

# Global Building Data Initiative

for Reducing Resource Use and Embodied Carbon

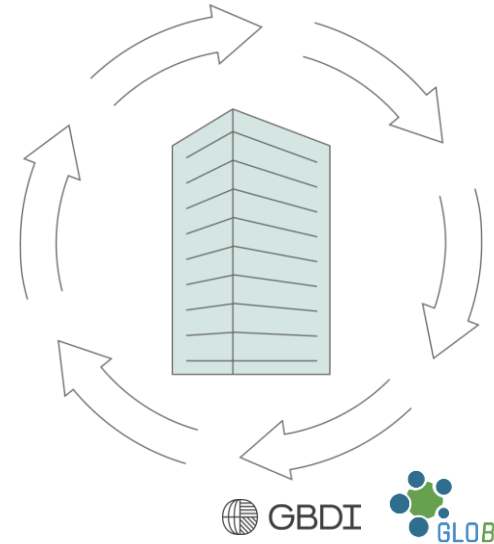
Advanced cementitious materials Course (MSE-420)

November 26<sup>th</sup>, 2025

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# Context

## Whole Life Cycle GHG Emissions



# Global Challenge of Embodied Emissions

~40%

global GHG emissions of building construction and operation

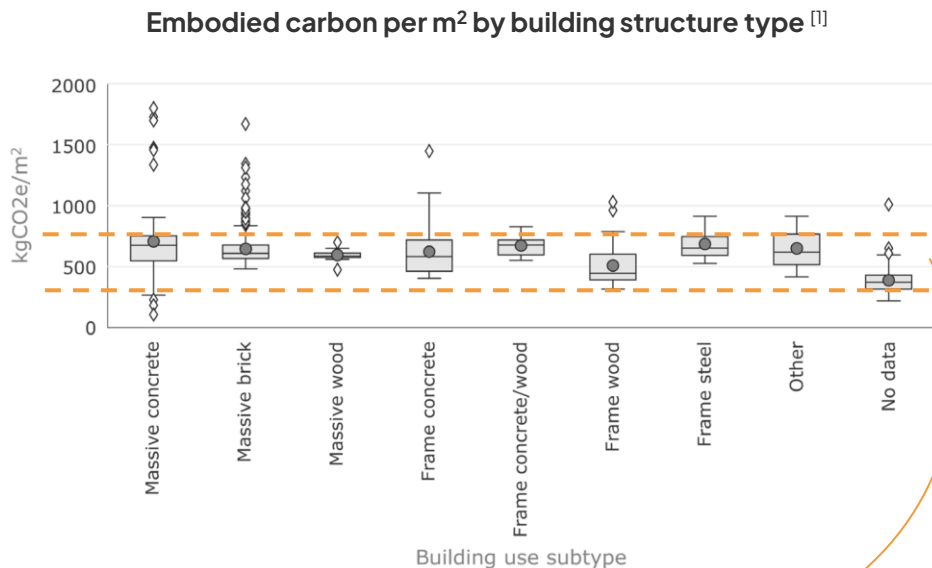
50-90%

life cycle emissions are embodied material production & processing

~2/3

embodied emissions in buildings are related to structural elements

# Embodied carbon in buildings, structures



Low variation across different structural materials typology, but substantial potential within material classes in terms of emissions

## Focus on materials & emissions

- Optimize material use, quantity
- Choose low-carbon alternatives

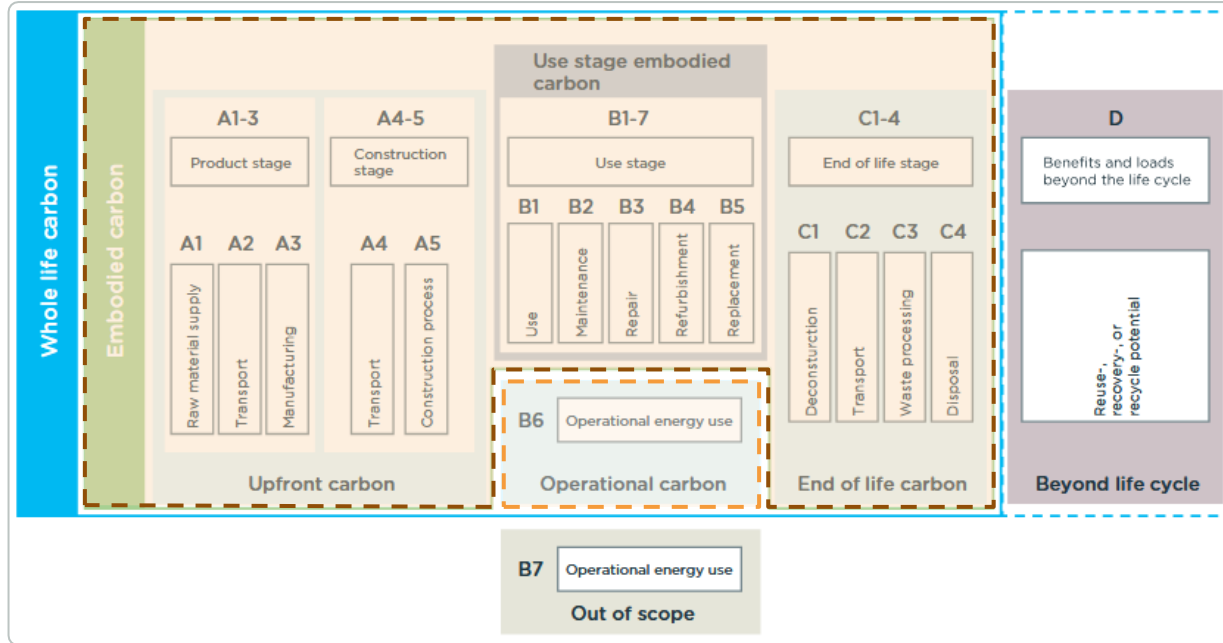
## Improve through benchmarking

- Compare with consistent metrics
- Enable optimization of materials, emissions

## Exchange via Common Data Protocol

- Global standard for high-quality data
- Details on materials, life cycle emissions

# Whole Life Carbon (WLC)



Definition of whole life carbon based on the life cycle stages and modules from EN15978:2012 <sup>[1]</sup>

[1] Tozan, B., Birgisdottir, H., Steinmann, J., Le Den, X., Horup, L. H., Sørensen, A., Røck, M., Towards EU embodied carbon benchmarks for buildings – Bridging the performance gap: A benchmarking framework, 2022. <https://doi.org/10.5281/zenodo.6120874>.

