Conditioned Floor Area would be 18,000 m².

Floors Above Ground: The number of floors you can see from the surface.

Example: "The Zenith Tower" has 20 floors that are mostly above ground and 2 floors are below ground. Therefore, the Floors Above Ground is 20 floors.

Floors Below Ground: The number of floors that are mostly under the surface.

Example: "The Zenith Tower" has 2 floors that are mostly below ground and 20 floors are above ground. Therefore, the Floors Below Ground is 2 floors.

5.2 Operational Information

To enable the BEAT to deliver a robust and reliable carbon footprint analysis, the following parameters, which directly impact a building's Operational Carbon footprint, are essential inputs.

A. Occupancy Metrics:

Number of Residents: Total dwelling occupants. (Example: 100 residents in an apartment building).

B. Operational Activity Metrics:

Operational hours: Total daily hours the building is in use. Example: A school building open 12 hours/day.

Hours per workday: Time of weekday building operates to understand its daily energy load. Example: a school building runs from 8 am to 8 pm.

Days per week: Days the building is in service.

Weeks per year: Weeks the building is used over the course of a year. (Example: A school building runs 42 weeks/year to calculate annual energy usage).

Room Heating Temperature: This is the indoor temperature at which building users typically start using heating systems because it feels too cold inside. It represents the comfort threshold below which heating is needed to maintain a warm indoor environment.

Room Cooling Temperature: This is the indoor temperature at which building users typically start using cooling systems (like air conditioners or fans) because it feels too warm inside. It marks the comfort point above which cooling is required to keep the space comfortable.

C. Building Energy appliances

The user must provide the following information for various energy appliances used in the building. More detailed information on each appliance system, including its Operational Carbon impact, is available below:

i. Heating Systems

Table 2 Heating Systems

Heating system type	Description	Operational Carbon Impact
Room Heaters	Standalone units heating individual spaces (electric resistance, infrared, oil-filled)	**High Carbon Intensity**: Direct electric resistance heating has highest Operational Carbon among heating options when using grid electricity; zone-level operation can partially offset this by heating only occupied spaces
Heat Pumps	Systems that extract and transfer heat from air, ground, or water sources (3-5 times more efficient than direct electric heating)	**Low Carbon Intensity:** Most climate-friendly heating option with lowest Operational Carbon, especially with clean electricity; coefficient of performance (COP) of 3.0-5.0 means significantly

		reduced electricity consumption per unit of heat delivered
Boilers	Central combustion systems burning gas, oil, biomass, or using electric elements to generate hot water/steam	**Medium – High Carbon Intensity:** Fossil fuel boilers produce direct emissions; gas better than oil; condensing models reduce carbon by 10-15%; biomass can be carbon-neutral if sustainably sourced
Split AC	Reverse-cycle operation of split air conditioners utilizing heat pump principles for heating	**Medium Carbon Intensity:** More efficient than direct electric but less efficient than dedicated heat pumps; performance and carbon intensity increases significantly in colder climates
Packaged AC	Single-unit heating/cooling systems using reverse-cycle operation, typically rooftop or through-wall	**Medium – High Carbon Intensity:** Higher carbon footprint than split systems; typically less efficient in heating mode than dedicated heating equipment; simplicity comes at carbon cost

User Input Required: Heating capacity in kW

ii. Cooling Systems

Table 3 Cooling Systems

Cooling system type	Description	Operational Carbon Impact
Window ACs	Self-contained units installed in windows or wall openings providing cooling directly to rooms	**High Carbon Intensity**: Most carbon-intensive cooling option per ton of cooling delivered; inefficient operation with EERs of 8-12; air leakage and poor controls compound carbon impact
Split ACs	Systems with separate indoor/outdoor components connected by refrigerant lines allowing flexible indoor placement	**Medium Carbon Intensity**: Significantly lower carbon than window units; modern inverter models further reduce carbon through variable operation; proper sizing critical for carbon performance
Variable Refrigerant Flow	Advanced multi-split systems with variable speed compressors allowing simultaneous connection of multiple indoor units	**Low Carbon Intensity**: Among the most carbon-efficient DX cooling systems; load-following capability minimizes unnecessary operation; heat recovery between

		zones further reduces net carbon emissions
Packaged AC	Self-contained rooftop or ground-level units combining all cooling components in a single housing	**Medium High Carbon Intensity**: Higher carbon than split/VRF but better than window units; integrated economizers can significantly reduce cooling season carbon when properly maintained
Chiller Systems	Central cooling plants producing chilled water that is distributed to air handlers or terminal units throughout building	**Variable Carbon Intensity**: Highest efficiency potential for large buildings; water-cooled chillers with proper controls offer lowest carbon option for large cooling loads; air-cooled variants less efficient

