

EMIRATESGBC TECHNICAL WORKSHOPS

EMIRATESGBC X EGIS

Whole Life-Cycle and Embodied Carbon Analysis Approach for
Projects and Existing Buildings

Presented by **Teeba Aljabery**, Sustainability Specialist, Egis.

13th October 2023



EMBODIED CARBON & LIFECYCLE ANALYSIS

—



Teeba Aljabery

Sustainability Specialist

Teeba.al-jabery@egis-group.com



www.egis-group.com

contents

- 1. Defining Lifecycle Analysis (LCA) And Embodied Carbon**
- 2. Global Targets & Certification**
- 3. LCA Process**
 - Defining Your Objective
 - Setting Goals
 - Defining LCA Scope
 - Calculation Process
 - Outcomes
- 4. Reduction**
- 5. Short Exercise**

Aim

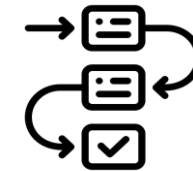
The aim of this workshop is to provide different stakeholders including architects, engineers, interior designers, sustainability specialists and contractors, with



Comprehensive understanding of LCA and embodied Carbon



Ability to carry out the LCA & embodied carbon accounting



Set carbon reduction plans for projects

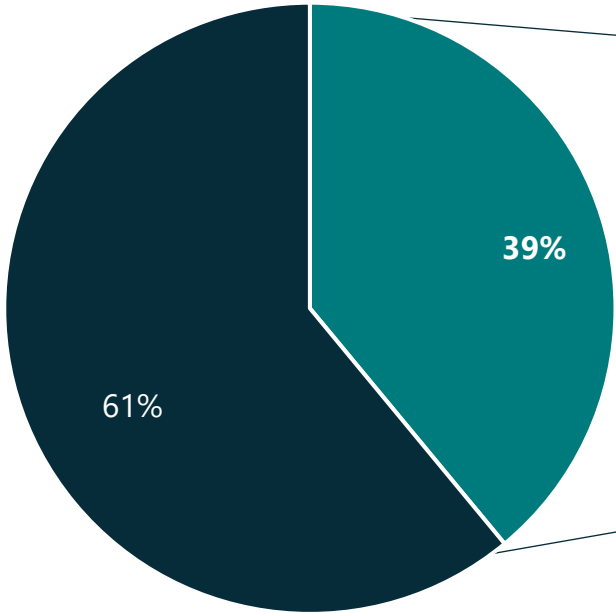


DEFINING LIFECYCLE ANALYSIS & EMBODIED CARBON

—

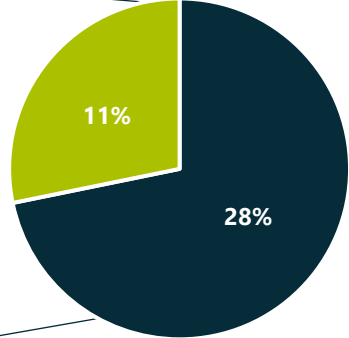
The Bigger Picture

Global Emissions Breakdown



■ Building Industry ■ Other Industries

Buildings Carbon Emission Breakdown

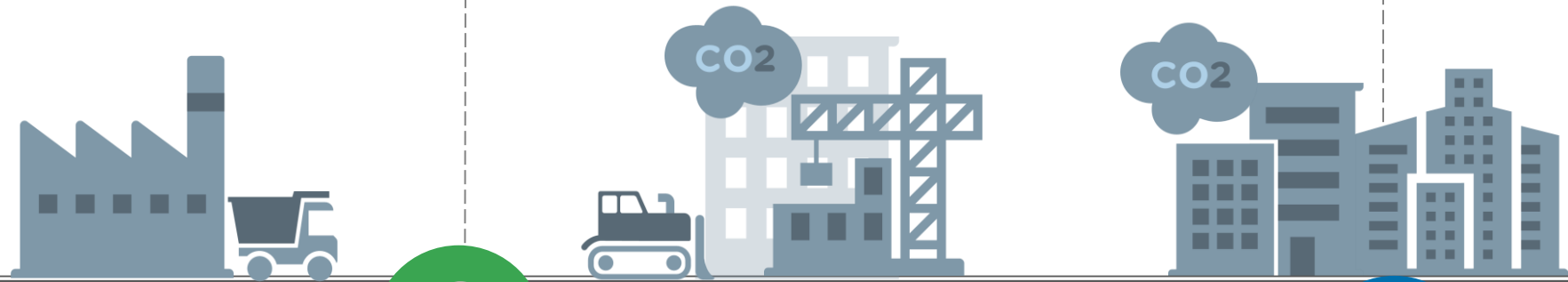
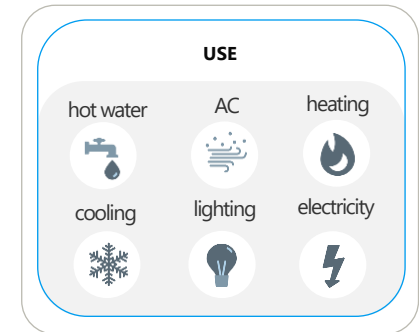
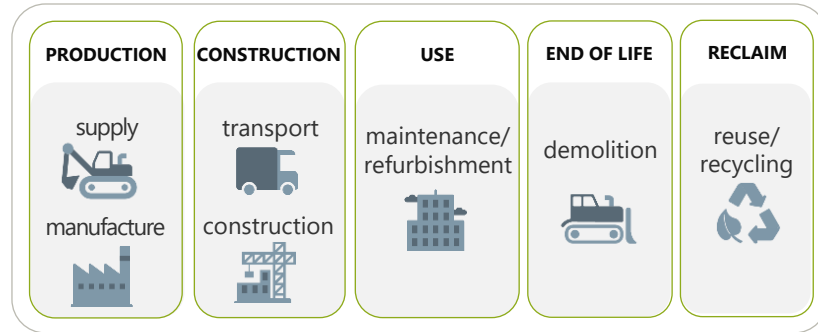


■ Operational Carbon ■ Embodied Carbon



Lifecycle Stages

Life cycle analysis (LCA) is a method of quantifying the environmental impacts associated with a given product.



EMBODIED CARBON

?

How can LCA help?

OPERATIONAL CARBON

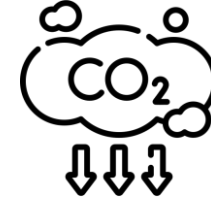
LCA Possible Outcomes



**Understanding the
overview on emissions**



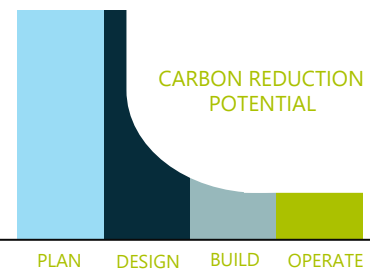
**Discover the biggest
contributors**



**Detect areas for carbon
reduction**



**Identify carbon reduction
targets**



Set out reduction plans



GLOBAL TARGETS & CERTIFICATIONS

—

WORLD GREEN BUILDING COUNCIL (WGBC) VISION

By 2030, all new buildings, infrastructure and renovations must have at least **40% less embodied carbon** with significant upfront carbon reduction, and all new buildings must be **net zero operational carbon**.

