RE4 Presentation for SeRaMCo

Project Overview

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Content

- RE^4 main goals
- RE^4 structure
- Explanation of the work
- Achievements
- Specific S&T objectives *vs* Actions take
- Success indicators
- Exploitable results

RE^4 main goals

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

RE^4 main goals

CDW Management

- Stakeholder engagement
- DSS for CDW estimation and management
- New attractive business opportunities
- New technical profiles (CDW managers)

CDW Recycling

- RE^4 advanced sorting technologies
- Compliance assessment (geometrical, physical, chemical, durability and variability) and definition of new quality classes
- RE^4 materials and prefabricated elements

CDW Reuse

- Disassembly strategies
- Innovative design concepts for prefabricated elements
- Innovative design concepts for a fully prefabricated, easy dismountable RE^4 building (flexibility: climate and structural requirements)

CDW Perception

- Performance assessment
- Certification and standardisation strategies (TDS, DoP, EPD based on EN 15804)
- Life-cycle analyses (including s-LCA)
- HSE analyses
- Training videos for students and new young technical profiles

65% Maximizing virgin material replacement

95% Improving recycling rate

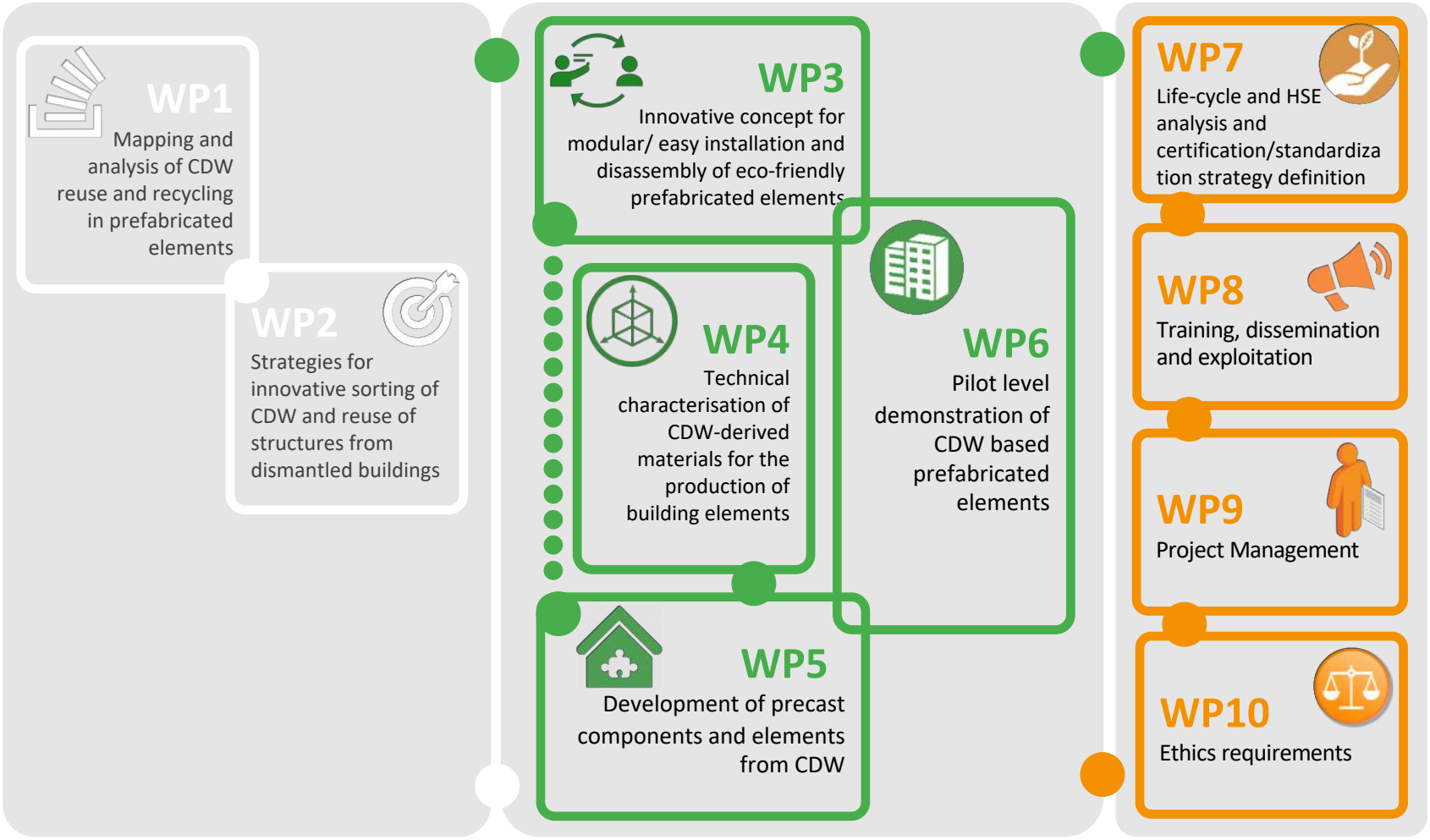
90% Reusable structures from RE^4 building

