ECO-SEE

Breakthrough eco-materials and components for healthier and more energy efficient buildings

María Casado, Advanced Materials Group
auroramaria.casado.barrasa@acciona.com

Eco-materials for low-carbon construction, Madrid, 21 Nov 2017

ECO-SEE is co-financed by the European Commission under the 7th Framework Programme for Research and Technological Innovation.

What are eco-materials?

Low carbon/low energy/renewable traditional materials

- Bio-based materials
  - Crop residues (straw, hemp)
  - Bamboo
  - Wood
  - Wool
- Mineral based materials
  - Clay/earth based (plasters, blocks, monolithic)
  - Natural stone

Lower energy/carbon developments of industrial materials

- Lower carbon cements and concretes
  - Cement replacements
  - Geopolymers
- Recycled products
  - Recycled metals and reuse of waste materials

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Goal of the ECO-SEE project

Development of novel eco-materials for wall panels which will enhance the indoor environment and the energy efficient of buildings.

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Introduction to project

- EC FP7 research project
- Led by the University of Bath, UK
- Project Lead : Professor Pete Walker
- Four years : Sep 2013 - Aug 2017
- 11 Work Packages (9 technical)
- EU contribution = 6.5 million Euro
- 18 partners (from 8 EU countries and India)

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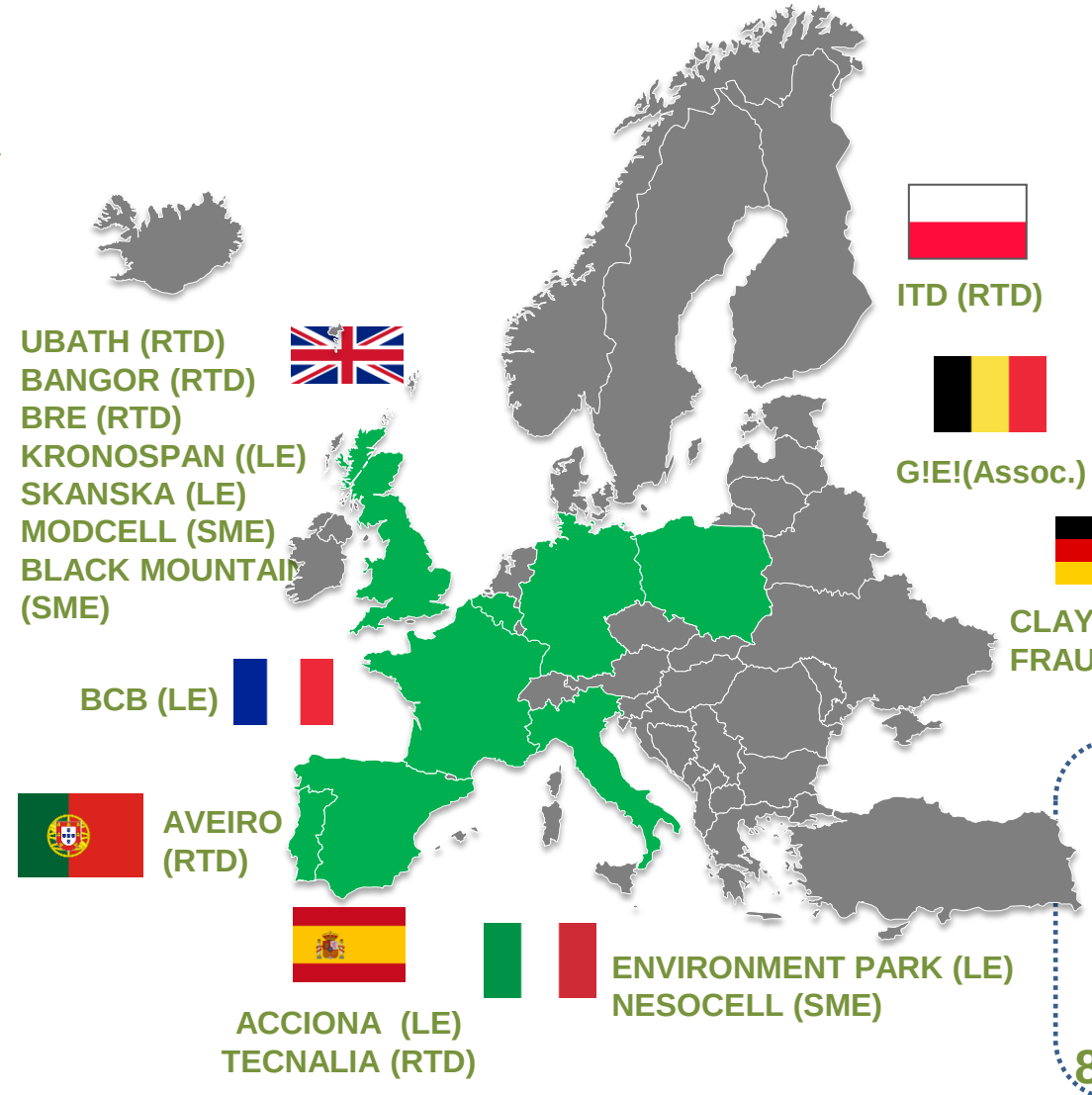