By 2050, new buildings, infrastructure and renovations must have **net zero embodied carbon**, and all buildings, including existing buildings, must be **net zero operational carbon**.



International Certifications

LEED BD+C: New
Construction v4.1 -
LEED v4.1



**Credit Name:
Building Life-cycle
Impact Reduction**

Path 1: Conduct a life cycle assessment of the project's structure and enclosure (1 point).

Path 2: Conduct a life cycle assessment of the project's structure and enclosure that demonstrates a minimum of **5% reduction** compared with a baseline building (2 points).

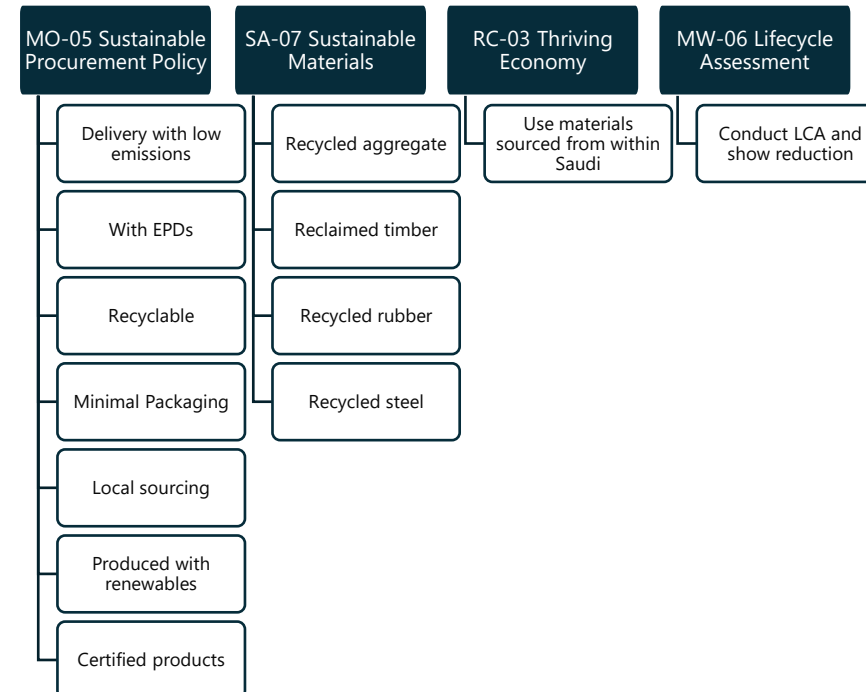
Path 3: Conduct a life cycle assessment of the project's structure and enclosure that demonstrates a minimum of **10% reduction** compared with a baseline building (3 points).

Path 4: Meet the requirements of Path 3 and incorporate reuse and/or salvage materials into the project's structure and enclosure for the proposed design. Demonstrate reductions compared with a baseline building of at least **20% reduction** (4 points)