User Input Required: Cooling capacity in kW or tons of refrigeration.

iii. Ventilation Systems

Table 4 Ventilation Systems

Ventilation system type	Description	Operational Carbon Impact
Air Handling Units	Central systems that condition and distribute air via ductwork, typically including filters, coils, and fans	**Variable Carbon Intensity**: Can be high carbon due to significant fan energy; heat recovery reduces heating/cooling carbon by 50-85%; becomes low carbon when equipped with energy recovery, ECM motors, and VAV capability
Fan Coil Units	Distributed terminal units with local fans and water coils that recirculate and condition room air	**Medium Carbon Intensity**: Lower fan energy than central AHUs reduces carbon footprint; typically require separate outdoor air system; energy use scales with zone demands reducing unnecessary operation
Ceiling/Wall Cassette ACs	Ductless indoor units mounted on ceiling or walls, typically part of split or VRF systems	**Medium-Low Carbon Intensity**: Minimal distribution losses improve carbon performance; typically limited ventilation capability may require supplementary systems; primarily for space conditioning not ventilation

Dedicated outdoor air system (DOAS)	Dedicated systems handling only outdoor air requirements, separate from space conditioning	**Low Carbon Intensity**: Separates ventilation from space conditioning for optimization; becomes very low carbon when equipped with high-efficiency energy recovery (70-90%); precise outdoor air control prevents over-ventilation waste

User Input Required: Airflow rates (m^3/h), cubic feet per minute

iv. Lighting Systems

Table 5 Lighting Systems

Lighting system type	Description	Operational Carbon Impact
Compact Fluorescent Lamp (CFL)	Compact fluorescent lamps that use fluorescent technology in a form factor similar to incandescent bulbs	**Medium Carbon Intensity**: 65-75% lower carbon than incandescent but higher than LED; moderate efficacy (40-70 lm/W) results in moderate Operational Carbon; contains mercury creating disposal environmental impact
LED Lights	Solid-state lighting using light emitting diodes as the primary light source	**Low Carbon Intensity**: Most carbon-efficient lighting option; 80-90% lower carbon than incandescent, 30-50% lower than fluorescent; superior efficacy (80-200+ lm/W) with excellent control capabilities for further carbon reduction
T5/T8 Fluorescent	Linear tube fluorescent lighting commonly used in commercial spaces, utilizing phosphor coating and mercury vapor	**Medium - Low Carbon Intensity**: Good efficacy (80-100 lm/W) delivers reasonable carbon performance; electronic ballasts reduce carbon vs. magnetic ballasts; higher Embodied Carbon than LED due to shorter lifespan
Halogen Lights	Enhanced incandescent technology using halogen gas to improve efficiency and lifespan	**High Carbon Intensity**: Most carbon-intensive modern lighting option; very low efficacy (15-25 lm/W); converts 90% of energy to heat, creating additional cooling loads and carbon impacts; very short lifespan increases replacement Embodied Carbon

User Input Required: Lightning capacity in kW

6. Building Component and Material Data Entry

Building components are the fundamental "building blocks" of a building and include both **structural elements**—such as foundations, columns, beams—and **non-structural elements**, like exterior, interior walls, windows, doors, finishes and insulation. Structural elements are load-bearing components that are essential for building stability, strength and structural integrity whereas non-structural elements contribute to defining spaces, providing thermal and acoustic comfort, and enhancing the visual appeal and usability of the building. From the foundation that anchors the structure to the ground, to the walls that define spaces, to the roof that offers protection from the elements, each component plays a vital role in the performance and integrity of the building.

In the **BEAT tool**, both **structural and non-structural building elements** are analysed for their **carbon footprint**. This comprehensive approach enables a detailed assessment of Embodied Carbon across the entire building, supporting low-carbon design strategies and more sustainable construction practices.

When adding materials to your BEAT assessment, you have two main options:

6.1 Bill of Quantities (BoQ) Method

This option allows you to add material and quantity data directly from your project's BoQ document. A BoQ is a comprehensive, itemized list of materials required for construction, typically prepared by quantity surveyors or construction professionals.

