Maximizing Materials Efficiency
The Building Sector

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World Materials Forum
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HeidelbergCement has committed to doing more with less

SUSTAINABILITY COMMITMENTS 2030

SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD

DRIVING ECONOMIC STRENGTH AND INNOVATION

8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
11 SUSTAINABLE CITIES AND COMMUNITIES

ACHIEVING EXCELLENCE IN OCCUPATIONAL HEALTH AND SAFETY

3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION

REDUCING OUR ENVIRONMENTAL FOOTPRINT

6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
15 LIFE ON LAND

ENABLING THE CIRCULAR ECONOMY

8 DECENT WORK AND ECONOMIC GROWTH
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

BEING A GOOD NEIGHBOUR

4 QUALITY EDUCATION
17 PARTNERSHIPS FOR THE GOALS

ENSURING COMPLIANCE AND CREATING TRANSPARENCY

5 GENDER EQUALITY
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

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Concrete is needed to develop new and smart cities as well as to respond to a growing middle class and population growth at large

Green Township in Gurgaon

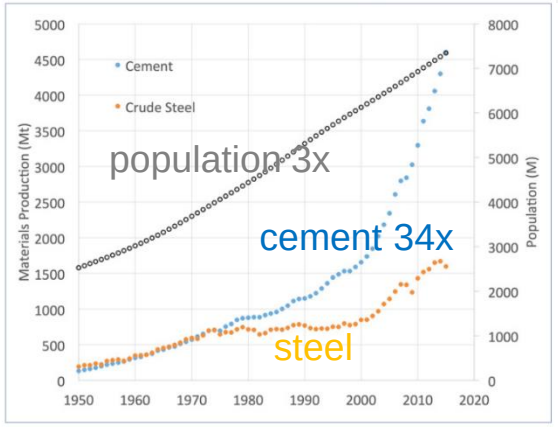
Smart cities & reduced land use

Smart buildings & high performance materials

Infrastructures for mobility

(Grey) building blocks

Growth in cement use over the last 70 years



Source: UNEP Report (2016) "Eco-efficient cements"

Sustainable growth is a must

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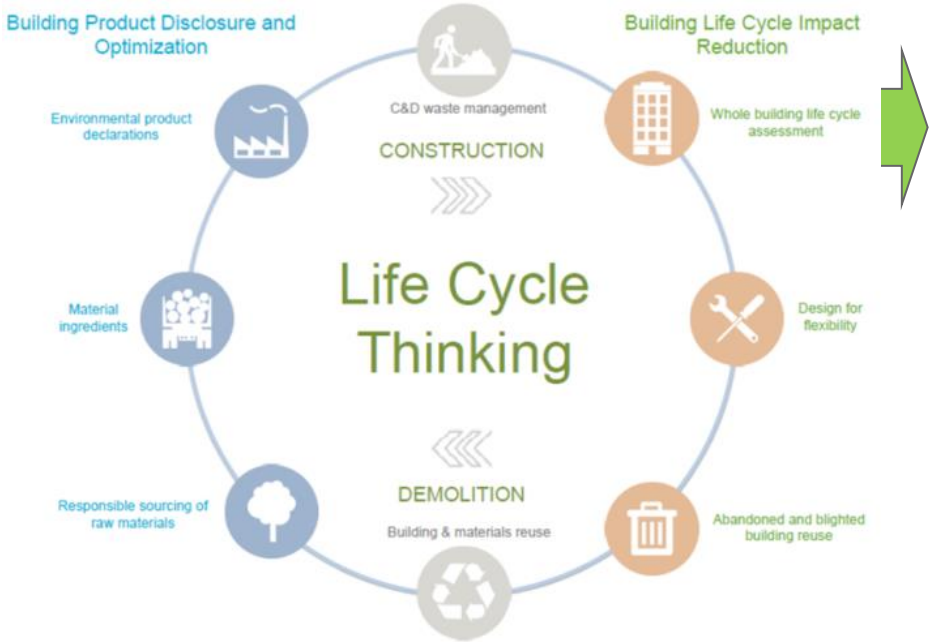
Circular economy and resource efficiency at product level