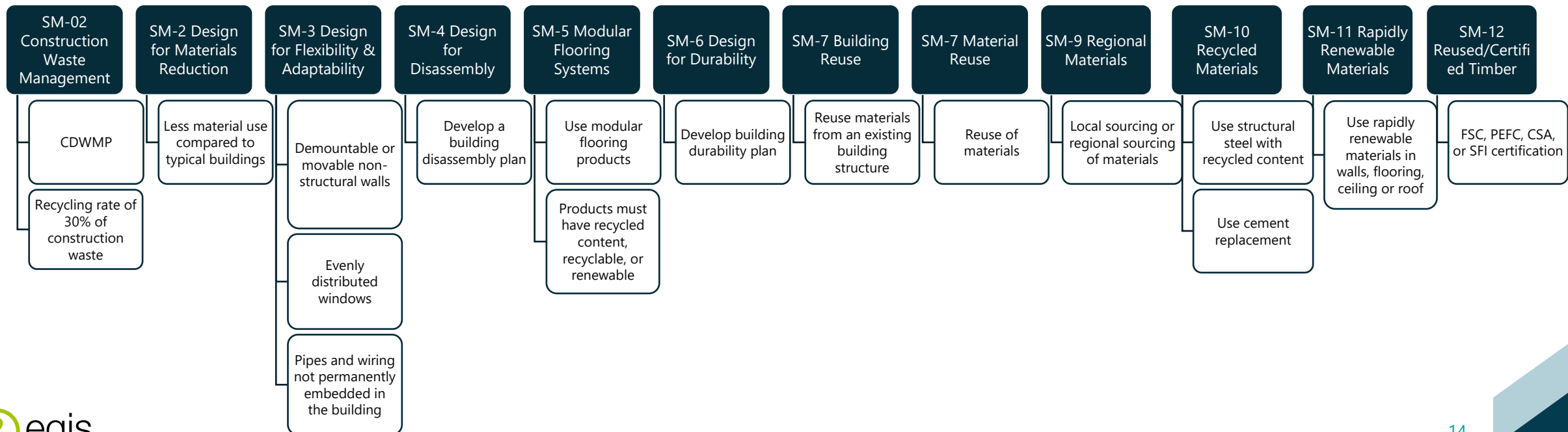
Local Certifications & Embodied Carbon



البناء المستدام
Sustainable Building



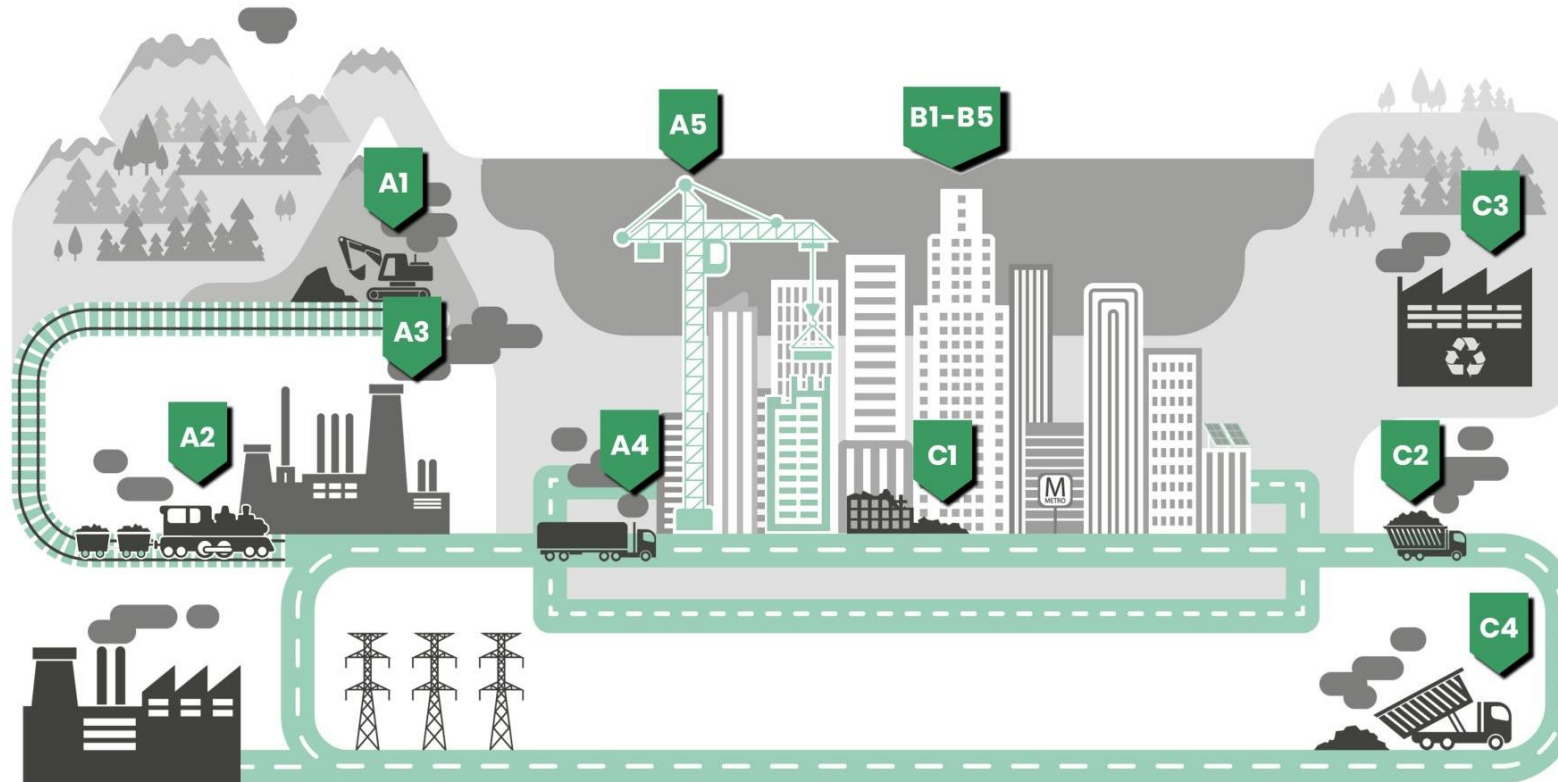
Local Certifications & Embodied Carbon



LCA PROCESS



Step 1: Define Your LCA Scope



A1 - A3 Product stage

- A1 Raw material extraction
- A2 Transport to manufacturing site
- A3 Manufacturing

A4 - A5 Construction stage

- A4 Transport to construction site
- A5 Installation / Assembly

B1-B5 Use stage

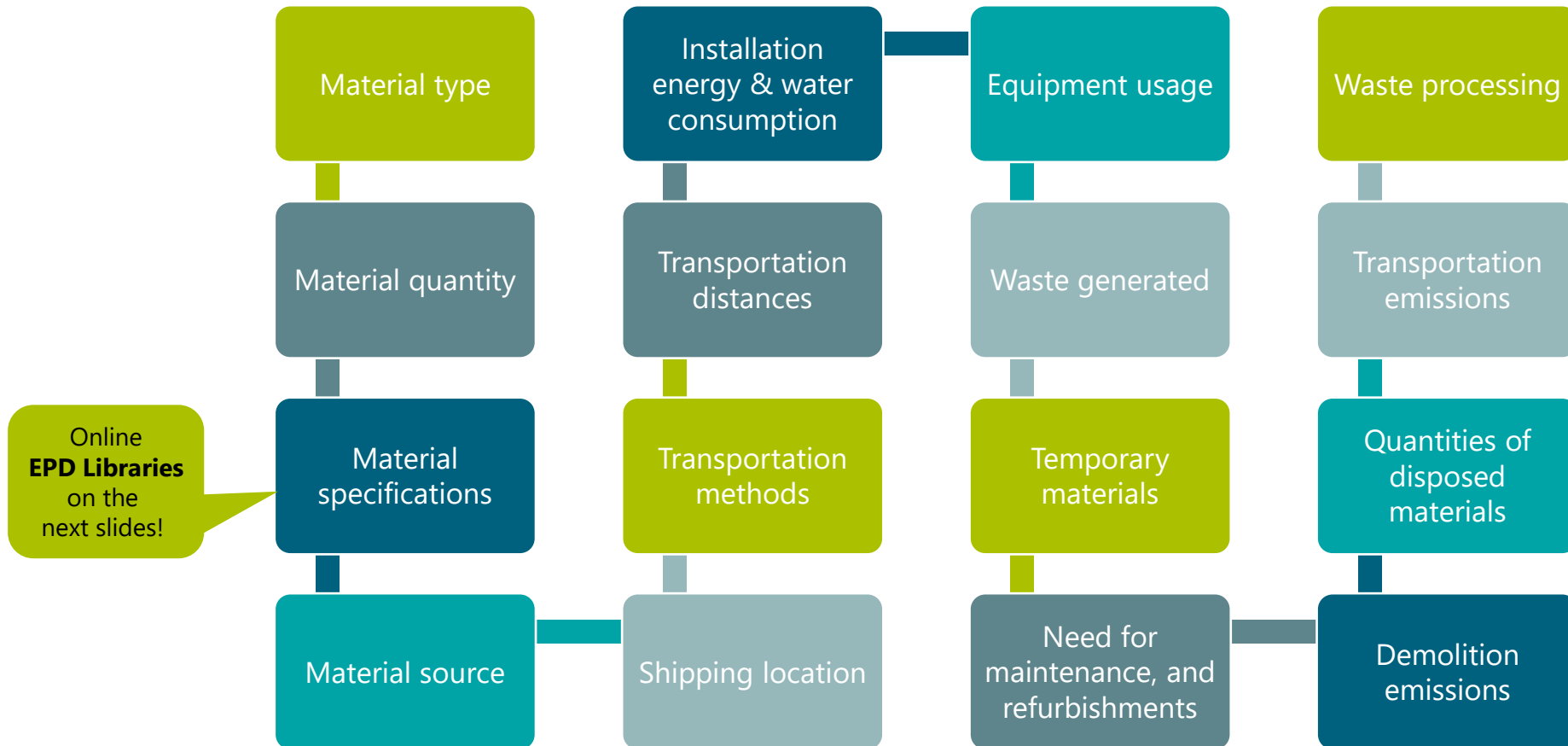
- B1 Use
- B2 Maintenance
- B3 Repair
- B4 Replacement
- B5 Refurbishment

