



CIRCULAR BUILDING PASSPORT TO SUPPORT SUSTAINABLE AND POSITIVE ENERGY HOMES

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PRESENTATION OBJECTIVES



Why are we here?

The building sector urgently needs tools that integrate **energy, circularity, and social dimensions**. The EPBD recast 2024 highlights digital logbooks, life-cycle assessment, and building passports as key drivers for decarbonisation.



What will you discover?

How **LEGOFIT** is turning this vision into practice by developing the **Circular Building Passport (CBP)**:

- Aggregating **data** at building level
- Embedding **environmental, social, and economic indicators**
- Providing a **decision-support platform** for design, renovation, and policy
- Enabling **replicable, scalable renovation pathways** for Energy-Positive Homes

EUROPE'S BUILDING STOCK: A CALL FOR CHANGE



~40%

of **energy consumption**
in the EU is from **buildings**



~1%

**annual deep
renovation rate**



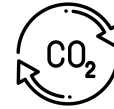
~35%

total EU waste
from Construction, demolition,
and renovation



~50%

extracted materials
consumed by the B&C sector



~ 15 %

total building emissions from
Embodied carbon (materials &
construction)

WHY WE NEED A CIRCULAR BUILDING PASSPORT - CBP



Today's data is **fragmented and inconsistent**



Transparency for decision-makers and citizens is **lacking**



EPBD recast pushes for **LCA, logbooks, and passports**



Circularity, comfort, and affordability are **poorly integrated**

The **Circular Building Passport** directly **addresses** these gaps:

- ❑ **Consolidates all relevant data** (material, energy, cost, comfort)
- ❑ Provides a **transparent, digital, EU-aligned tool**
- ❑ Enables **better design, renovation, and investment decisions**

WHY CBP MATTERS ... NOW

EPBD (Energy Performance of Buildings Directive) RECAST 2024



What has changed with the EPBD Recast?

- Stronger focus on **energy performance and decarbonisation** of buildings
- Obligation to calculate and present **the GWP of buildings using LCA**
- Push towards **digital building logbooks** and building passports
- Requirement for **transparent and comparable data** across the EU



Why CBP:

- Provides a **practical methodology** to assess not only energy but also circularity, social and economic aspects
- Uses **LCA** to calculate **building GWP** across the **whole lifecycle**
- Supports **data collection and digitalization** (potentially interoperable with **DBL** and **BIM**)
- Offers a **unified and transparent tool** for designers, investors, and authorities
- The CBP is **designed to be interoperable with recognised certification schemes** such as **LEED, BREEAM, DGNB**, and **WELL**, strengthening its **acceptance** in the market

LEGOFIT AT A GLANCE

LEGOFIT *Adaptable technological solutions based on early design actions for the construction and renovation of Energy Positive Homes*

PROGRAMME: HORIZON-CL5-2022-D4-01-02

TYPE OF ACTION: HORIZON-IA

TOTAL BUDGET: 7.033.325,00 €

GRANTS AMOUNT: 5.599.531,25 €

DURATION: 48 months

LEAD PARTNER: De sürdürülebilir enerji ve inşaat sanayi ticaret limited şirketi - demir enerji - DEM

PROJECT PARTNERS: R2M; LIST; BDAB; CERT; OSM; AUG; METU; E2C; ABUD; EOS; VAL; OzU; IMP; IES



THE LEGOFIT OVERALL AIM

LEGOFIT aims to design, implement and validate an adaptable and dynamic **holistic approach** to accomplish **Energy-Positive Homes** (EPHs) based on smart and innovative solutions with **high scalability and replicability** for efficient building **construction and renovation**.

LEGOFIT provides **professionals and end-users** with an innovative holistic **design platform** with three **main functionalities**:



supporting
the **decision-making process**



aiding
the **design process**



setting up
an **innovative marketplace**

THE LEGOFIT CIRCULAR BUILDING PASSPORT

One of the tools of the LEGOFIT platform is the Circular Building Passport (CBP).

It acts as a **core element** tool that consolidates transparent, life-cycle data on **materials, energy use, circularity, and environmental impacts**. With CBP, LEGOFIT embeds sustainability and circularity **from the very first design decisions** through renovation, operation, and end-of-life, enabling:



Informed design & investment choices



Better tracking of material flows & residual value



Alignment with EU requirements



Scalable, replicable renovation pathways

WHAT IS THE CIRCULAR BUILDING PASSPORT?

There is currently **no single, universally accepted definition** of a Circular Building Passport.