# Types of GHG emissions of buildings



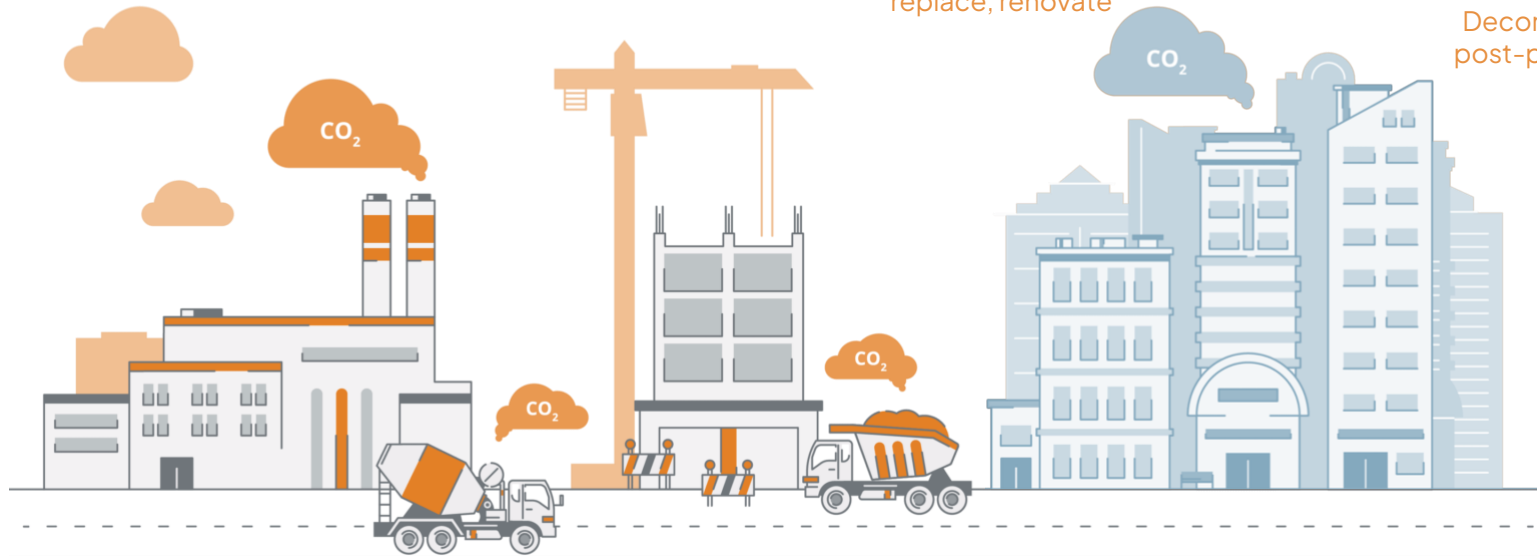
Extract, transport and manufacture

Transport, construct and install

Use phase: maintain, replace, renovate

Use phase: operate

Deconstruct, post-process



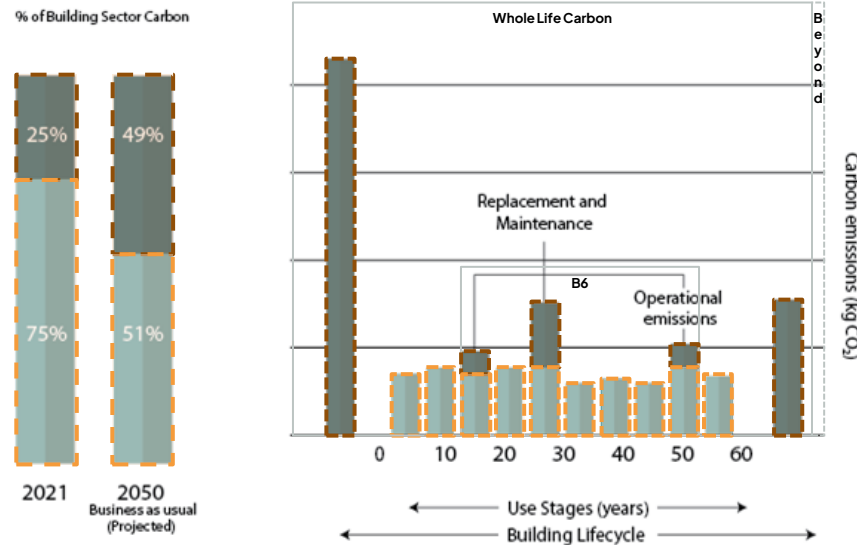
## Embodied carbon

Emissions from material production and processing, transport

## Operational carbon

Emissions from energy, water use, mobility

# Embodied vs Operational Carbon



Source: Global ABC: Sustainable Building Materials Hub

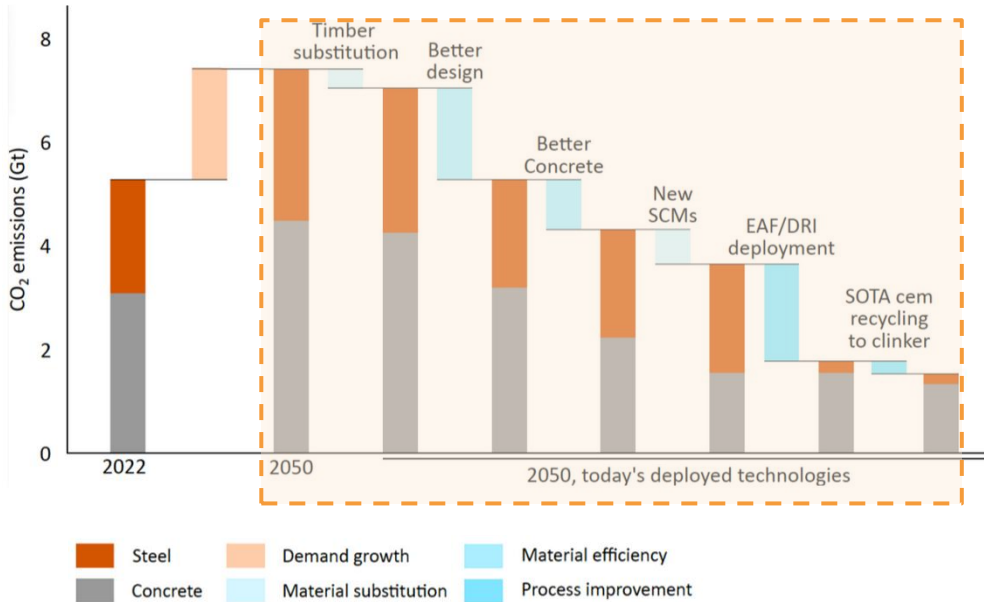
## The 2050 problem

- **With more energy-efficient buildings**, the share of embodied carbon emissions increases
- **Absolute embodied carbon increased** due to complexity, but also inefficiency, overdesign
- **Significant embodied emissions are upfront**, before the building is used

[1] GlobalABC Building Materials Hub: <https://globalabc.org/sustainable-materials-hub/home>