C1 - C4 End of life stage

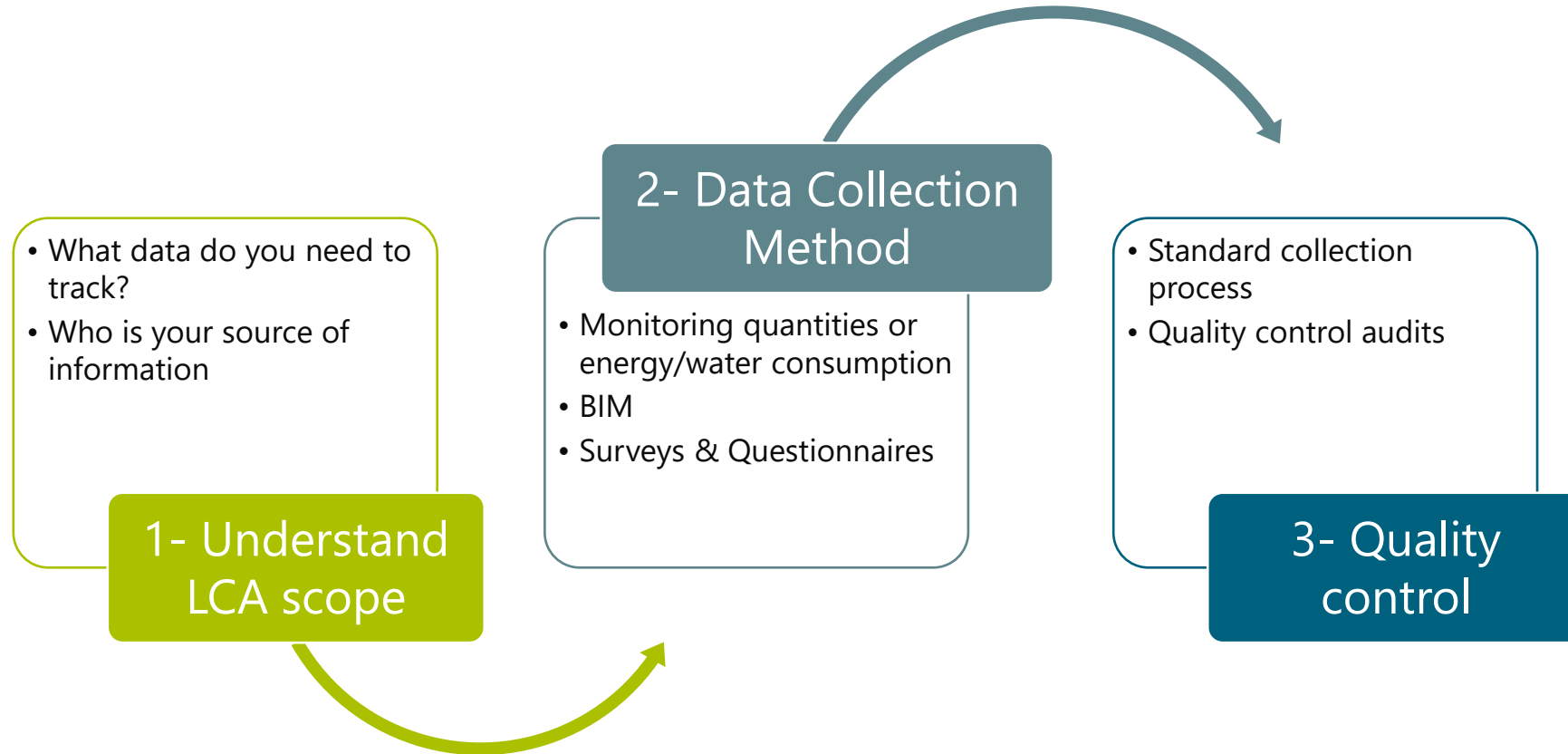
- C1 Deconstruction & demolition
- C2 Transport
- C3 Waste processing
- C4 Disposal

Step 2: Data Collection

what data do you need?



Data Tracking Methodology



What Is An EPD?

Environmental product declarations (EPDs) are environmental labels that report a peer-reviewed summary of the results of a lifecycle assessment (LCA) of a certain material or product.

What does it **include**?



bre

Environmental Product Declaration

BREG EN EPD No.: 000055 Issue: 01
ECO EPD Ref. No.: 000162

This is to certify that this verified Environmental Product Declaration provided by:
Emirates Steel Industries Co. PJSC (member of UK CARES)

Is in accordance with the requirements of:
EN 15804:2012+A1:2013

This declaration is for:
Non-Alloy Structural Steel (Direct Reduced Iron production route)

Company Address
PO Box 9022, Industrial City of Abu Dhabi (ICAD-I), Mussafah, Abu Dhabi



emirates steel
a SENAAT company | احدى شركات صناعات


Signed for BRE Global Ltd Operator

Derek Hughes
Operator

30 March 2015
Date of First Issue

30 March 2015
Date of this Issue

30 July 2016
Expiry Date

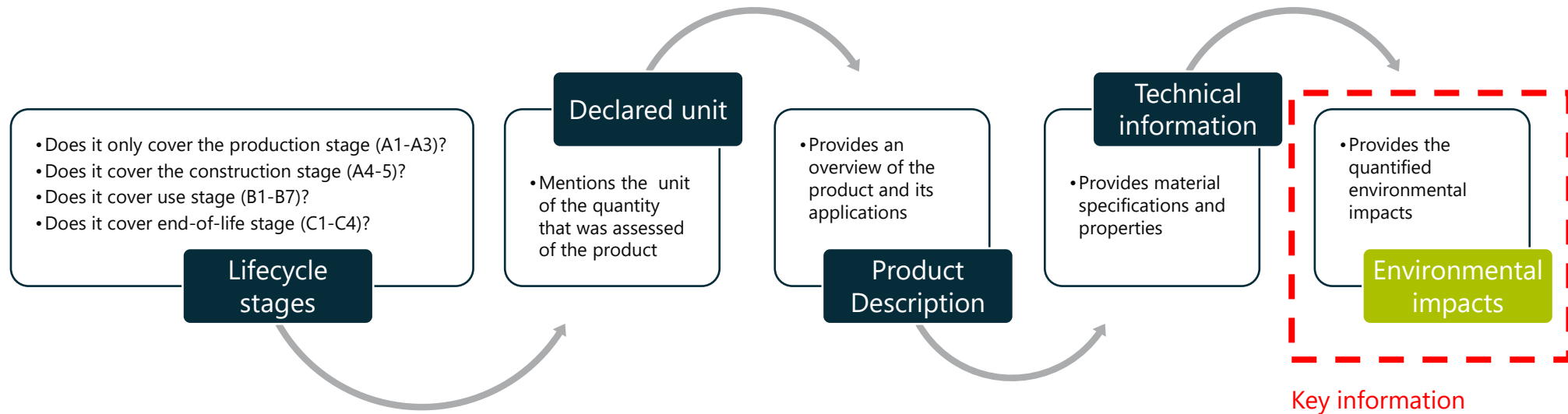
This verified Environmental Product Declaration is issued subject to terms and conditions (for details visit www.greenbook.live.com/terms). To check the validity of this EPD please visit www.greenbook.live.com/check or contact us.
BRE Global Ltd, Garston, Watford WD25 9XX.
T: +44 (0)333 32188 11 F: +44 (0)1923 664603 E: Enquiries@breglobal.com



BF1331ECOP Rev 0.2 Page 1 of 11 © BRE Global Ltd 2015

EPDs Content

All EPDs provide the reader with



Where to **obtain** EPDs?