30% CO_2 savings

RE^4 structure

Interlinkages among WPs

RE^4 structure - WP



Explanation of the work

M1-M42

Explanation of the work

WP1 Mapping and analysis of CDW reuse and recycling in prefabricated elements.

Project framework definition: CDW management strategies, technical regulations and legislations, policy measures across EU28, KPI, identification of certification issues.

M1-M9

WP2 Strategies for innovative sorting of CDW and reuse of structures from dismantled buildings.

Sustainable strategies for disassemble and reuse concrete and timber structures, **innovative CDW washing processes** to improve the quality of CDW-derived aggregates.

M1-M24

WP3 Innovative concept for modular/easy installation and disassembly of eco-friendly prefabricated elements.

Preliminary architectural **design concept** for RE⁴ prefabricated elements, preliminary overall design concept for a RE⁴ building typology, supported by numerical modelling.

M1-M33

Explanation of the work

WP4 Technical characterisation of CDW-derived materials.

Geometrical, chemical and physical characterization of different sorted CDW fractions (mineral and LW aggregate from S-EU and N-EU) and analysis of performance variability over time and geographic location. **Definition of new quality classes.**

M3-M20

WP5 Development of precast components and elements from CDW.

Formulations and validation of **5 materials incorporating CDW** (normal and lightweight concretes with OPC and AAB – *SCC, vibrated, semi-dry*, earthen materials).

78%
Average virgin material replacement

M2-M31

WP6 Pilot level demonstration of CDW based prefabricated elements.

Definition of the preliminary concept for the **RE⁴ demo buildings** to be built in Spain and U.K.

M18-M42

Explanation of the work

WP7 Life-cycle and HSE analysis and certification/standardization strategy definition.

Preliminary **goal & scope** definition for life cycle analyses.

M13-M42

WP8 Training, dissemination and exploitation.

Widespread **dissemination** to the relevant target groups, appropriate data management, results exploitation, capacity building activity in IPR management.

M1-M42

WP10 Ethics requirements.

Setting out the **ethics requirements** that RE4 must comply with.