[2] Rock M, Ruschi Mendes Saade M, Balouktsi M, Nygaard Rasmussen F, Birgisdottir H, Frischknecht R, Habert G, Lützkendorf T, Passer A. Embodied GHG Emissions of Buildings – The Hidden Challenge for Effective Climate Change Mitigation. Applied Energy, 2020. <https://doi.org/10.1016/j.apenergy.2019.114107>

# Better Data, Better Design, Better Buildings



**50-75%**  
reduction of emissions from materials is possible today<sup>[1,2]</sup>, reducing embodied emissions at scale – Avoid / Shift / Improve framework<sup>[2]</sup>

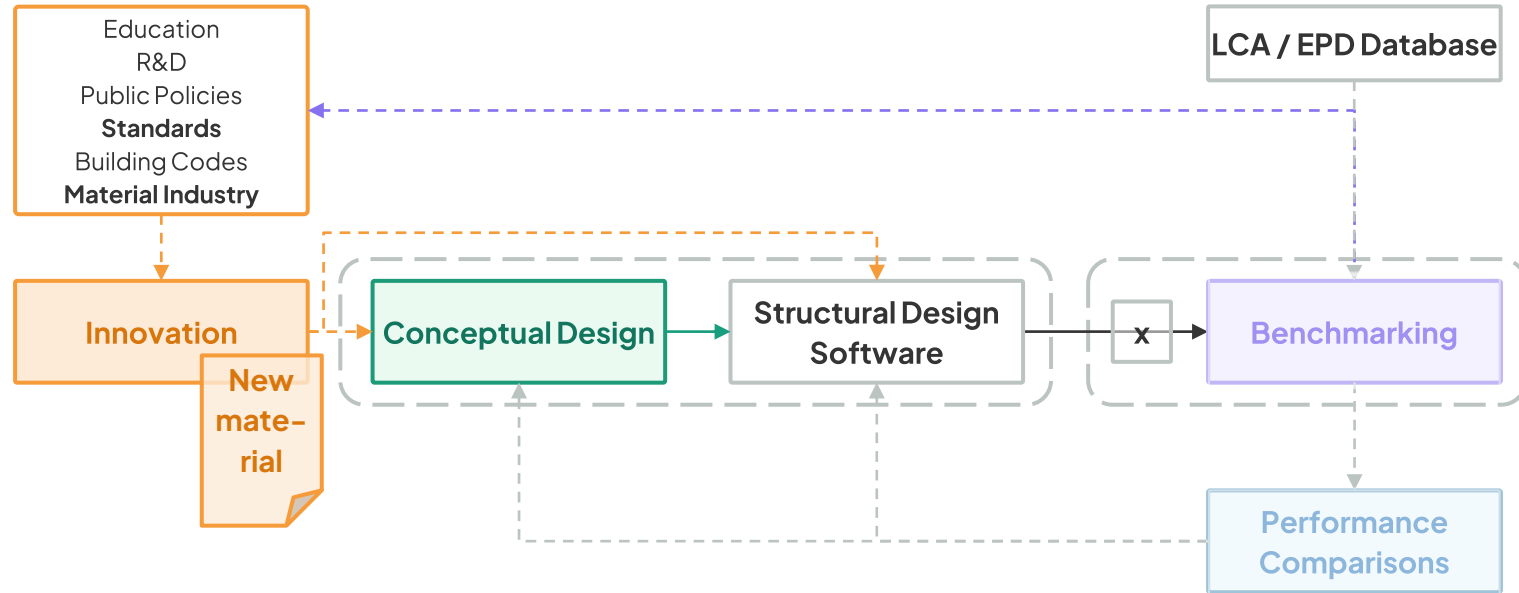
**Current challenge**  
Data is inconsistent, scarce, and fragmented across tools

**Better building data is needed to**  
understand and reduce emissions

[1] Olsson, Josefine A., Sabbie A. Miller, and Mark G. Alexander. "Near-Term Pathways for Decarbonizing Global Concrete Production." *Nature Communications* 14, no. 1 (July 29, 2023): 4574. <https://doi.org/10.1038/s41467-023-40302-0>