UBATH (RTD)
BANGOR (RTD)
BRE (RTD)
KRONOSPAN ((LE)
SKANSKA (LE)
MODCELL (SME)
BLACK MOUNTAIN
(SME)

BCB (LE)

AVEIRO
(RTD)

ACCIONA (LE)
TECNALIA (RTD)

ENVIRONMENT PARK (LE)
NESOCELL (SME)

ITD (RTD)

G!E!(Assoc.)

CLAYTEC (SME)
FRAUNHOFER (RTD)

8 RTD

5 LEs

4 SMEs

1 EU Association

ITT DELHI (RTD)

8 EU countries & 1 extra EU partner

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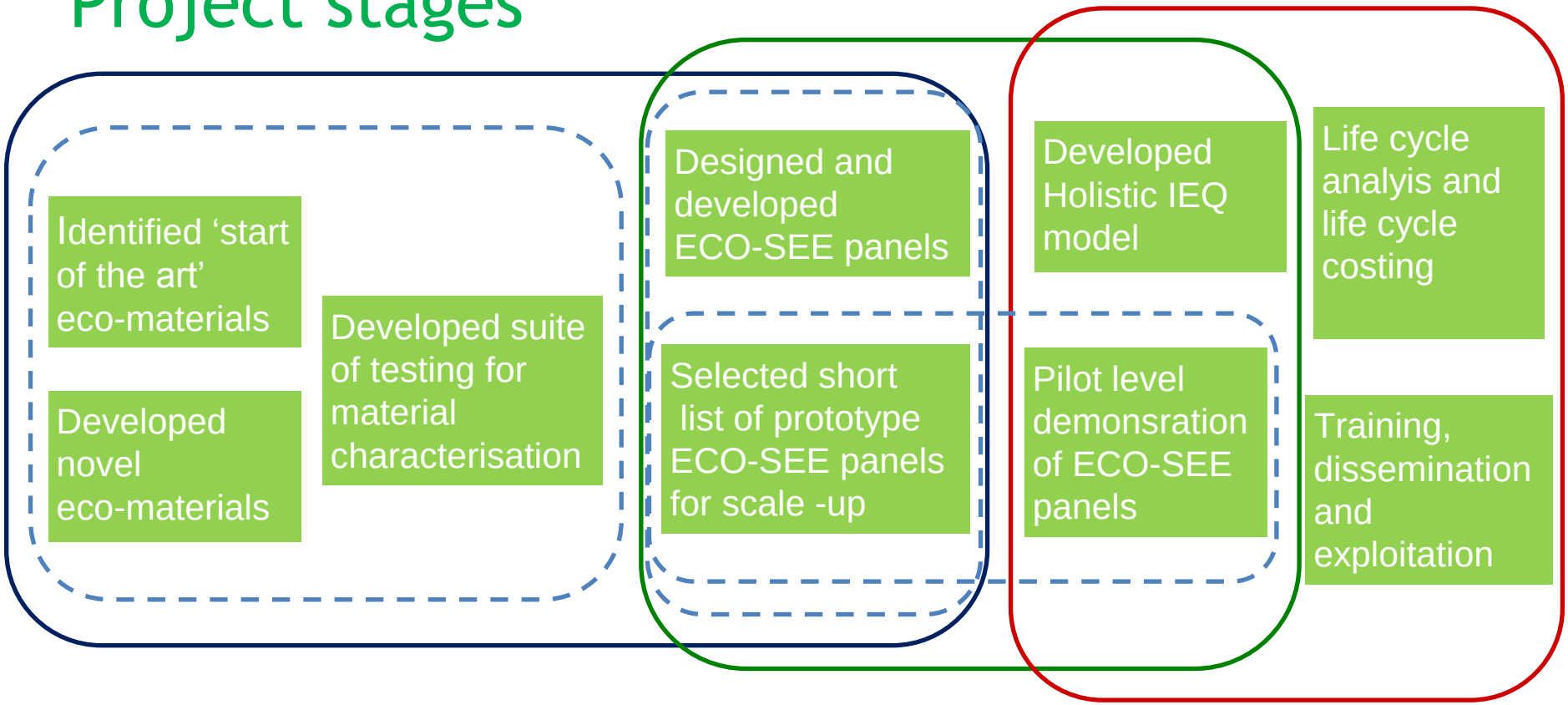
Project stages