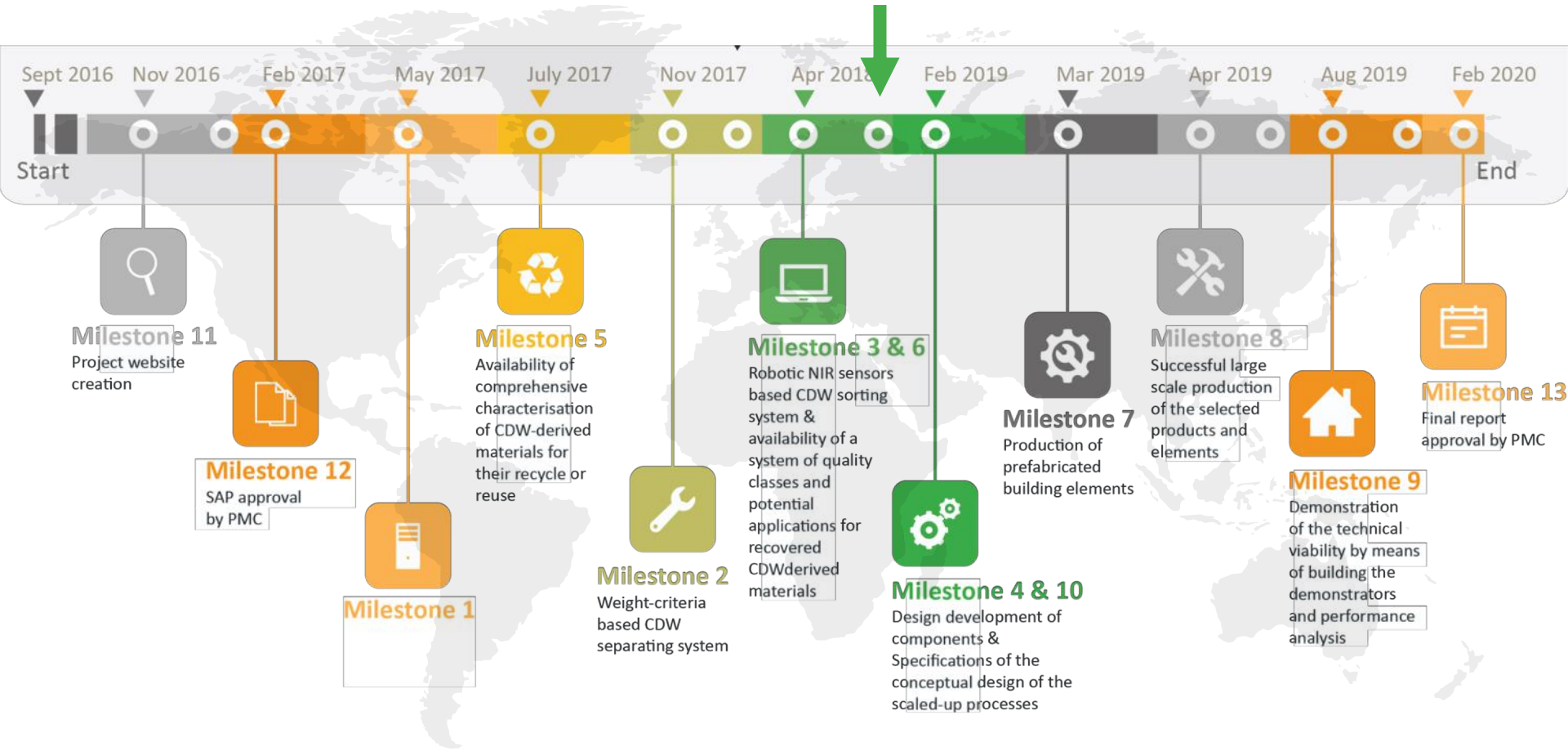
M1-M42

Achievements

Timeline, Deliverables and Milestones

Achievements (M28)

timeline



Achievements (M18)