Step 2: Data Collection

Examples of online EPD libraries



[The International EPD System](#)



[Dap habitat](#)



[PEP Ecopassport](#)





[One Click LCA Database](#)

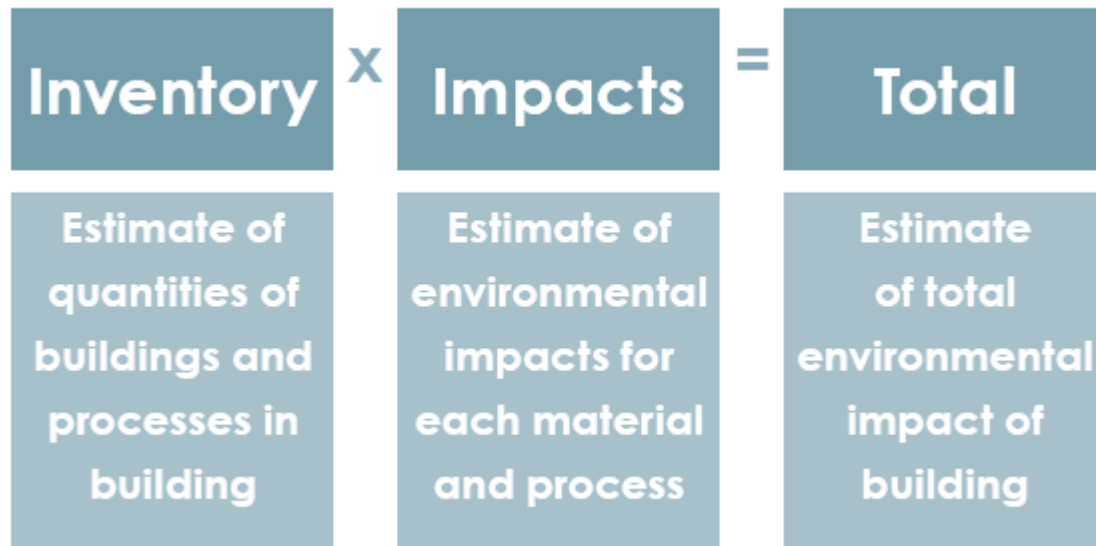
Step 2: Data Collection

Free database:

[ICE Database](#)
[V3](#)

ICE (Inventory of Carbon & Energy)	
Authors:	Dr Craig Jones* Professor Geoffrey Hammond
Affiliation:	 
*corresponding author. Contact details: http://www.circularecology.com/contact.html	
Version Control	
Version:	V3.0 - 10 Nov 2019
Is this version still valid?	Check link below, to see if a newer version is available.
Check if this copy is up to date at:	http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html

Step 3: Calculation



CARDINAL LCA

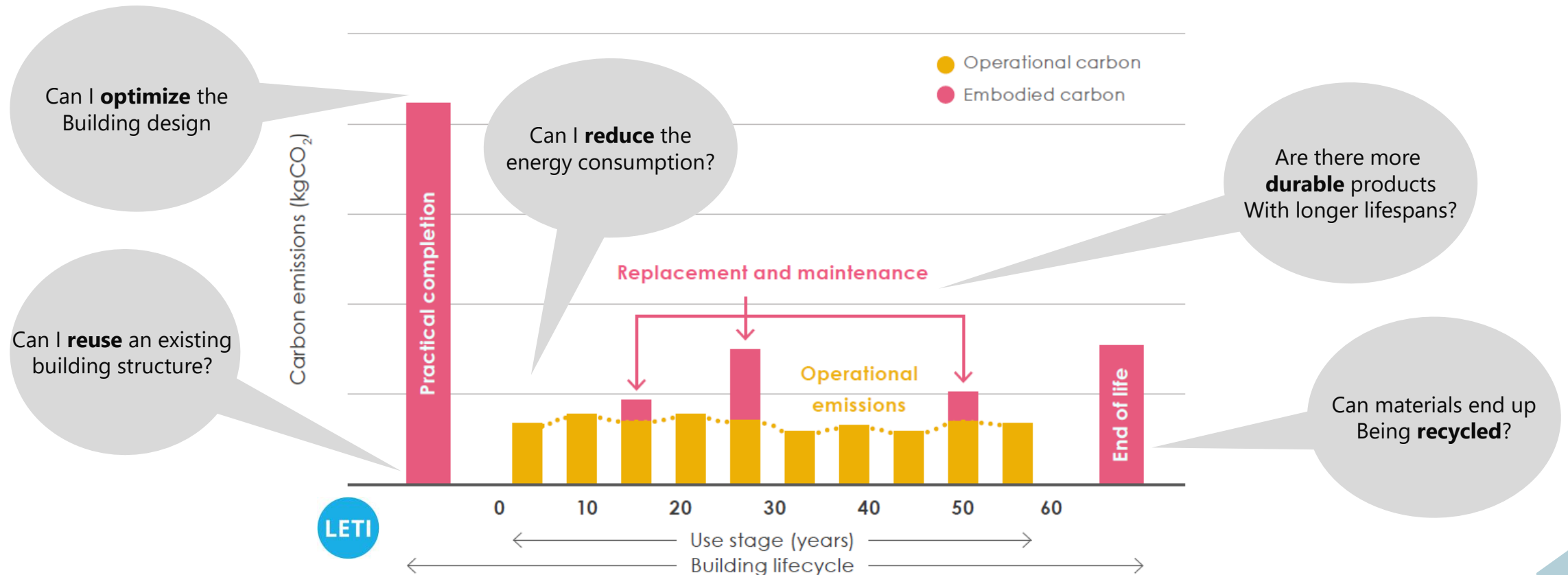


?

Where to complete the **calculation** process?