Use this option when you have information on material quantities but not their exact association with specific building components. It enables a quick transfer of pre-measured material quantities into BEAT, saving time and ensuring alignment with your project documentation.

6.2 Component-Based Method

This option allows you to build your assessment by selecting from standardized, pre-defined material composites of building components available in the BEAT library.

The component options are further sub-divided into two options:

i. **Create custom:** This option provides maximum flexibility, allowing you to define material composites from scratch based on your building project. When creating a custom material composite that goes in a building component, you can:
    a. Select the building component type (e.g. foundation, beam, column, floor, roof, etc.)
    b. Choose from a library of construction techniques
    c. Specify material types and quantities
    d. Define composite-specific parameters (dimensions)
    e. Save your custom composite for reuse in same or future projects

    This approach is ideal for innovative designs, region-specific construction techniques, or when exploring alternative materials to reduce Embodied Carbon. With this method you can also build your own default components for efficient modelling.

ii. **Select from defaults:** This option allows you to reuse previously created custom material composites, making the assessment process more efficient. After selecting a building component type (e.g., exterior wall, column, floor, beam..), you can:
    a. Choose from your saved material composites.
    b. Specify the quantity (area, volume, or number) of the material composite
    c. Apply the same component across multiple buildings or projects

    This approach is particularly valuable for users who are working on building projects with repeating material composites.

    As of April 2025, this feature is in ongoing development in the current BEAT web tool and will be made available in a later BEAT version release.

Both methods allow for comprehensive carbon assessment, with the choice depending on your project phase, available documentation, and desired level of customization.

7. Energy carriers

The BEAT model uses a straightforward approach to calculate emission factors for energy carriers in ALCBT countries:

1. **Default values come from German data**: The model uses well-documented German emission factors for each energy carrier which is provided in the Table *6*.

2. **Apply country adjustment**: Each country's unique adjustment factor is multiplied by the German baseline values (see Table *7*).

3. **Account for efficiency differences**: The model assumes fuel delivery and heating systems in ALCBT countries may be less efficient than in Germany.

Table 6 Global warming emission factors of Energy Carriers

Energy carrier	Global Warming Potential ($kgCO_2e/kWh$)
Electricity	0.42
Light fuel oil	0.27
Heavy fuel oil	0.29
Liquefied petroleum gas (LPG)	0.22
Natural gas	0.24
Coal	0.40
Lignite	0.43
Diesel	0.27
Kerosene	0.29
Firewood (log wood)	0.012
Firewood (wood chips)	0.022
Firewood (wood pellets)	0.030

Charcoal	0.035[5]

7.1 Country Adjustment Factors

The adjustment factors are calculated based on the national grid intensity for electricity generation in the ALCBT countries related to grid intensity in Germany as the baseline. This calculation implies that the production and use of the other energy carriers is as efficient in each country as the generation of electricity. This simplification in the BEAT-tool allows modelling with complete but generic data from the beginning. Generic data acts as a placeholder for better local data. As more officially published emission factors become available the BEAT database will be improved.

Table 7 Cooling adjustment factors to calculate emissions from baseline values

Country	Grid Intensity ($kgCO_2e/kWh$)	Adjustment Factor
Germany (Baseline)	0.42	100%
India	0.71	168%
Indonesia	0.68	161%
Vietnam	0.41	98%
Cambodia	0.42	99%
Thailand	0.56	133%

Source: https://ourworldindata.org/grapher/carbon-intensity-electricity?tab=table

7.2 Energy Carriers Affected

These adjustment factors are applied to all common building energy carriers in ALCBT countries:

- Electricity
- Light fuel oil
- Heavy fuel oil
- Liquefied petroleum gas (LPG)
- Natural gas
- Coal
- Lignite
- Diesel
- Kerosene
- Firewood (log wood)
- Firewood (wood chips)
- Firewood (wood pellets)
- Charcoal

7.3 Example Calculation

For a building which runs on natural gas:

[5] While bio-based fuels such as wood have low fossil emission factors, wood burning has negative environmental impacts ranging from air pollution to biodiversity loss .

   - German emission factor × 161% = Indonesia emission factor

This simple multiplication approach allows the BEAT tool to generate reasonably accurate emission factors for all ALCBT countries without requiring extensive local data collection, while still accounting for regional differences in energy systems and carbon intensity. As more officially published emission factors become available the BEAT database will be improved.