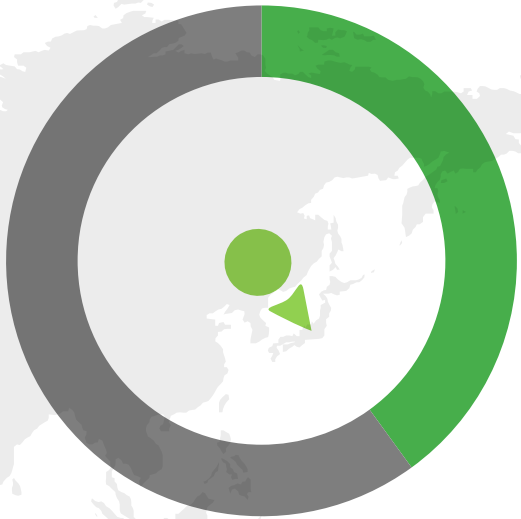
deliverables & milestones

100%

26 deliverables and 5 milestones @ M18

43%

26 out of 60 deliverables



40%

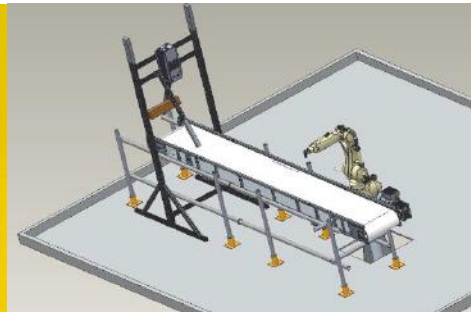
5 out of 13 milestones

Specific S&T objectives

Actions taken

Specific S&T objectives

Actions taken



Maximization of recycled CDW amount and value by advanced sorting technologies (obj. 1)

Development of advanced sorting technologies based on attrition, density separation and automated robotics' equipped with advanced sensors and artificial intelligence software.
The state-of-the-art recycling rate will be increased from 80% to 90-95% (HQ mineral fractions, lightweight fractions).

Actions taken

Identification and pilot scale testing of 3 new CDW separation methods (attrition cell scrubbing, CFCU separation and spiral separation). Tests showed significant improvement in the quality of sand (the highest value product).

Definition of the detailed architecture of the robotic sorting system. 4 different sensor technologies (hyperspectral - NIR, SWIR and MWIR - cameras and RGB cameras) were tested and the most suitable methods to detect the different materials (normal and lightweight) were identified. Other components (robotic arm, conveyor belt, etc.) of the sorting system were also identified and installed.