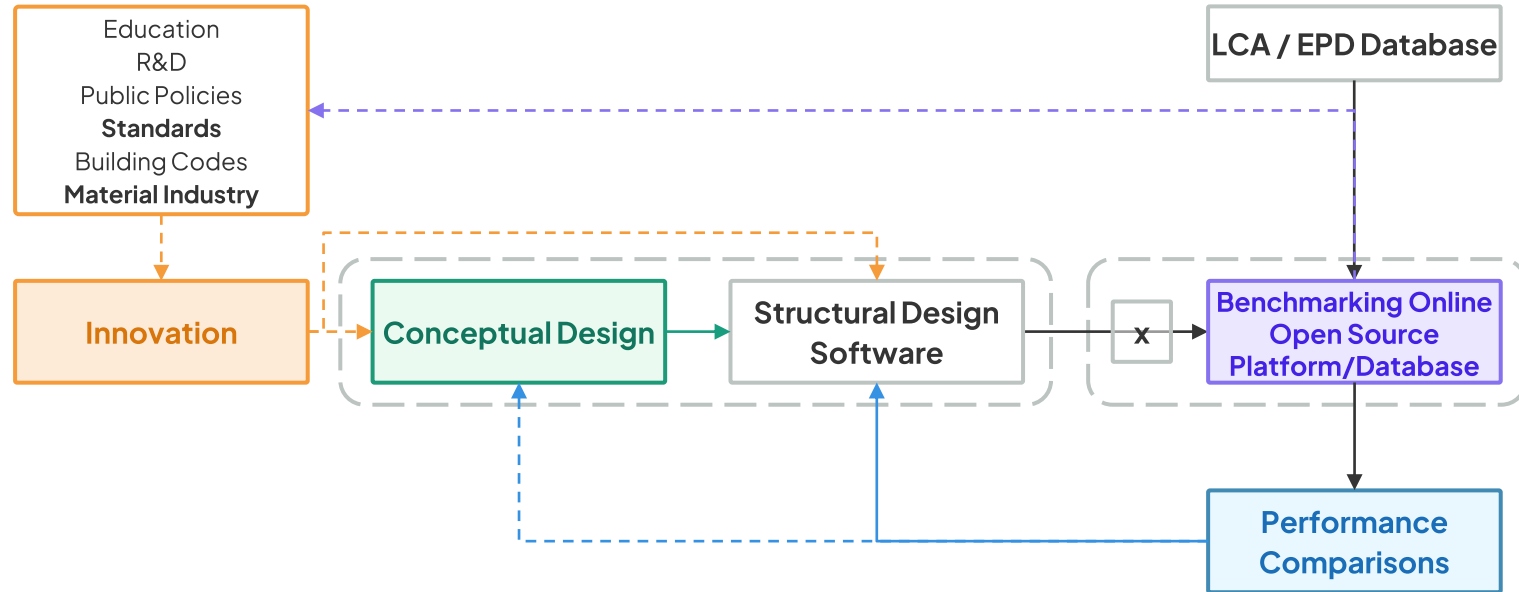
[2] Scrivener, K., Duan, C., Miller, S.A., Hafez, H., Franco, Z., Marsh, A., Schmidt, W., Röck, M. "What construction materials will the world use in 2050?". *Forthcoming* / 2024.

# Ecosystem for Embodied Carbon Analysis



# GLOBE\* Vision

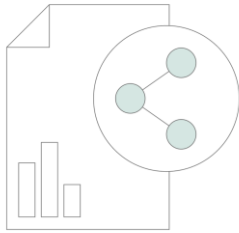
\*Global Consensus on Sustainability in the Built Environment



A conceptual framework for implementing and assessing performance to simulate innovation throughout its pipeline

# Global Building Data Initiative (GBDI)

The GBDI's **mission** is to empower **industry and policy leaders** with data-driven insights **for reducing resource use and whole-life carbon (WLC) emissions**



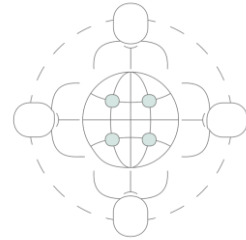
## **Harmonized Open Building Data Format (OpenBDF)**

coordinated & scalable, to facilitate **data exchange** and management



## **Open Source Data Platform**

for **building data analytics** and **benchmarking**

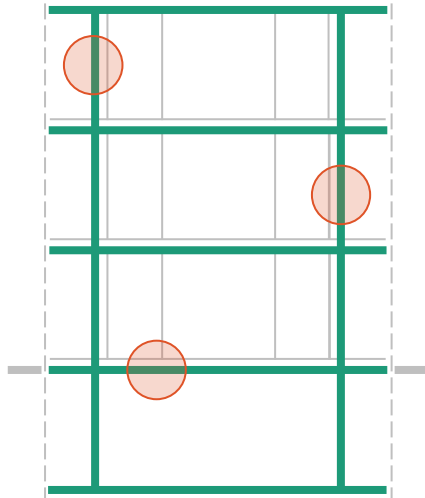


## **Collaborative Global Effort**

multi-stakeholder (research, practice, policy) approach with **Global South** focus



# Open Building Data Format (OpenBDF)



**GBDI minimum scope**

<b>Structure</b>	Slabs	material specs	quantities
	Beams	material specs	quantities
	Columns	material specs	quantities
	Walls	material specs	quantities
	Stairs	material specs	quantities
	Roof	material specs	quantities
<b>Façade</b>	Opaque systems	material specs	quantities
	Glazing systems	material specs	quantities
<b>Site</b>	External floor	material specs	quantities
	External networks	material specs	quantities
<b>Partitions &amp; finishes</b>	Fixed partitions	material specs	quantities
	Internal doors	material specs	quantities
	Acoustic and thermal insulation	material specs	quantities
	Floor coverings	material specs	quantities
	Wall and ceiling finishes	material specs	quantities