Applied research

Upscale, demo & validation

Future market uptake

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ECO-SEE innovative products

- Bio-based insulation with enhanced capability (sheep's wool, cellulose, hemp-fibres)
- Novel clay plasters with improved hygrothermal regulation
- Novel photocatalytic coatings, suitable for interior spaces and applied to lime and wood based substrates, with aim of improving air quality
- Low VOC wood panels
- Desing tools for holistic indoor environmental quality
- ECO-SEE wall panels

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ECO-SEE Materials: Insulation

Mineral wool

Hemp

Thermal flax

Hemp-lime (275 kg/m^3)

Cellulose flakes

Sheep's wool

Wood fibre

Hemp-lime (300 kg/m^3)

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ECO-SEE panel designs

INTERNAL

1. ECO-SEE wall liner

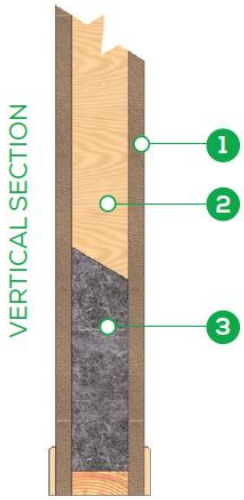
There are three liner finishes; Photocatalytic Lime, Clay, Photocatalytic Timber Boards.

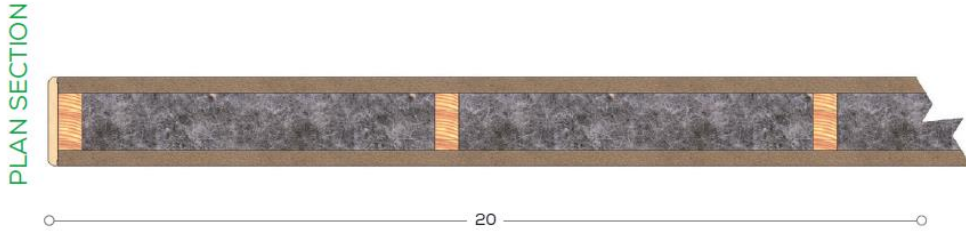
2. ECO-SEE internal panel timber frame

The panel is made up of a softwood timber frame. In new buildings internal panels may be prefabricated as either open or closed elements. For installations in both new and retrofit projects the final finish will be installed in-situ once the building is weather tight and risk of surface damage is low.

3. ECO-SEE insulation

The internal panels use enhanced Sheep's Wool insulation for acoustic separation. This inner blanket helps to buffer humidity and to degrade VOCs, which permeate through the vapourpermeable liners.





EXTERNAL

1. ECO-SEE wall liner

There are three liner finishes; Photocatalytic Lime, Clay, Photocatalytic Timber Boards.

2. ECO-SEE external panel timber frame

The timber frame is made up of two sections; an outer chamber formed with timber I-Joists and an inner chamber. The two are separated with an OSB diaphragm which controls water vapour movement into the colder outer chamber while still allowing the moisture buffering properties of the inner insulation to be coupled with the internal environment.

3. Outer layer of ECO-SEE insulation

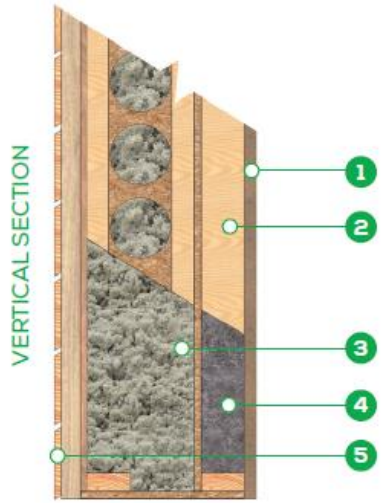
Uses either factory installed hemp fibre or Nesocell cellulose, which is blown in on-site.