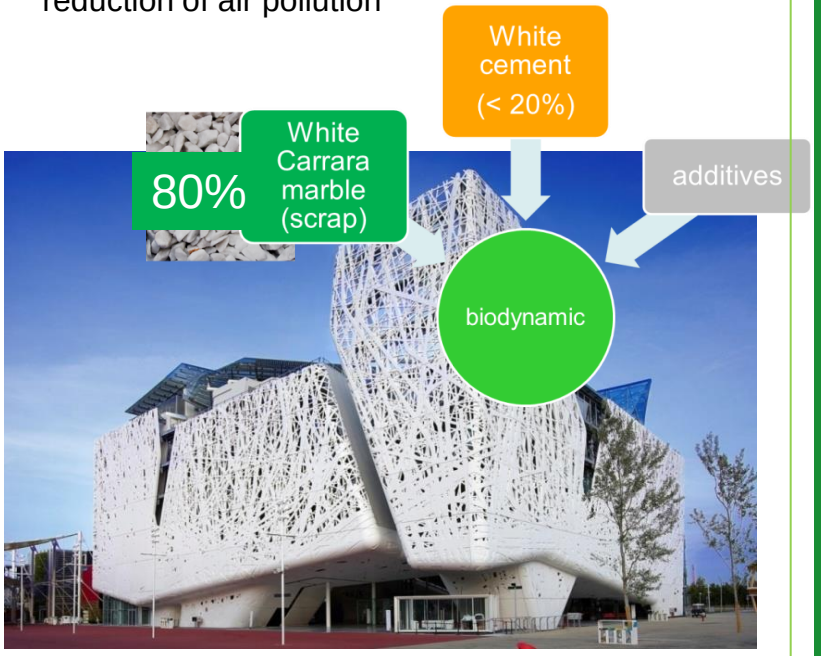
Focus on life cycle opportunities in resource efficiency:

- Alternative fuels & raw materials
- Advanced recycling technologies



Architectural design material

- High performance, highly flowable cement mortar for non-structural architectural precast elements
- 80% recycled aggregate
- **fully recyclable** after use as an inert material
- use of photocatalytic additives (TX-Active) for reduction of air pollution



Milan EXPO 2015: palazzo ITALIA

We apply Life Cycle Thinking in reseach and product innovation

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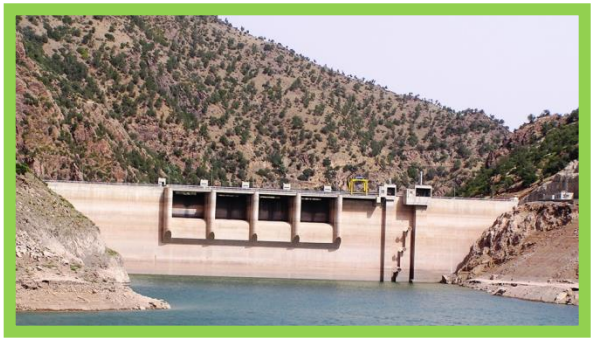
Alternative raw materials: continuous R&D efforts

- Clinker is the high CO_2 content component in cement
- Using by-products from other industries in composite cements clinker content in cement can be reduced (state of the art)

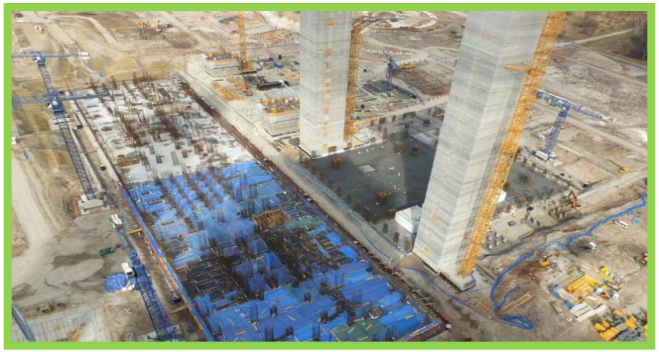
- Alternative cementitious systems without clinker are researched
- Development of these new binders requires time and effort to ensure durability, performance, standardization

- Use of manufactured sand or aggregate from recycled materials in concrete (state of the art)

Use of by-products from other industries in composite cements



Fly ashes cement used for a dam in Morocco



Use of slag cement for basements and massive construction parts for a power plant in Poland

Alternative raw materials help reduce CO_2 in concrete

Use of recycled concrete aggregates (RCA) is a common practice

Backfilling and earthwork	Road construction	RCA for asphalt materials
Land reclamation	Precast concrete products	**RC Concrete**

Geusseltbad Maastricht
Built with 3500 m3 Ecocrete®100 delivered by Mebin

FAXX Building Tilburg
Built with RCA (recycled aggregate): 100% in foundation beams 60% RCA in foundation piles; 20% in hollow core slabs; 100% in prefabricated components and containing 750m³ of Ecocrete® delivered by Mebin