Available via openBDF

## Focus

- Upfront embodied carbon
- Building structures
- Material quantities and characteristics
- Easy, open, global reporting

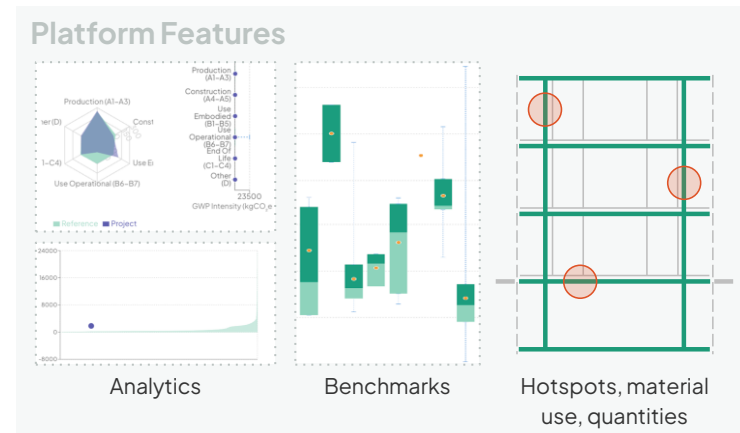
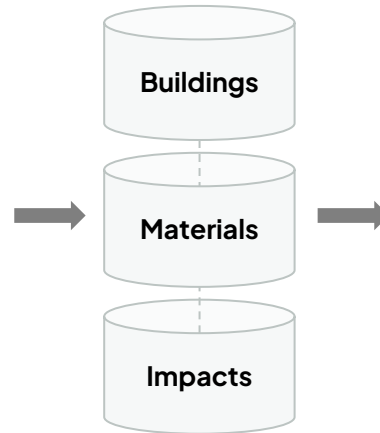
# Quantify materials and life cycle emissions



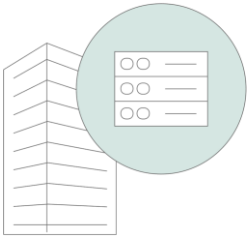
GBDI minimum scope

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Available via openBDF

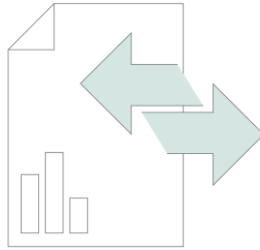


# Open Building Data Platform



## Decentral

- Federated information architecture
- Retain data ownership and control
- Data management and analytics



## Open API

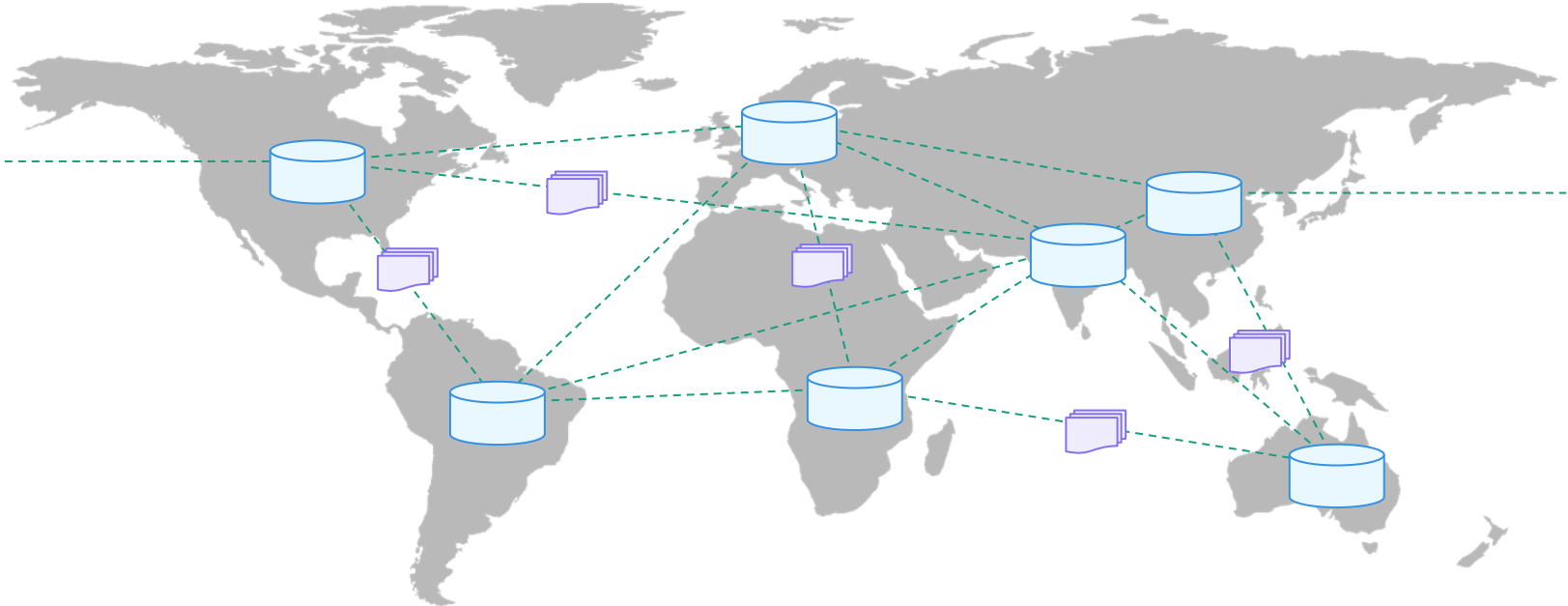
- Open API for custom integrations
- Enables database communication
- Supports exchange, benchmarking