Specific S&T objectives

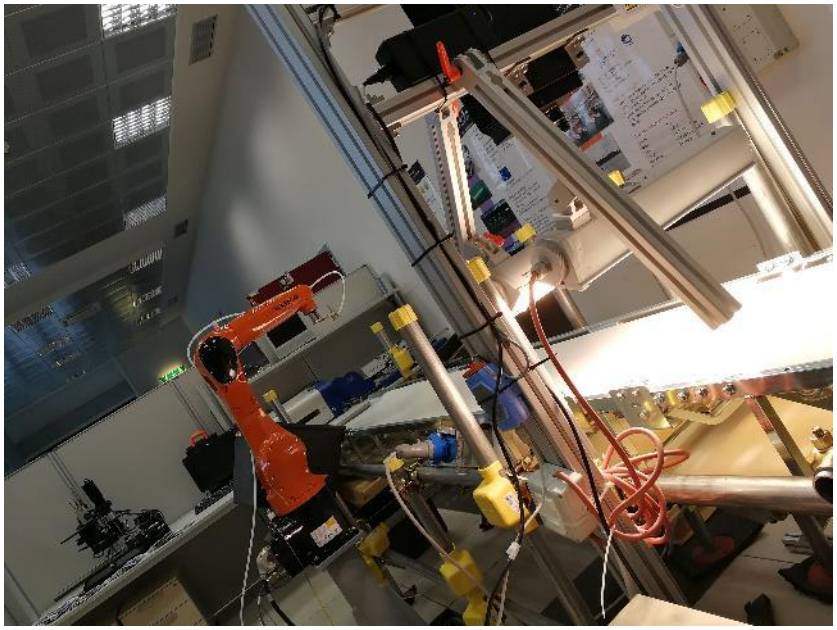
Actions taken

Laboratory built counter flow classification unit (CFCU) in CDE facility

CFCU during commissioning phase at a recycling plant in Glasgow, Scotland

Specific S&T objectives

Actions taken

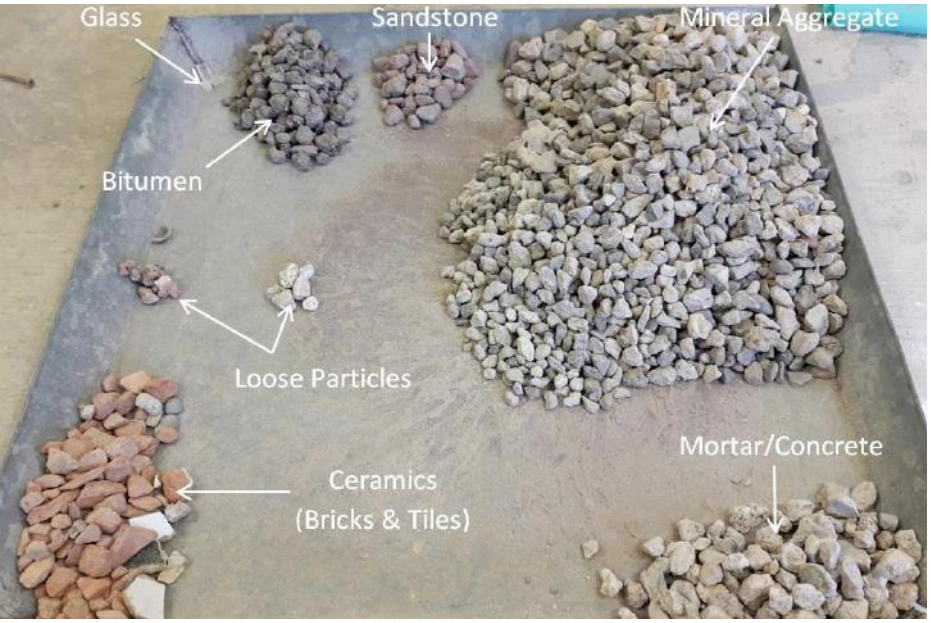


Robotic sorting system in Stam facility in Genoa, Italy

Stamtech and CDE members operating robotic sorting system at Sheehan's, Oxford

Specific S&T objectives

Actions taken



Assessment of CDW-derived materials properties for building elements (obj. 2)

Establishment of the quality of the output of sorting (sorted/unsorted mineral aggregates, lightweight, and timber) in a quantitative way, assessing the compliance of each sorted fraction against relevant National and European specifications. New quality classes will be defined identifying the optimal recycling strategy for each fraction of CDW.

Actions taken

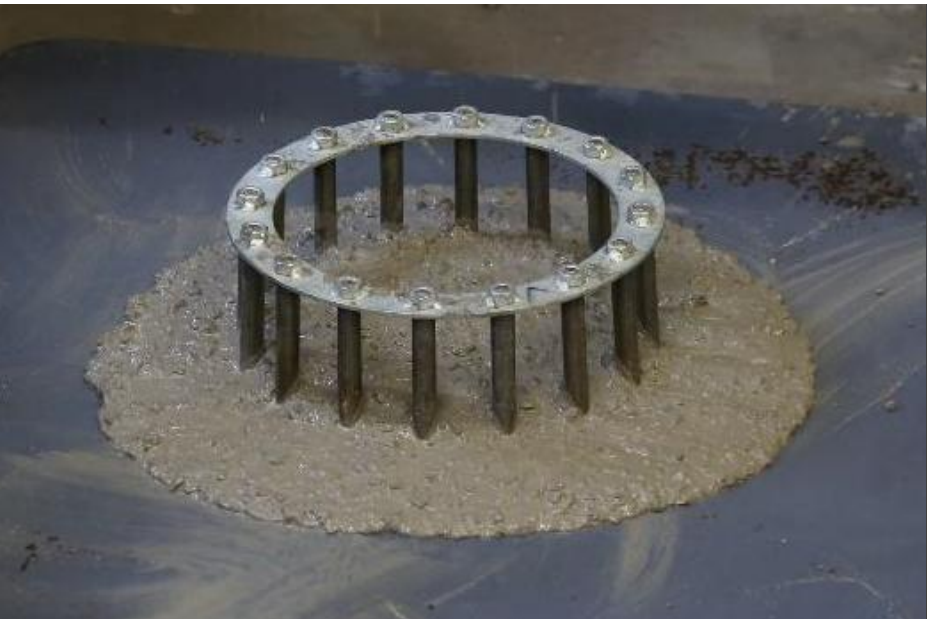
Geometrical, chemical and physical characterization of different sorted CDW fractions (S-EU and N-EU) and variability of the chemical-physical features of different sorted CDW fractions. New quality classes for CDW-derived aggregates were proposed with the aim to support the development of new standards in the field of CDW.