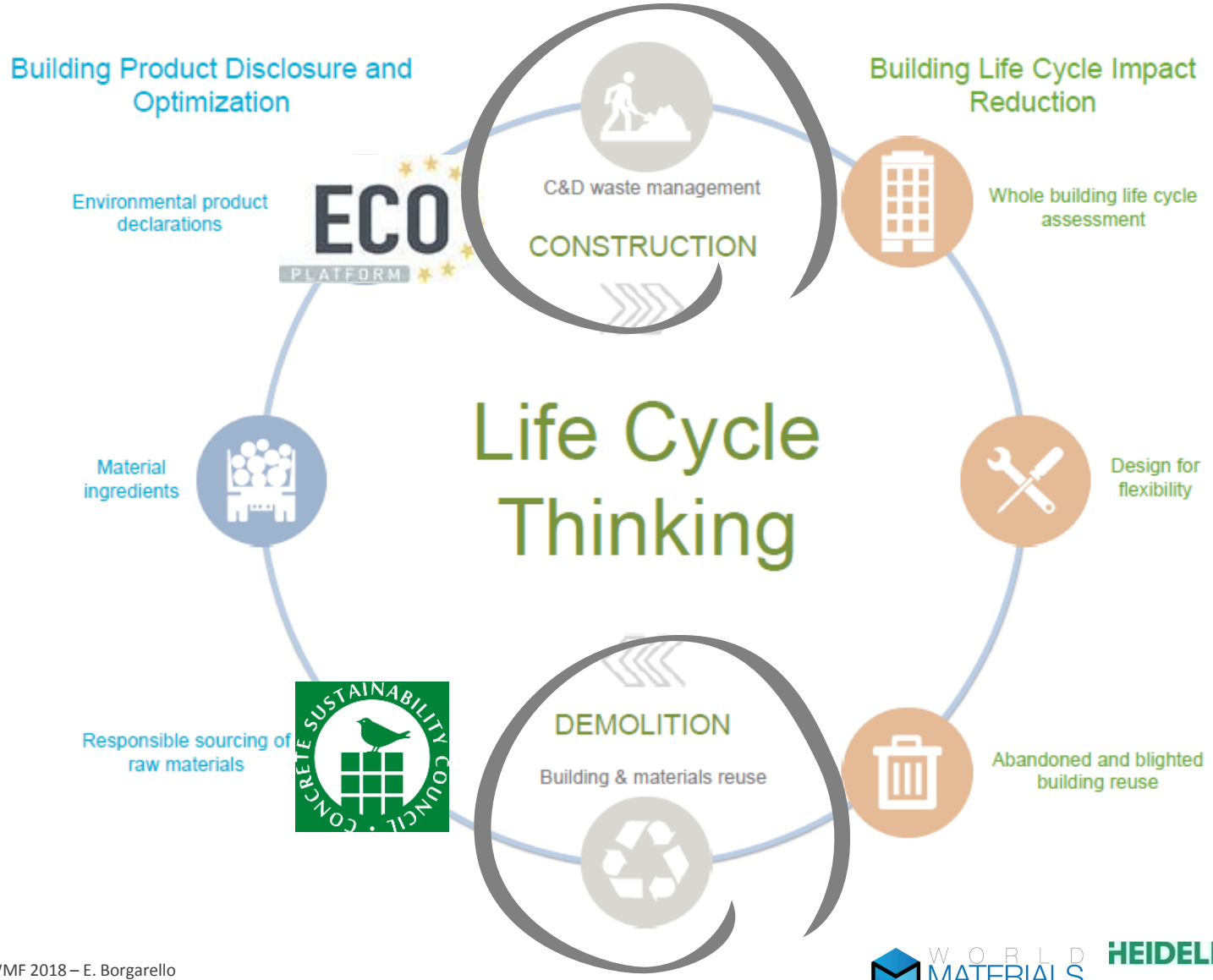
Use of recycled and industrial aggregates in Europe is regulated by law and standards

- About the composition of recycled concrete aggregates (RCA):
  - thresholds for impurities such as for clay, glass, wood, plastic or rubber need to be met

- About use of RCA in concrete, regulations typically:
  - specify permitted concrete exposition classes
  - specify the permitted range of concrete strength classes and % substitution
  - exclude the use in certain applications, such as in Germany in pre-stressed concrete and in lightweight concrete
  - limit or exclude the use of recycled fines

- **Sustainable construction rating schemes** (voluntary) and **Green Public Procurement** (mandatory) promote reuse of recycled and industrial aggregates