## Open Source

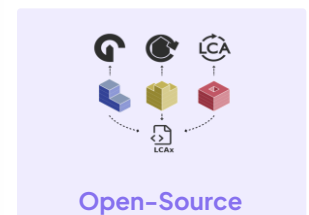
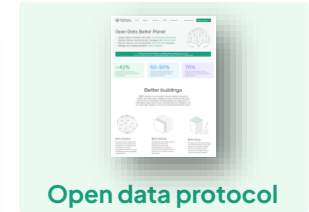
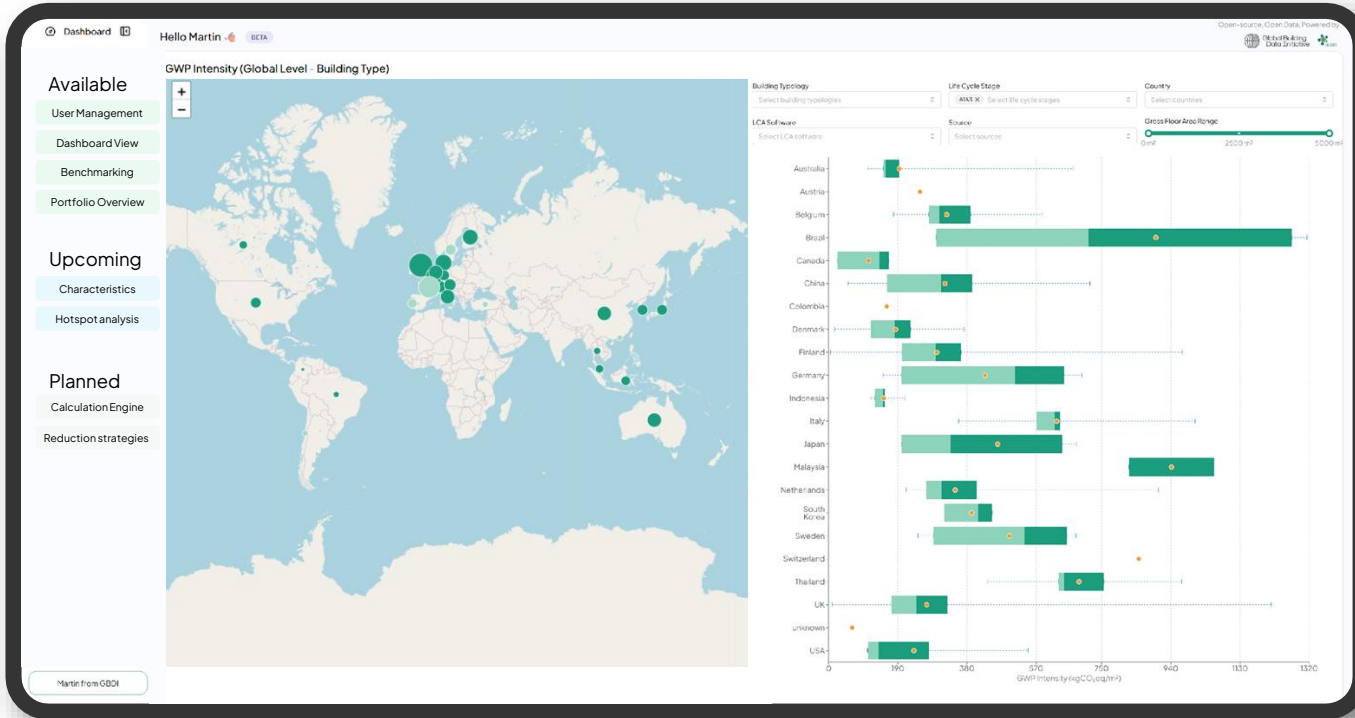
- Joint development of core function
- 1.000 sample cases
- Customizable local instances
- Code on Github (Apache 2.0)