8. Environmental Product Declarations (EPDs)

Environmental Product Declarations (EPDs) are a core component of the BEAT tool. They provide standardized and independently verified data on the environmental impacts of building materials throughout their life cycle. In essence, EPDs serve as the environmental "nutrition labels" of construction materials and products, offering users a clear view of Embodied Carbon and other key impact indicators.

EPDs are based on the international standard ISO 14025 and have thereby defined content and structure. They are available for building products in some countries. Some countries have large EPD-databases for local products and specific production efficiencies already. In other countries only a few EPDs are available to be used in LCA-calculations. Therefore, BEAT offers generic EPDs for the ALCBT countries till a better local database become available.

8.1 Understanding EPDs in BEAT

The BEAT tool currently utilizes Global Warming Potential (GWP) values from EPDs, specifically covering the A1–A3 life cycle stages.

To keep things organized, BEAT uses a **hierarchical structure** to sort EPDs in its database—derived from **ÖKOBAUDAT** dataset. Each EPD is grouped into categories, subcategories, and child categories.

Here's an example:

- **Category**: Mineral Building Products
   - **Subcategory**: Bricks, blocks and elements
      - **Child Category**: Fired Brick

This structure enables users to easily locate relevant EPDs within the database. Additionally, BEAT provides a **text-based search function**, allowing users to quickly find EPDs by filtering based on the **country of origin** where the material was manufactured.

A significant challenge in implementing the Asia Low Carbon Building Transformation (ALCBT) initiative across Cambodia, Indonesia, India, Thailand, and Vietnam is the limited availability of local, verified Environmental Product Declarations (EPDs). Unlike European markets where EPD programs are well-established and comprehensive, these target countries currently have fragmented or nascent EPD infrastructures.

To address this critical limitation while maintaining assessment integrity, BEAT provides three distinct EPD options. Understanding these options allows users to select appropriate EPDs based on what's available and what kind of data they are using:

Three are three types of EPDs available in BEAT:

1. Official EPDs

Official EPDs represent the highest quality environmental impact data in BEAT. Currently they are sourced from these 3 established sources which are:

- **The ÖKOBAUDAT database,** managed by the German government, is one of the most trusted sources of environmental data for building materials. It contains around 1,400 high-quality EPD datasets. All information follows strict European standards (EN 15804+A2), making it reliable and consistent for use in building life cycle assessments. The data available in Okobaudat platform has been directly imported in BEAT.
- **ECO Platform** is a European initiative that brings together verified EPDs from different countries under one common standard. With more than 3,500 EPDs currently available, all declarations meet EN 15804 requirements and are third-party verified. These EPDs carry the ECO EPD mark and are provided in machine-readable formats, which makes them easy to import and use in BEAT.
- **The IFC EDGE Materials Database for India** was developed to provide environmental data for construction materials used in India, especially where official EPDs are not available. The data created by IFC EDGE was collected directly from manufacturers across the country and reviewed carefully to ensure accuracy. It uses India-specific energy and transport data to reflect real local conditions, making it a valuable resource for projects in the Indian context. This data has been imported in BEAT.

2. Generic EPDs

Due to the significant gap in official EPD availability for materials across the target ALCBT countries, we developed a set of generic EPDs that could be used in case the official EPDs for the particular building materials are not available.

The adjustment factors are calculated based on the national grid intensity for electricity generation and the energy use per gross domestic product (GDP) in the ALCBT countries related to the same values in Germany as the baseline. This calculation uses the efficiency of electricity generation and the energy intensity of the local economy as an indicator for the efficiency of local material production.

Thereby the BEAT-tool scales EPD datasets for the most common and necessary building materials from the ÖKOBAUDAT to provide generic data for modelling in the ALCBT countries. This simplification in the BEAT-tool allows modelling with complete but generic data from the beginning. Generic data acts as a placeholder for more justified and specific environmental product data which might become available in future.

Table 8 adjustment factors to calculate emissions from baseline values

Country	Grid Intensity ($kgCO_{2e}/kWh$)		Energy Intensity ($kg\ oil_e/1000\$$)		Adjustment factor
Germany (Baseline)	0.42	100%	82,0	100%	100%
India	0.71	168%	134,5	164%	275%
Indonesia	0.68	161%	118,9	145%	233%
Vietnam	0.41	98%	85,6	104%	102%

Cambodia	0.42	99%	142,5	174%	173%
Thailand	0.56	133%	98,7	120%	161%

Sources: https://ourworldindata.org/grapher/carbon-intensity-electricity?tab=table
World Development Indicators | DataBank

3. Specific EPDs (Future Implementation)

The ability to create and upload **custom EPDs** will be introduced in a later version release of BEAT. This functionality will allow users—such as manufacturers, consultants, or research teams—to input material-specific EPD data that may not yet be included in official databases. Users will be able to manually enter life cycle inventory (LCI) and impact values, provided the data complies with recognized standards such as **EN 15804** or **ISO 21930**. This feature will enhance flexibility and support the integration of new materials, innovative products, and region-specific solutions into the BEAT tool, ensuring greater coverage and adaptability for diverse project needs.