Demand for labelling: green building rating systems promote circular economy



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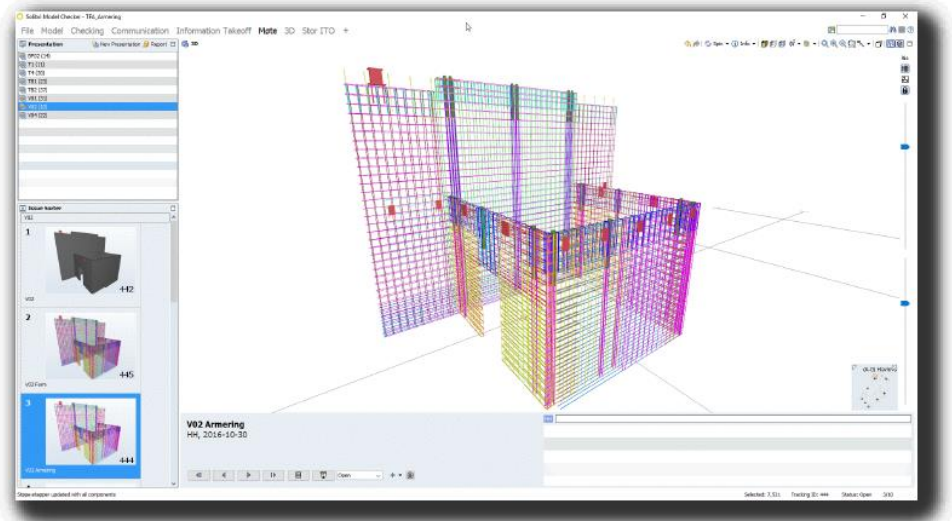
Moving towards “digital concrete” for large construction projects: BIM experience

- Digital ordering from suppliers directly via BIM
- Digital production, no drawings
- Digital reception control
- Delivery, supply information linked to BIM
- Documentation saved in BIM
- Facilities management

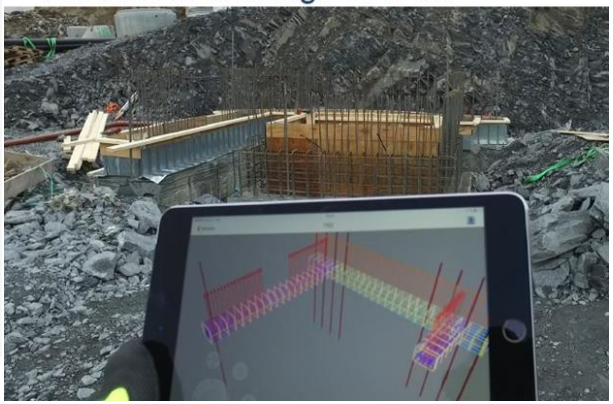
BI Distant® a tool for service support (when casting on site) through “prognosis” for industrialized construction *with RMC*

Production drawings

- Overview
- Bending list
- Construction Plan
- Information
- Assembly
- Casting stage
- Form
- Rebar



Production drawings on iPad



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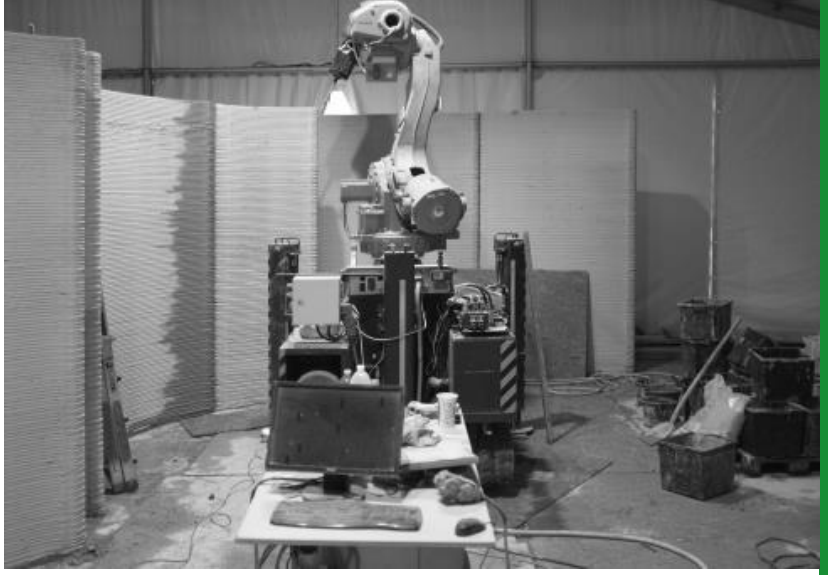
NEW FRONTIERS:
3D printing technology



3D printing offers infinite possibilities

in the field of architecture.