# Federated Information with open APIs

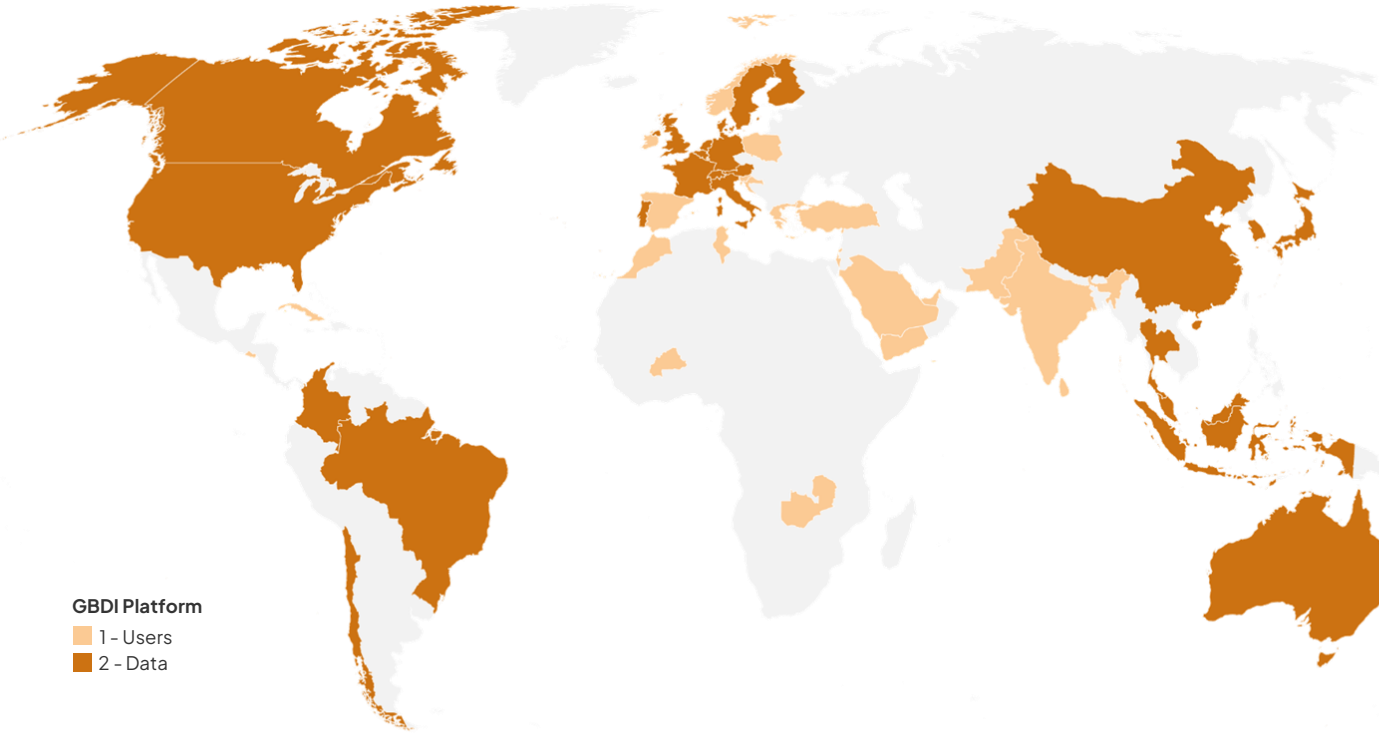


 Databases  Data  Exchanges

# Open Building Data Exchange & Analysis



# GBDI Open Building Data Platform



## Understand Emissions

- Differentiate and quantify embodied and operational emissions

## Assess Data Quality

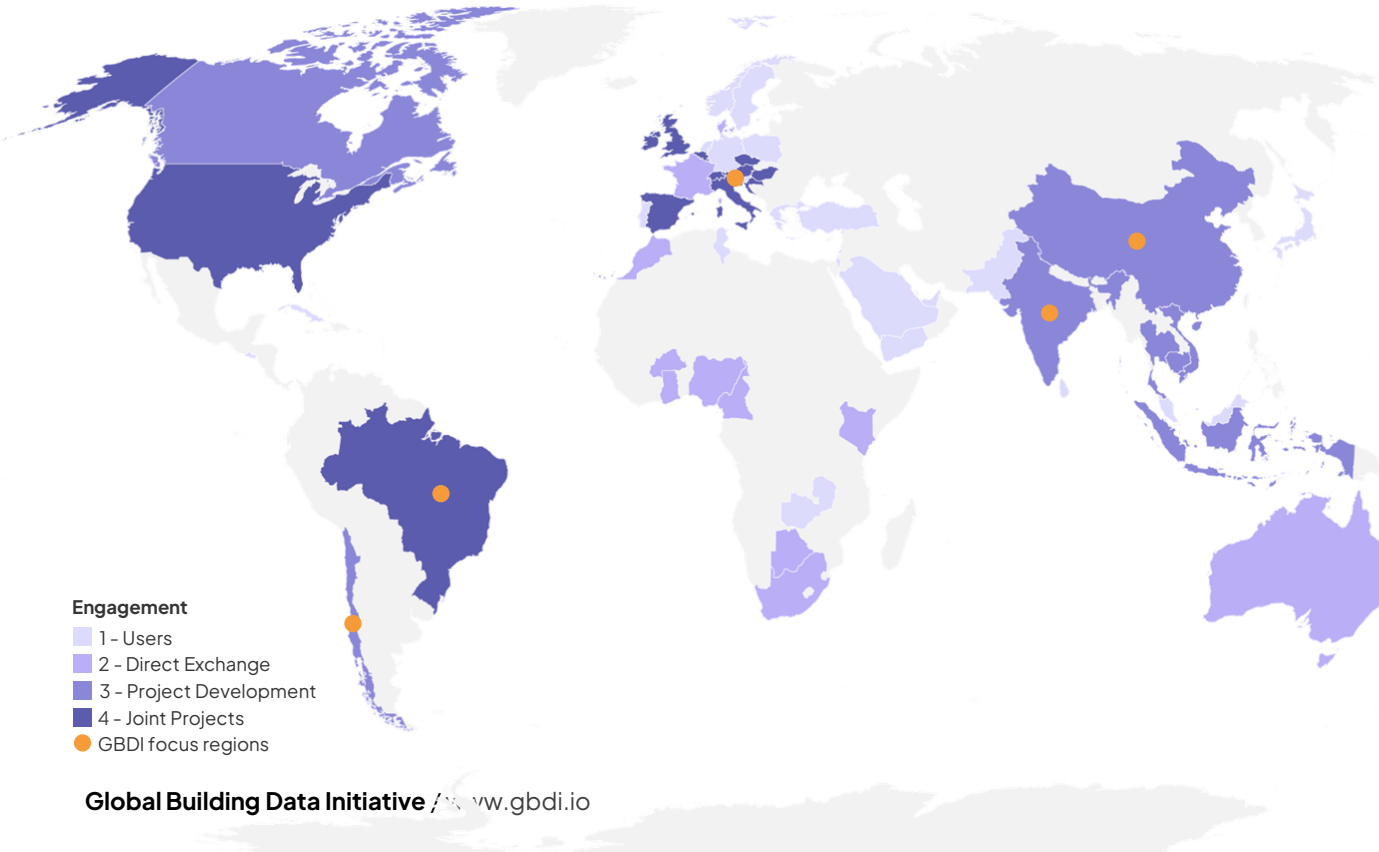
- Evaluate and improve data reliability
- Provide robust, actionable insights

## Map Emissions Trajectories

- Analyse emissions globally and regionally 2025-2050
- Support defining budget-based targets