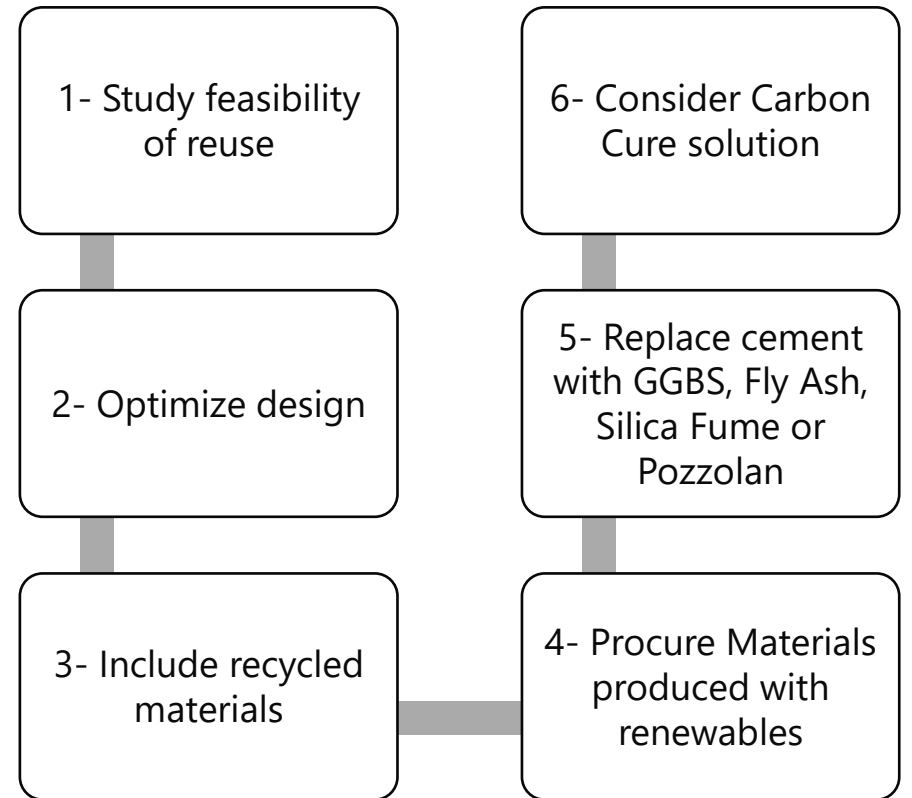
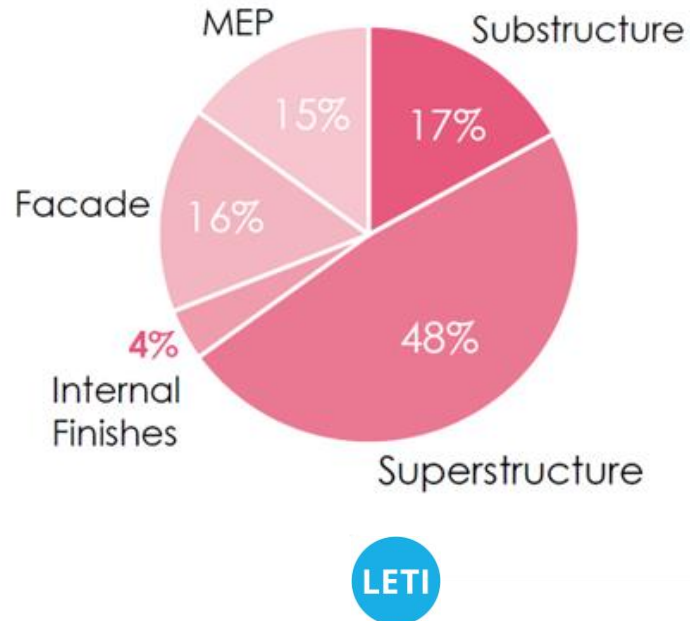
Step 4: Analyse The Carbon Footprint

Look at the carbon footprint of the building over its lifetime



Step 4: Analyse The Carbon Footprint

Understand the footprint to identify hotspots with results breakdown to tackle further carbon reductions



Step 5: Base-case & Proposed Scenarios



Base-case scenario of conventional construction practices in the region:

- Concrete: No recycled content (0% GGBS)
- Steel: No recycled content
- Timber: Not FSC certified

Proposed scenario based on the targeted materials specifications and building design:

- Concrete: with cement replacements
- Steel: with recycled content
- Timber: FSC certified
- Carbon Cure
- Materials produced with renewables
- Structural Design



What should the LCA **report** look like?