After carrying out trial mixes, the designed concretes reached the target strength and workability targets set by the manufacturers within the project.

Newly quarried aggregate replacement varied from 60-100% depending on the source of the recycled aggregate and the type of concrete produced.

Specific S&T objectives

Actions taken



Development of prefab elements integrating high level of CDW-derived materials (obj. 3)

Structural and non-structural prefab elements with CDW-derived materials will be designed for their assembling into the RE^4-prefab energy-efficient building concept. The replacement of traditional raw materials will minimize the environmental impact in terms of CO_2 thus contributing to energy savings.

Actions taken

Development of 5 materials incorporating CDW: concrete based on different binders (ordinary Portland cement-OPC, alkali activated binder-AAB) for structural and non-structural applications, lightweight insulating concrete, alkali activated binder from bricks and tiles, and earthen building materials.

Several features have been measured (e.g. physical, chemical, durability). The final validation and the replicability has been verified performed through Round Robin test involving all the laboratories.

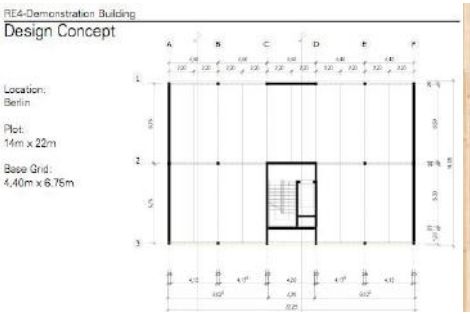
78% Average virgin material replacement

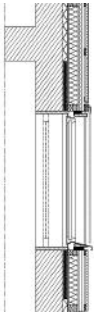
65% RE^4 goal

15% EEB04 target

Specific S&T objectives

Actions taken





Development of innovative design concepts for smart installation and disassembly (obj. 4)

An innovative design concept will be developed for modular/smart installation and disassembly/re-use of the RE4-prefab building, made of the RE^4-prefab elements (obj. 3)

Actions taken

Development of the design concept of the fully recycled, dismountable and modular RE^4 building and pre co-ordination of its demonstration in WP6.

The concepts is being designed so that multiple applications for different building typologies (e.g. residential, commercial) will be easy to implement.

RE^4 building elements is being designed to be tailored to different climatic (i.e. appropriate glazing ratio, thermal mass of insulation) as well as structural (i.e. anti-seismic) requirements of different geographic zones across Europe (UK, Italy and Spain) and outside EU (Taiwan).

Specific S&T objectives

Actions taken

CDE were responsible for the collection and logistics of material for WP5&6

Over 200 tonnes of material sent to the partners within the relevant work packages

Specific S&T objectives

Actions taken

RE^4 demonstration in industrial environment, testing and evaluation, replication (obj. 5)

Demonstration of the proposed RE^4 solutions for new constructions and refurbishment. Demonstration of the strategy for disassembly and reuse materials and structures from dismantled buildings. Replication of the RE^4 results in the EU (UK and Spain) and outside EU (Taiwan).

Actions taken

Definition of elements needed in the demonstration activities of WP6, preliminary definition of the building concepts (Spain, U.K., Italy, and Taiwan), and demonstration of sustainable strategies for disassembly developed in WP2.

The Spanish RE^4 building will be dismantled to validate deconstruction strategies developed in WP2 while the U.K. RE^4 building will used in the real life scenario as new offices for Creagh.