# Global Network & Stakeholder Engagement



## Inform Global Action

- Support international decarbonisation efforts
- Consider regional contexts

## Enable WLC Tracking

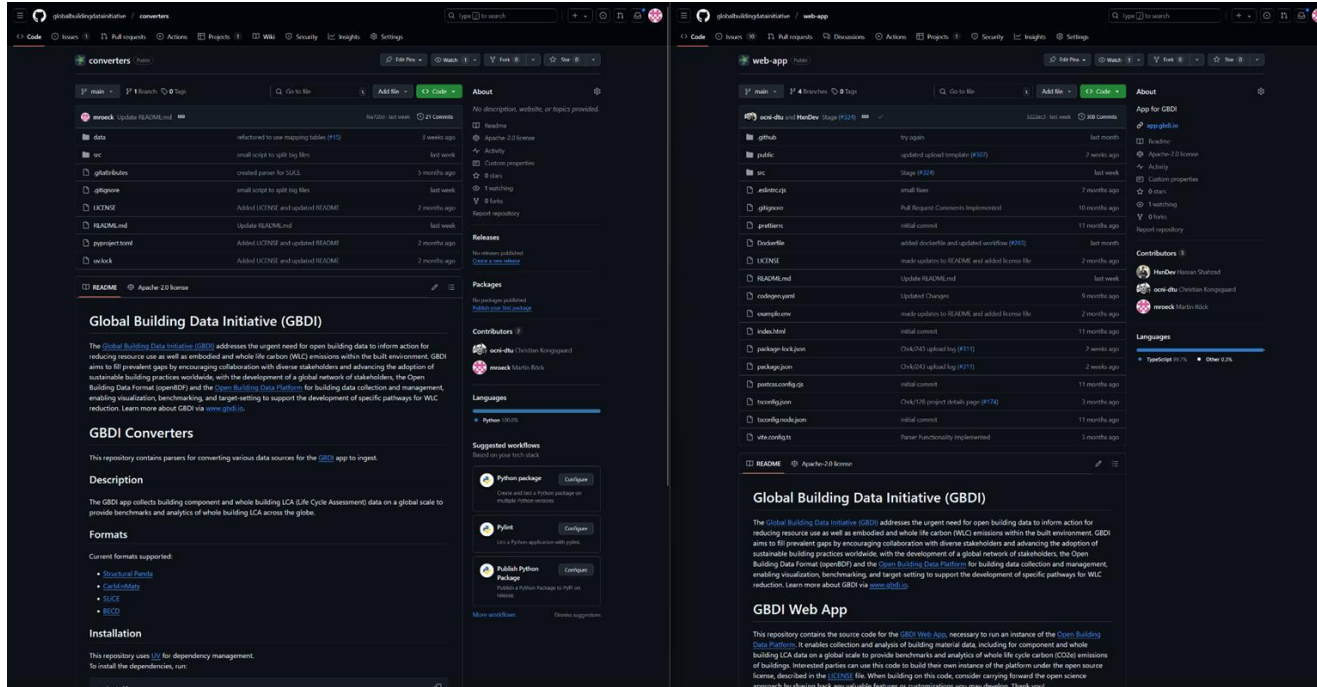
- Track WLC emissions in built environment
- Progress towards climate goals

## Improve Data Exchange

- Offer open interfaces, scalable infrastructures, custom integrations
- Provide comprehensive WLC results and insights



# Open Source Development



@globalbuildingdatainitiative

# GBDI Team



**Dr. Martin Röck (RISE)**  
Executive Director



**Dr. Karen Scrivener (EPFL)**  
Chief Advisor



**Dr. Vanderley John (USP)**  
Advisor GLOBE



**Léa de Courten-Serikoff (EPFL)**  
Stakeholder & Communication



**Dr. Nicole Di Santo (EPFL)**  
LCA & Digital Integrations Lead



**Dr. Zuhaib Batra (EPFL)**  
Senior Scientist - Global Policy



**Son Pham-Ba (EPFL)**  
Software Engineer



**Pierre Guilbert (EPFL)**  
Software Engineer



# GBDI – Join the community!



Use Open Building Data Platform

- **Openly accessible upon signing up**
- **Free to use, no hidden fees – try it!**
- **1'000+ public sample cases already**
- **Use your own data, start comparing**
- **Open API to connect your workflows**

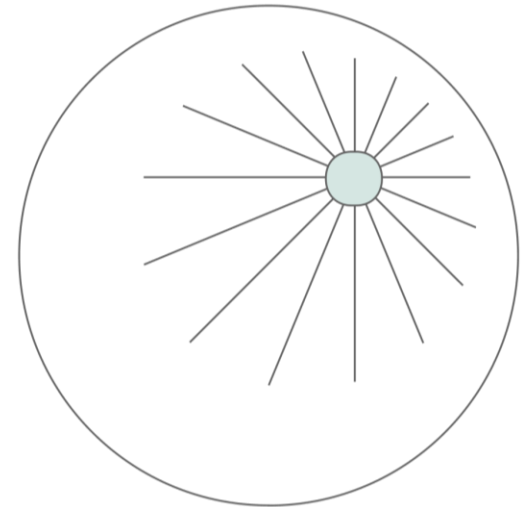
**Direct link**  
<http://app.gbdi.io>



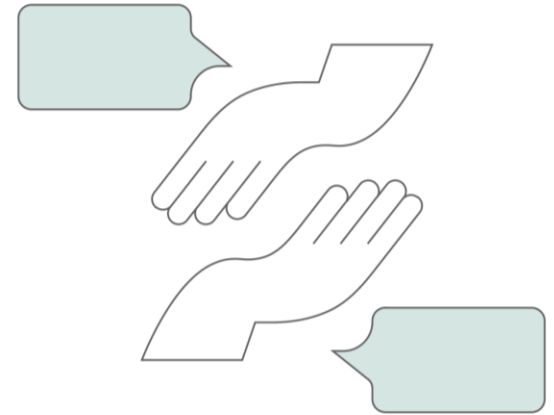
# Live session



<https://app.gbdi.io/>



# Q&A





# Global Building Data Initiative