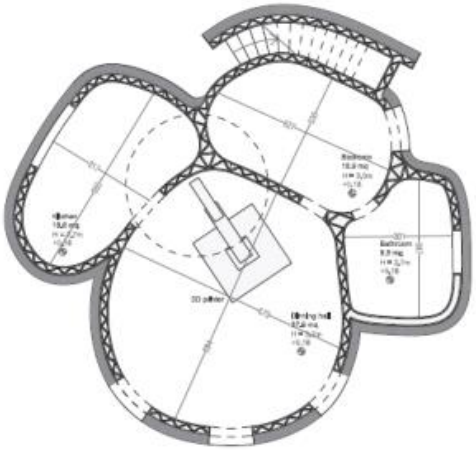
The key challenges are:

- **Sustainability**: a sustainable alternative to the traditional construction process, reducing material waste and allowing the use of recycled concrete. Components of 3D-printed buildings can be reused in the future
- **Flexibility**: greater flexibility in the shape of buildings, allowing the creation of more complex structures, such as double curved walls, at lower cost. In addition, the on-site construction process has few limitations regarding site location
- **Affordability**: less expensive than traditional construction due to the more efficient use of materials and a more structured and faster building process
- **Accuracy**: direct transfer of information from the 3D design model to construction operations, drastically reducing building inconsistencies and potential mistakes
- **Rapidity**: increase efficiency during the building process

NEW FRONTIERS: 3D printing technology

Project: "3D HOUSING 05": a real house of 100 m^2 realized by on site 3D printing (extrusion technology) in Milan city center for the Fuorisalone Milano 2018.

- 3D HOUSING 05 is composed of a living area, a bedroom area, a kitchen, a bathroom and a terrace roof;
- PARTNERS:
  - **CLS Architetti – Massimiliano Locatelli** (Architectural firm - Milan) => Owner and Designer;
  - **Arup** (International Engineering and Design firm) => Structural design;
  - **Italcementi-HeidelbergCement Group** (Cement, Aggregate and Concrete producer) and **CyBe Construction** (Dutch tech-company specialized in 3D concrete printing) => 3D printing technology and materials providers



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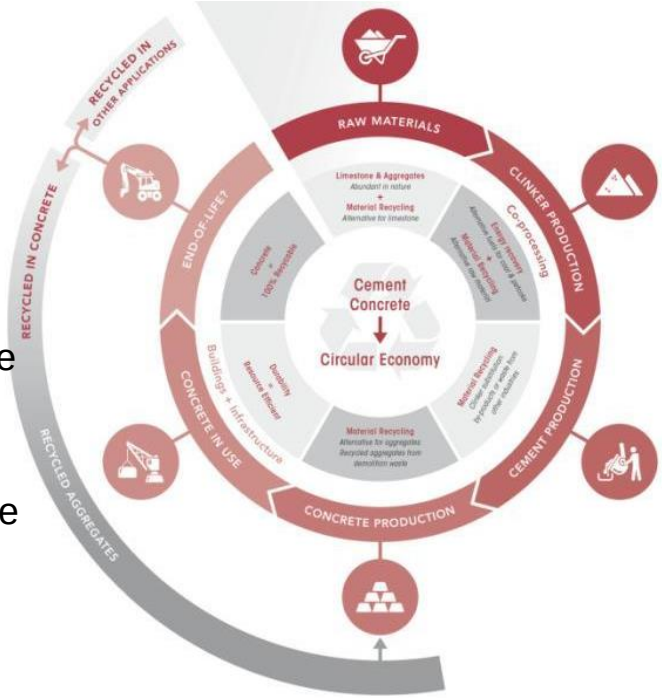
Concluding remarks

- The **cement industry** keeps working with stakeholders to:
  - **identify practices** that make co-processing waste a safe and eco-efficient operation, as well as
  - **identify proper waste streams** to be used as alternative raw materials in cement or artificial aggregate in concrete.



- **Recycled content** in construction materials should be promoted, considering the whole life cycle approach from raw materials to demolition of the building
- **Cost** is an issue. Innovation and new frontier technologies are an opportunity to deliver low cost sustainable solutions
- **Public support**, including from local authorities, is needed to allow for urban mining
- Adequate **standards/regulations** are needed in order to implement sustainable solutions in the building sector
- **Collaboration** with all the actors on the value chain of the construction industry is a must.