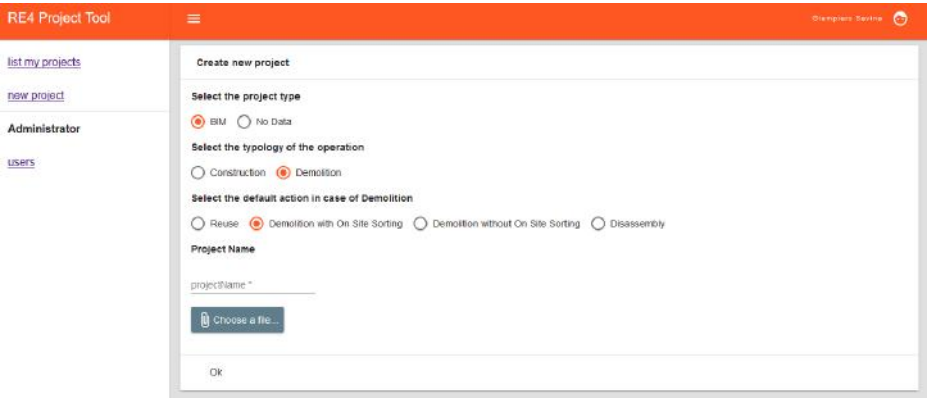
Specific S&T objectives

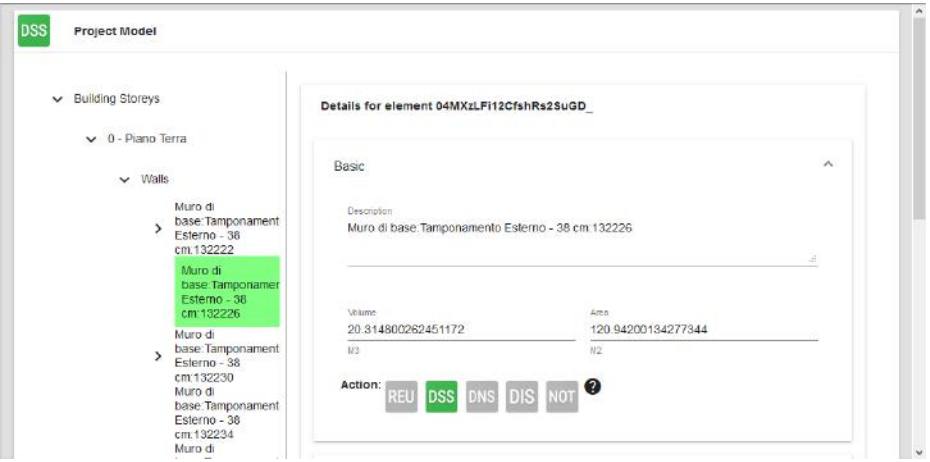
Actions taken

CREAGH CONCRETE

Specific S&T objectives

Actions taken





Development of a BIM-compatible DSS and platform for CDW management (obj. 7)

Development of a BIM-compatible tool to support owners and construction/demolition companies by providing an estimation of the types and quantities of CDW that will be generated during construction/demolition. The planning of the off-site production of the innovative components made with CDW is made possible.

Actions taken

Definition of the general platform of the DSS (Decision Support System) tool architecture. The DSS will make use of pre-defined rules, taking into account the building geometry, materials information, separation degree of the different materials and the Waste Volume adjustment factor (which correlates the volume of the building components to the volume of the material lot after demolition).

Specific S&T objectives

Actions taken

Enhancement of the sustainability and future applications of RE4 prefabricated products (obj. 6)

LCA, s-LCA, LCC, HSE analyses will be performed. Moreover, though RE4 products will not get certification during the project, support to their future industrial applications will be provided by the analysis and definition of the most convenient certification strategy and by the development of technical documentation (i.e. technical data sheets, declaration of properties, EPD declaration).

Actions taken

Development of a common assessment framework for the LCA, LCC and S-LCA.

Development of business models for industrial exploitation (obj. 8)

New business models will be developed at a wide implementation of the proposed approach and the related project results, enhancing their replication potential. An economic assessment will be performed to evaluate the profitability of the revenue model, to understand future cash flows and to highlight the need for additional funding or external investment to reach the first sales.