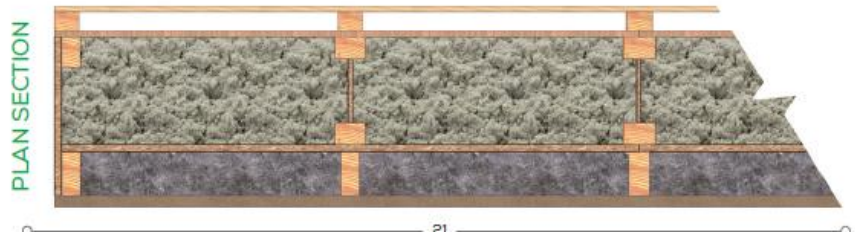
4. Inner layer of ECO-SEE insulation

Uses enhanced Sheep's Wool insulation. This inner blanket helps to buffer humidity and to degrade VOCs, which permeate through the vapour permeable internal liner.

5. External cladding

Provides weather protection to the external ECO-SEE panels. Cedar cladding is shown but a wide range of materials and finishes can be used.





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ECO-SEE panels installation

Comparable to conventional timber frame construction:

- Include installation of lifting straps
- Panels may then be fixed to the existing structure:
  - Screw through the timber;
  - Use external propriety connections.

A typical installation may include:

- Use of concrete foundations;
- Installation of a timber sole plate, damp proof course and timber floor;
- Installation of external ECO-SEE wall panels and roof

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SOUTH WEST CRANE HIRE


SterlingOSB

Lining out

Cells may be lined either off-site or on-site

Design of an ECO-SEE cell includes a layer of insulation within the air tight barrier.

- Timber studs at regular intervals.

- In-filled with insulation and lined with a plasterboard.
  - treated sheep's wool insulation
  - magnesium oxide board as lining.

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Finishing

The internal ECO-SEE finish is achieved through one of:

- Clay plaster
- Photocatalytic Lime plaster
- Photocatalytic timer boards

Demonstration

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Validation of ECO-SEE panels

Building performance tests included:

- Microbial air quality (air spore measurements)
- Acoustic testing
- Indoor Air Quality
- Thermographic imaging surveys
- Airtightness
- Hygrothermal performance
- Environmental performance (energy use and co-heating)
- Thermal comfort

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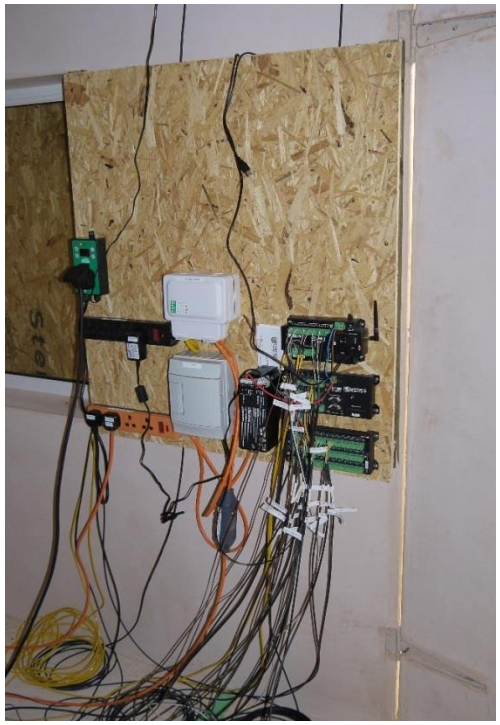

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Achievements (I/II)

- Developed breakthrough eco-materials and innovative ECO-SEE products:
  - ✓ Bio-based insulation
  - ✓ Novel clay plasters
  - ✓ Novel photocatalytic coatings, suitable for interior spaces
  - ✓ ECO-SEE wall panels

- ECO-SEE prototype products have been taken to proof of concept through field and implementation testing trials. Product development has been supported by LCA and LCC to ensure delivery of lower environmental impact and improved performance.

- Successfully created a novel holistic IEQ tool using Computational Fluid Dynamics (CFD) computer-based tool that combines air quality, hygrothermal performance and acoustic quality.

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Achievements (II/II)

- The key novel outcomes from the ECO-SEE project include:
  - ✓ 60% improvement in thermal resistance of clay plasters
  - ✓ 80% improvement in moisture buffering performance of clay plasters
  - ✓ Over 100% improvement in VOC capture potential of sheep's wool insulation
  - ✓ Up to 30% reduction in energy consumption for heating and 10% reduction for cooling,
  - ✓ Comparable acoustic performance of ECO-SEE external wall panel with the conventional construction.
  - ✓ Reduction of GWP (kg CO_2 eq.) above 100%.
  - ✓ Reduction of the Primary Energy Demand around 27-28%.