Major Materials Scope

CONCRETE



STRUCTURAL STEEL



REINFORCEMENT



TIMBER



GLASS

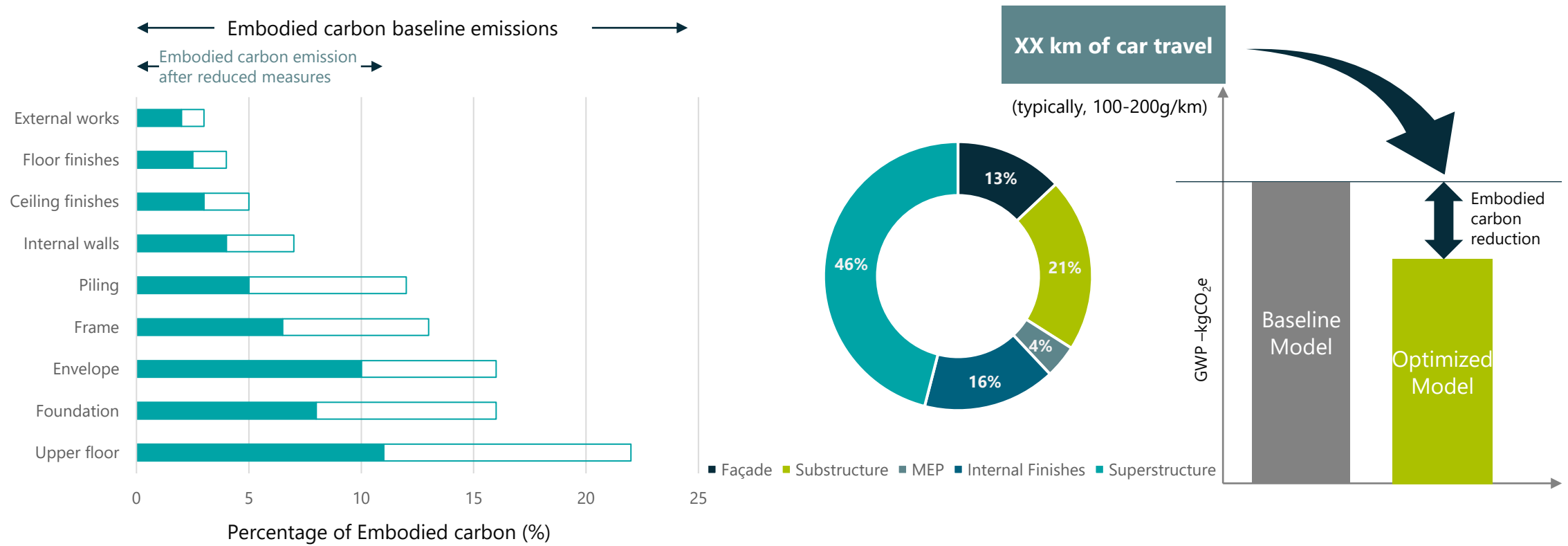


INSULATION



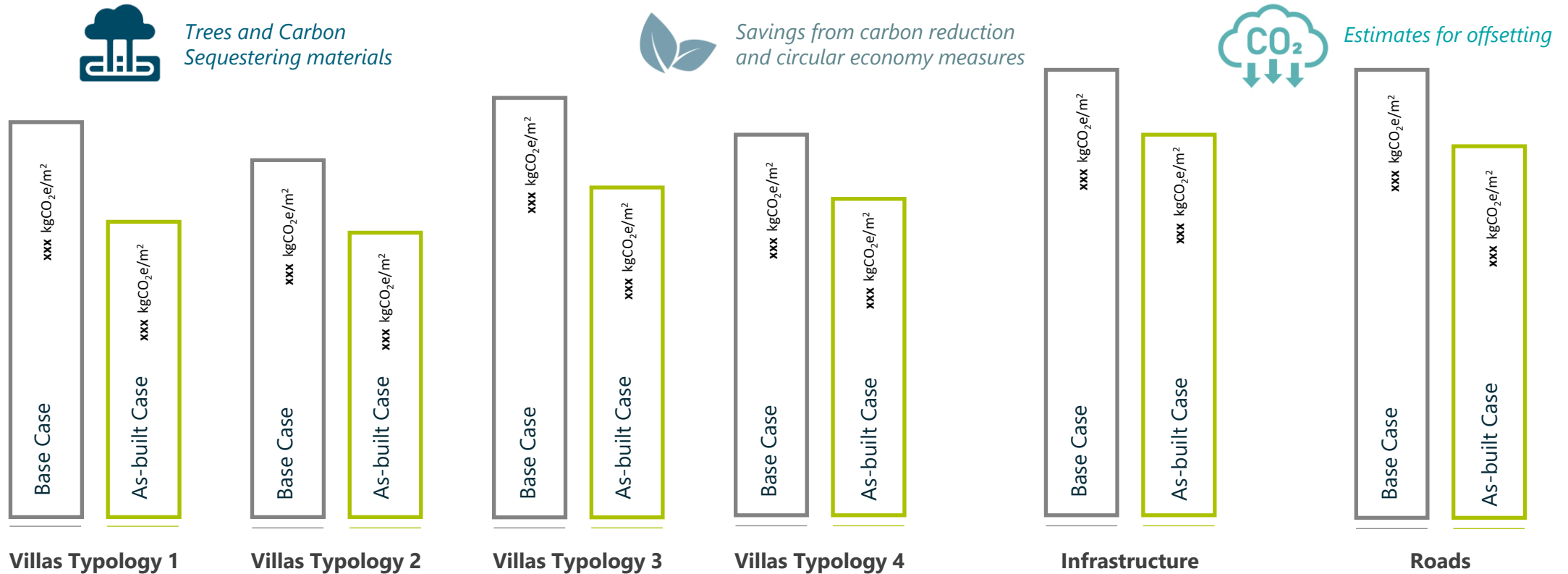
Sample Output

Proportions of embodied carbon by building elements



Sample Output

Embodied carbon assessment summary



CARBON REDUCTION

—

Embodied Carbon Reduction



01 PREVENT

Avoid embodied carbon from the outset by considering alternative strategies to deliver the desired function



03 PLAN FOR THE FUTURE

Take steps to avoid future embodied carbon during and at end of life, maximising potential for maintenance, renovation, reuse and deconstruction



02 REDUCE AND OPTIMISE

Evaluate each design and construction choice in terms of the upfront carbon reductions and as part of a whole lifecycle approach



04 OFFSET

As a last resort, offset residual embodied carbon emissions within the project or organisational boundary where possible or if necessary through verified offset schemes.

Responsibilities Toward Carbon Reduction



Developers

Set a mandatory embodied carbon target for all projects

Report carbon for all assets

Evaluate the possibility of refurbishing existing buildings

Invest in high-quality materials

Design Teams

Propose embodied carbon targets for the project

Perform LCA to benchmark building carbon footprint

Use a screening-level embodied carbon to identify hotspots

Develop alternative design solutions considering carbon and cost

Carry out studies to determine possibility of reducing material quantities or removal of unnecessary materials

Optimize the reuse of existing facilities-including maximum reuse rate possible

Contractor

Ensure meeting embodied carbon targets

Require verification of carbon performance (EPDs)

Use low-emitting construction machinery

Deconstruction of unwanted existing elements with salvaging or recycling of these materials

Propose embodied carbon improvements/ materials if any

Implement materials takeback program

Minimize and recycle construction and demolition waste



EXERCISE

—

4 Bedroom Villa In Dubai, UAE

You are working on a new project which is a 4-bedroom villa in Dubai, UAE. The project has reached the 100% Schematic Design stage, and you received the following information from the structural engineering team.

Estimate the upfront carbon for the lifecycle stage **(A1-A3)** for one grade of concrete:

- Grade: C32
- Cement Replacement: GGBS
- Percentage of Replacement: 70%
- Quantity: 500,000 kg of C32

Helpful Resources – ICE Database

% Cement Replacement - GGBS	Embodied Carbon Factor (A1-A3) (kgCO2e/kg)			Unit	Source
	25%	50%	70%		
C20/25 (20/25 MPa)	0.094	0.068	0.053	kgCO2e/kg	ICE database v3
C25/30 (25/30 MPa)	0.100	0.072	0.056		
C28/35 (28/35 MPa)	0.107	0.078	0.058		
C32/40 (32/40 MPa)	0.120	0.089	0.063		
C35/45 (35/45 MPa)	0.129	0.095	0.068		
C40/50 (40/50 MPa)	0.138	0.102	0.072		