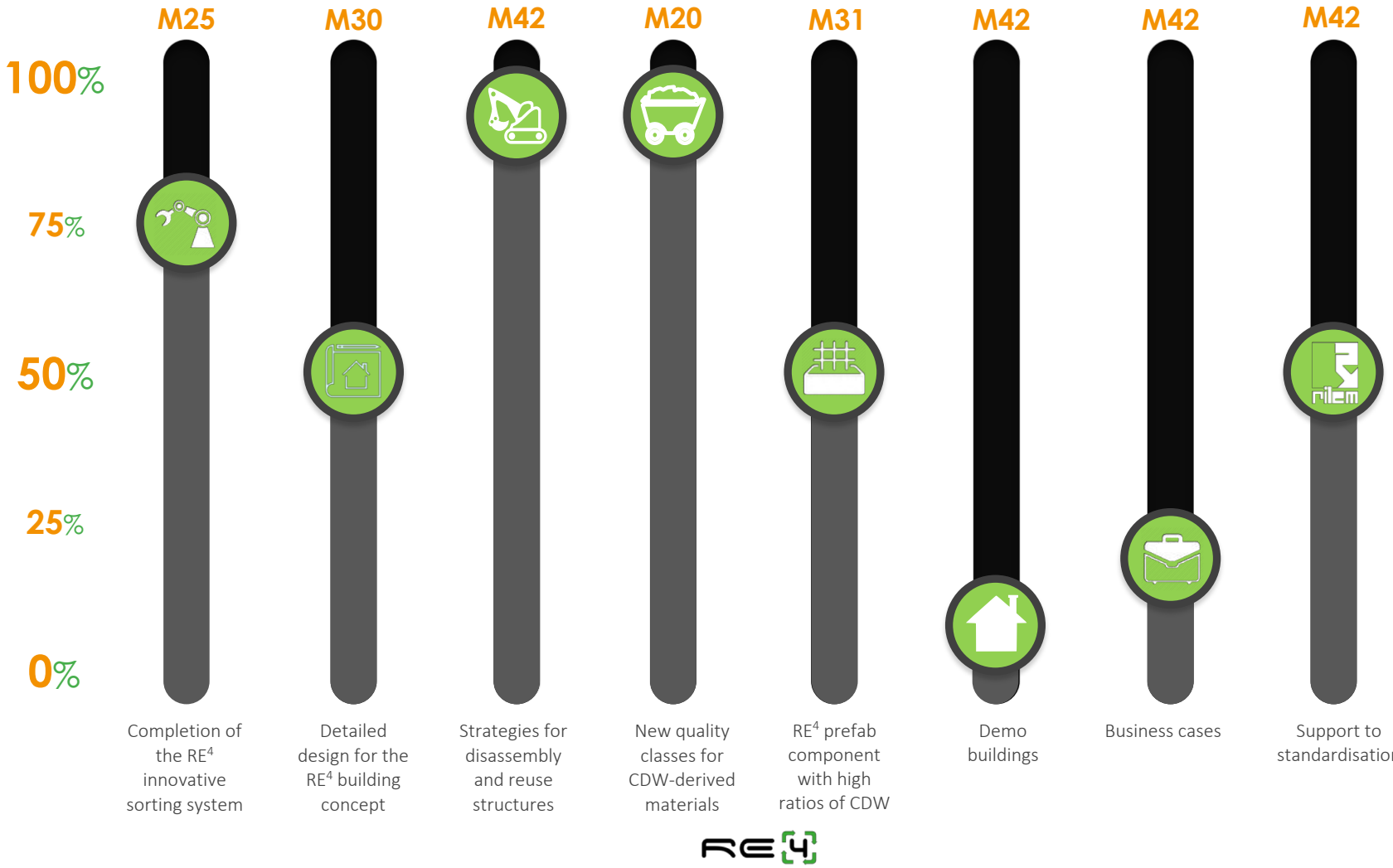
Actions taken

Activities related to this objective has started in M18.

Success indicators

RE[4] critical indicators against success criteria

Success indicators *RE⁴ critical indicators against success criteria*



RE4

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

Please visit our website www.re4.eu

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