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RE4

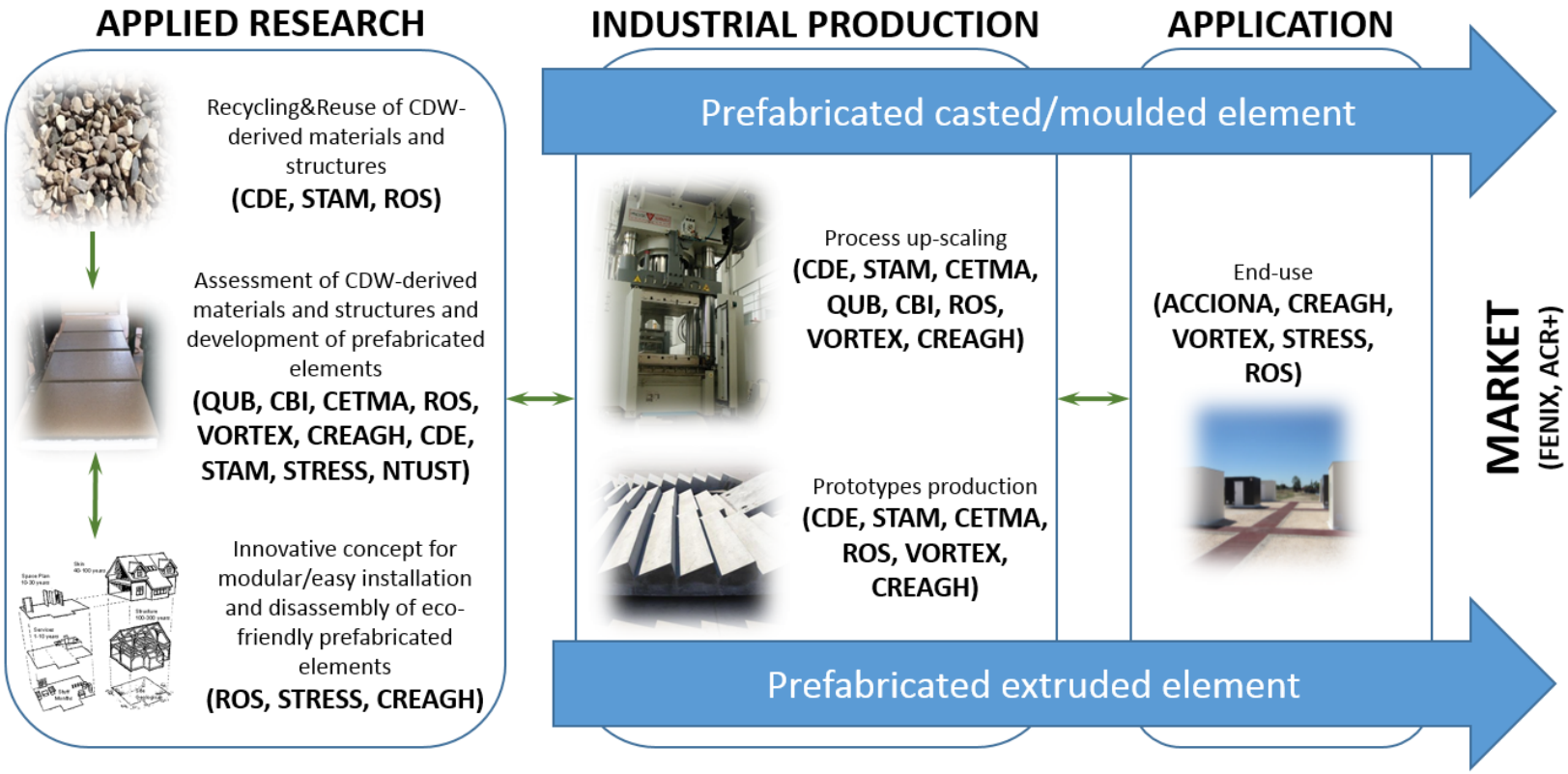
REuse and REcycling of CDW materials and structures in energy efficient pREfabricated elements for building REfurbishment and construction

Main objectives and project details

- The **overall** goal of the RE4-Project is to develop a **fully prefabricated energy-efficient building made of components containing up to 65%** by weight of **CDW-derived materials and structures.**

- Funded under the European Union's Horizon 2020 research and innovation programme.
- Led by CETMA
- 42 months: Sept 2016- Feb 2020
- EU contribution: 4,98M€
- www.re4.eu

RE[4] consortium and main tasks



Strong industrial character (4 SME and 3 LE), complemented by the specific competences of 5 top level research and innovation organizations

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Thanks for your attention

http://www.eco-see.eu/

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