However, the common understanding is that a CBP is a **digital document** that:

- ❑ **Builds on and collects Material Passports (MPs)** at building level
- ❑ Tracks **embodied carbon, circularity, and reuse potential**
- ❑ Integrates **energy, comfort, and affordability indicators**
- ❑ Provides a **life-cycle perspective** for design, renovation, and policy decisions

👉 In LEGOFIT, the CBP is developed as a **practical methodology** to connect **materials → buildings → decision-making**, ensuring sustainability and circularity are embedded throughout the building life cycle.

TURNING MATERIAL DATA INTO BUILDING INTELLIGENCE

Synthesis across scales → from product to building in **three** steps

1 Step 1 – Material Passport (MP)

Data at **product/component level**

Info: composition, impact, reuse/recyclability, embodied emissions

2 Step 2 – Aggregation

Collection of all MPs for one building

Add: energy, comfort, cost, accessibility
Interoperable with BIM / DBL / LCA tools

3 Step 3 – Circular Building Passport (CBP)

Building-level integrated document

Adds holistic indicators (GWP, circularity, social, economic)
Decision-support tool for designers, investors, municipalities, users
Enables **comparison, monitoring, and policy alignment**

STRUCTURE OF THE CIRCULAR BUILDING PASSPORT

4

MAIN DOMAINS



ENVIRONMENTAL INDICATORS:

GWP (kg CO₂-eq.)
Environmental score
(based on EF 3.1 approach
aligned with *Product
Environmental Footprint*
-PEF - methodologies)



CIRCULARITY INDICATORS:

Recycled content (%)
Renewable content (%)
Reused content (%)
EoL recycled content (%)
EoL reused content (%)
Recycling efficiency (%)
EoL recycling efficiency (%)



SOCIAL INDICATORS:

Health&Comfort score
Post-Occupancy evaluation
surveys
Affordability ratio
Accessibility



ECONOMIC INDICATORS

Economic gain
Total LCC
Cost per square meter
Payback period (y)
Recovered material
value

work in progress...

CBP CREATION WORKFLOW AT A GLANCE

Three steps to devise the CBP

Step 1 – Collect

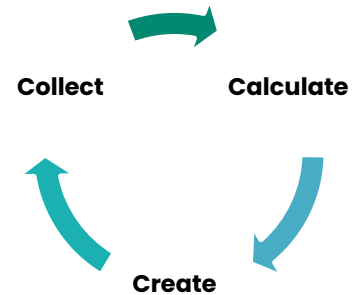
📁 Collect **material and building data** (composition, energy, comfort, cost, reuse potential)

Step 2 – Calculate Indicators

💻 Use **digital tools (LCA)** to compute environmental, circularity, social & economic indicators

Step 3 – Interpret & Create CBP

📊 **Interpret results** and generate the **CBP layout** as a transparent decision-support document



CBP ACROSS THE BUILDING LIFECYCLE



01 Early Design

Assess options, anticipate impacts



02 Procurement & Construction

Compare suppliers, specify circular materials



03 Renovation Pathways

Choose express, deep, or staged retrofits



04 Operation & Use

Monitor comfort, energy, and costs



05 End-of-Life & Reuse

Enable dismantling, recycling, and recovery

WHO BENEFITS FROM THE CBP?



Architects & Designers

Better design decisions,
informed material choices



Investors & Developers

Lower risks, clearer
return on investment



Polycymakers

Policy alignment, incentives, transparent
procurement



Citizens & Users

More comfort, affordability,
transparency

POTENTIALS & CHALLENGES



POTENTIALS:

- Supports **decision-making** in the **design phase**
- Enables **comparison** of materials and design options
 - Promotes **innovation and transparency**
 - A **single tool** with multiple perspectives
- The CBP also integrates a **commitment score**, enabling alignment with market frameworks and supporting **accountability** across the building value chain.



CHALLENGES:

- Data **difficult** to find or **not available**
- Data collection step is **time-consuming**
- **Difficulty** in assessing **social & economic** aspects

IN SUMMARY: FROM CONCEPT TO IMPACT

LEGOFIT is making the Circular Building Passport a reality.

Beyond LEGOFIT, the CBP is envisioned as a reference for **Positive Energy Buildings (PEB)** and **Positive Energy Districts (PED)**, accelerating the transition to a resource-efficient, climate-neutral, and resilient built environment.

Holistic data integration

From materials to buildings → life-cycle environmental, social, and economic indicators

Material → Building aggregation

Material Passports consolidated into a Circular Building Passport → scalable methodology

Decision-support platform

Guiding architects, investors, and municipalities with transparent, comparable information

Renovation & construction pathways

Supporting both new buildings and retrofits with tailored CBP-based strategies

Policy & market alignment

Interoperable with EPBD logbooks, BIM, and EU standards → ready for replication

THANK YOU!

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