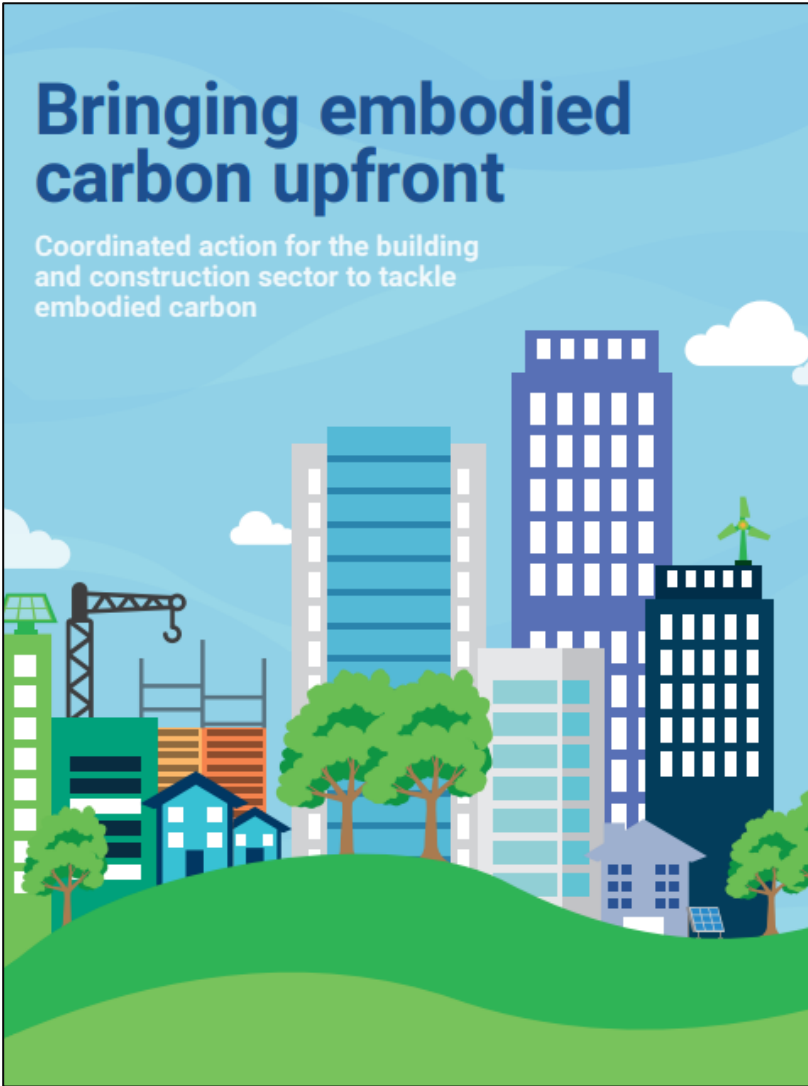
YOUR ANSWER SHOULD BE APPROXIMATELY

31,500
kgCO₂e

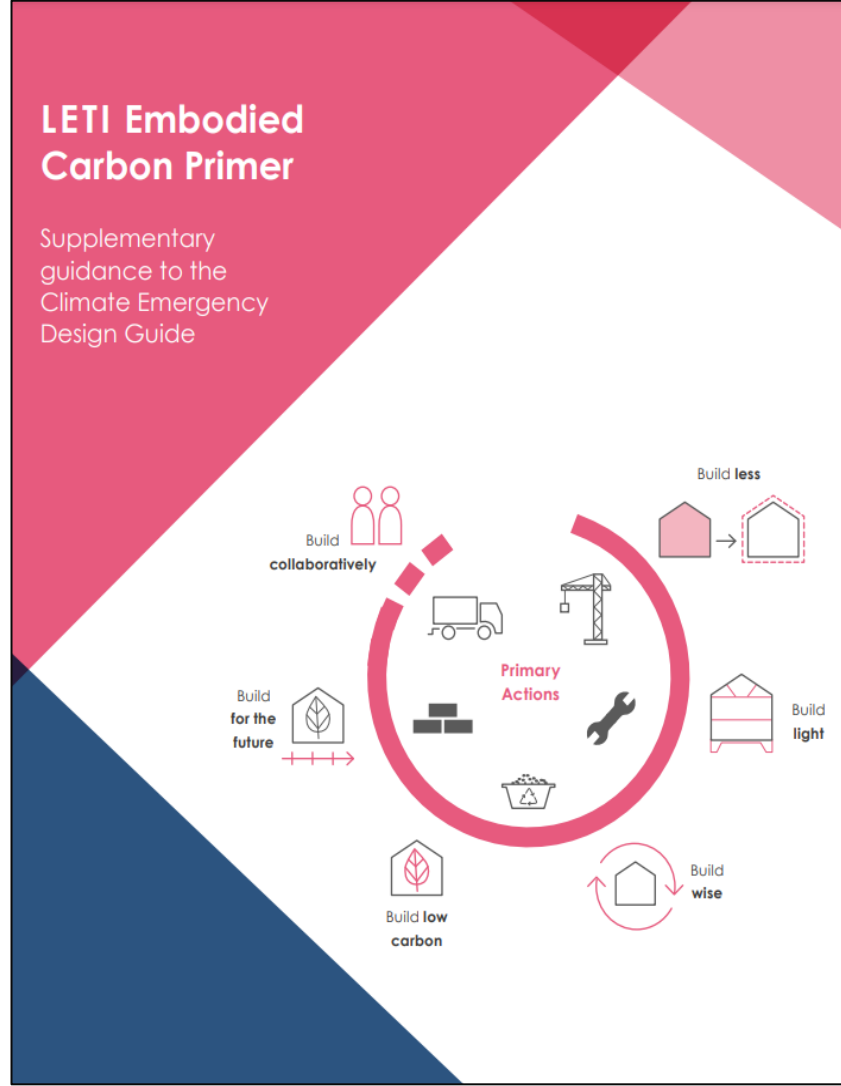


The background consists of a light teal upper section and a white lower section, separated by a diagonal line. On the left side, there are overlapping geometric shapes in a darker teal color.

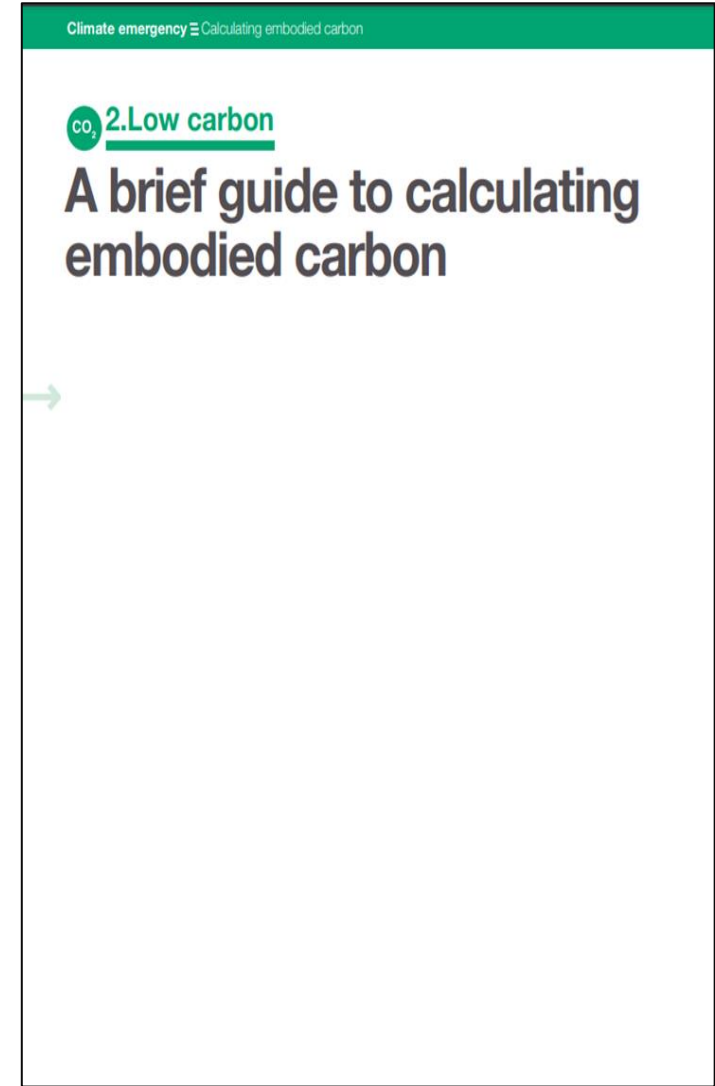
READING RECOMMENDATION



By WGBC



By LETI



By IStructE



ANY QUESTIONS?
—