The most accurate modelling can be performed with country and product specific data (type 3). But if such data is not available yet the BEAT-tool provides generic data (type 2) and international data (type 1) for use in the meantime. Local government and building industry is encouraged to generate local specific EPD datasets to make modelling more meaningful to the local conditions in future.

References

IEA – International Energy Agency (2022). Africa Energy Outlook 2022. Paris. Available at: https://www.iea.org/reports/africa-energy-outlook-2022. (Accessed: 15 February 2025).

IFC - International Finance Corporation (2024, May 15) EDGE user guide part 1 - Using the Design Tab (Version 3, Revision 1). Available at: https://edge.gbci.org/ (Accessed: 03 February 2025).

Our World in Data (2024). Carbon intensity of electricity generation. Available at: https://ourworldindata.org/grapher/carbon-intensity-electricity?tab=table (Accessed: 19 March 2025).

Rubel, F., & Kottek, M. (2024) World Maps of Köppen-Geiger climate classification. Available at: https://koeppen-geiger.vu-wien.ac.at/ (Accessed: 16 February 2025).

The Arch Space (2022) 5 different climate zones in India and important characteristics. Available at: https://thearchspace.com/5-different-climate-zones-in-india-and-their-important-characteristics/ (Accessed: 01 March 2025).

UN Environment Programme & Global Alliance for Buildings and Construction (2024) Global Status Report for Buildings and Construction 2024/2025. Available at: https://www.unep.org/resources/report/global-status-report-buildings-and-construction-20242025 (Accessed: 05 March 2025).

World Development Indicators | DataBank [Online]. Available at: https://databank.worldbank.org/source/world-development-indicators (Accessed: 15 March 2025).

About ALCBT Project

The Asia Low Carbon Buildings Transition (ALCBT) Project is a five-year multi-stakeholder project that seeks to reduce GHG emissions by catalyzing nationwide transition towards Low Carbon Buildings in five Asian countries, namely Cambodia, India, Indonesia, Thailand, and Vietnam. The ALCBT project is being implemented by the Global Green Growth Institute (GGGI) is partnership with the ASEAN Centre for Energy (ACE), Energy Efficiency Services Limited (EESL), and HEAT International. It is supported by the Government of Germany through its Federal Ministry for Economic Affairs and Climate Action (BMWK) under the International Climate Initiative (IKI).

About GGGI

Global Green Growth Institute (GGGI), headquartered in Seoul, Republic of Korea is a treaty-based international, inter-governmental organization dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies.

About ACE

The ASEAN Centre for Energy (ACE) is an intergovernmental organization within the Association of Southeast Asian Nations' (ASEAN) structure that represents the 10 ASEAN Member States' (AMS) interests in the energy sector.

About EESL

Energy Efficiency Services Limited (EESL) is a Super Energy Service Company (ESCO) that seeks to unlock energy efficiency market in India, estimated to at Rs. 74,000 crore that can potentially result in energy savings of up to 20 percent of current consumption, by way of innovative business and implementation models.

About HEAT International

HEAT International is an independently acting consulting firm with 30 years of experience in the field of climate, heating & cooling, and transport. HEAT's goal is to support countries in their effort to mitigate emissions and to implement transformative pathways towards zero GHG emission solutions.

Any person who believes they may be harmed by an IKI project or who wish to report corruption or the misuse of funds, can lodge a complaint to the IKI Independent Complaint Mechanism at IKI-complaints@z-u-g.org. The IKI complaint mechanism has a panel of independent experts who will investigate the complaint. In the course of the investigation, we will consult with the complainant so as to avoid unnecessary risks for the complainant. More information can be found here.

ASIA LOW CARBON BUILDINGS TRANSITION

Life Cycle Assessment for Transitioning to a Low-Carbon Economy | PROJECT

https://alcbt.gggi.org

GGGI
ASEAN CENTRE FOR ENERGY · ACE ·
EESL
HEAT

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE