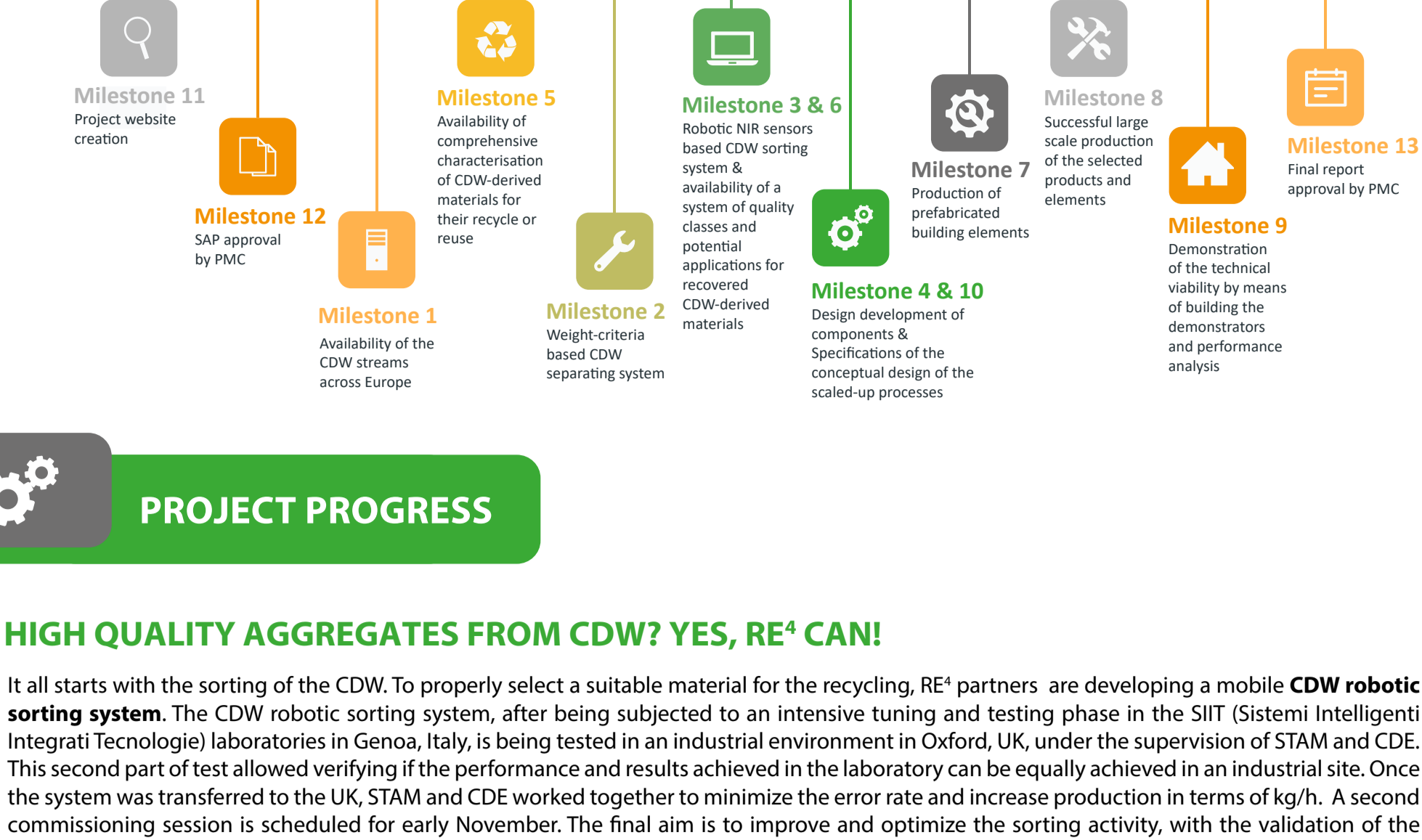


Dear Reader,
We are delighted to introduce the third edition of the RE⁴ newsletter. In this edition, we will share with you what types of prefabricated building materials we are able to produce from construction & demolition waste (CDW), progress made in the development of the sorting system, and of course a list of planned and past events.

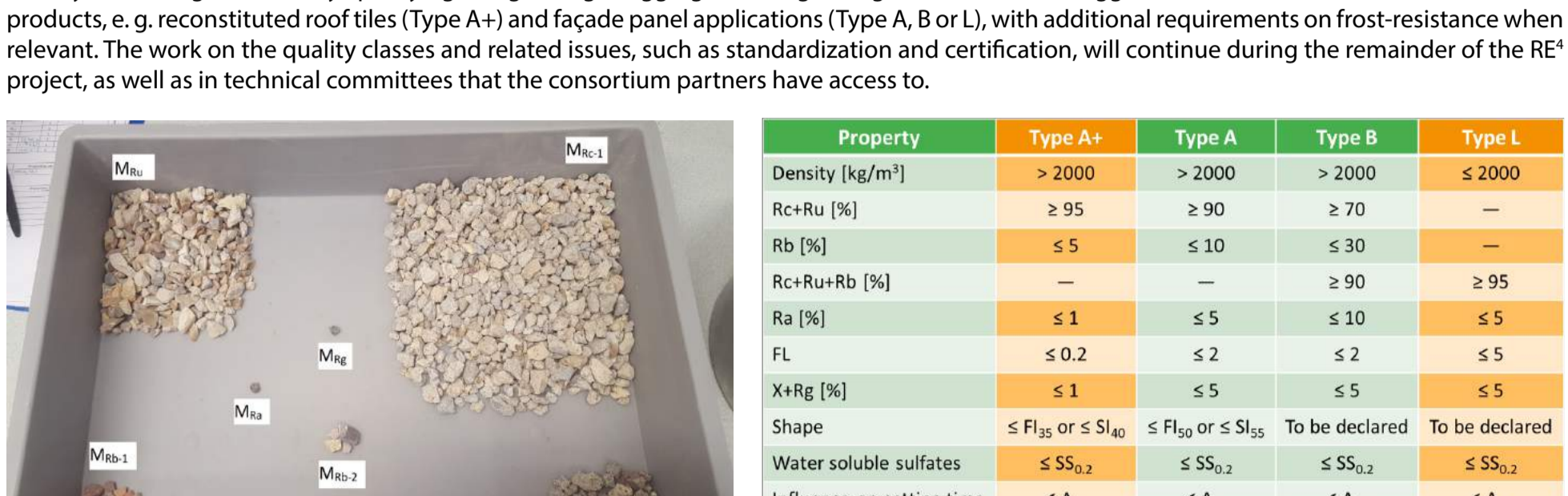
WHERE WE ARE



PROJECT PROGRESS

HIGH QUALITY AGGREGATES FROM CDW? YES, RE⁴ CAN!

It all starts with the sorting of the CDW. To properly select a suitable material for the recycling, RE⁴ partners are developing a mobile **CDW robotic sorting system**. The CDW robotic sorting system, after being subjected to an intensive tuning and testing phase in the SIIT (Sistem Intelligenti Integrati) laboratories in Genoa, Italy, is being tested in an industrial environment in Oxford, UK, under the supervision of STAM and CDE. This second part of test allowed verifying if the performance and results achieved in the laboratory can be equally achieved in an industrial site. Once this system was tested to the UK, STAM and CDE worked together to minimize the error rate and increase production in terms of kg/h. A second commissioning session is scheduled for early November. The final aim is to improve and optimize the sorting activity, with the validation of the robotic sorting system in an industrial environment.



When classifying coarse recycled mineral aggregates for use in new concrete, the constituent material is examined and quantified in relative proportions (see Fig. 2). Based on this quantification, the recycled aggregate is classified in the two quality classes **Type A** and **Type B**, which can be then used to vary extent in new concrete based on class and expected exposure class. **The novelty of our work** is a suggested refinement of the quality classes and their suggested limits of use, based on the extensive assessment of mineral CDW and its performance in concrete conducted in the RE⁴ project. Above the two already existing classes, two new are suggested: **Type A+** and **Type L** (see Tab.1).

The quality of classes Type A+ and Type A is suitable for use in concrete in load-bearing structures, whereas class Type B would be intended for applications in, for instance, concrete masonry units or in non-structural concrete. Type L should be used for mineral CDW, which have oven-dry density ≤ 2000 kg/m³, thereby qualifying as lightweight aggregate for lightweight concrete. The suggested classes can also be used for other products, e.g. reconstituted roof tiles (Type A+) and façade panel applications (Type A, B or L), with additional requirements on frost-resistance when relevant. The work on the quality classes and related issues, such as standardization and certification, will continue during the remainder of the RE⁴ project, as well as in technical committees that the consortium partners have access to.

Property	Type A+	Type A	Type B	Type L
Density [kg/m ³]	>2000	>2000	>2000	≤2000
Rc+Ru [%]	≥ 95	≥ 90	≥ 70	—
Rb [%]	≤ 5	≤ 10	≤ 30	—
Rc+Ru+Rb [%]	—	—	≥ 90	≥ 95
Ra [%]	≤ 1	≤ 5	≤ 10	≤ 5
FL	≤ 0.2	≤ 2	≤ 2	≤ 5
X+Rg [%]	≤ F ₁₅₀ or ≤ S ₁₄₀	≤ F ₁₅₀ or ≤ S ₁₄₀	≤ 5	≤ 5
Shape	≤ F ₁₅₀ or ≤ S ₁₄₀	≤ F ₁₅₀ or ≤ S ₁₄₀	To be declared	To be declared
Water soluble sulfates	≤ S _{5,1,2}	≤ S _{5,1,2}	≤ S _{5,1,2}	≤ S _{5,1,2}
Influence on setting time	≤ A ₁₀	≤ A ₁₀	≤ A ₁₀	≤ A ₁₀
Water absorption [%]	≤ 5	≤ 10	To be declared	To be declared

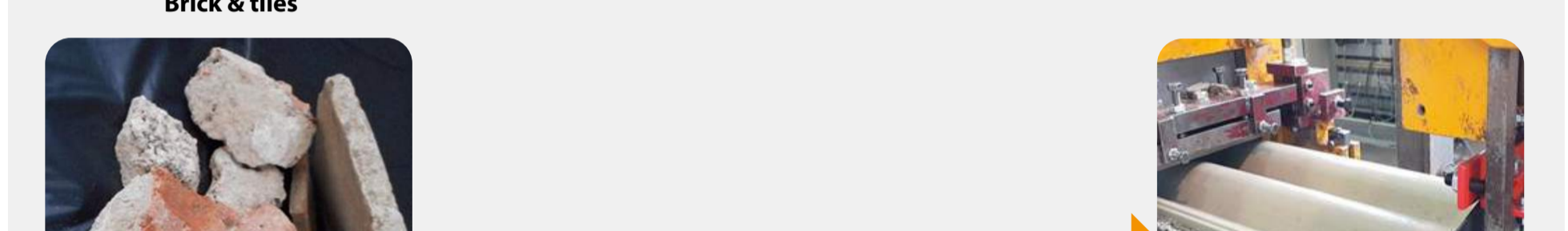
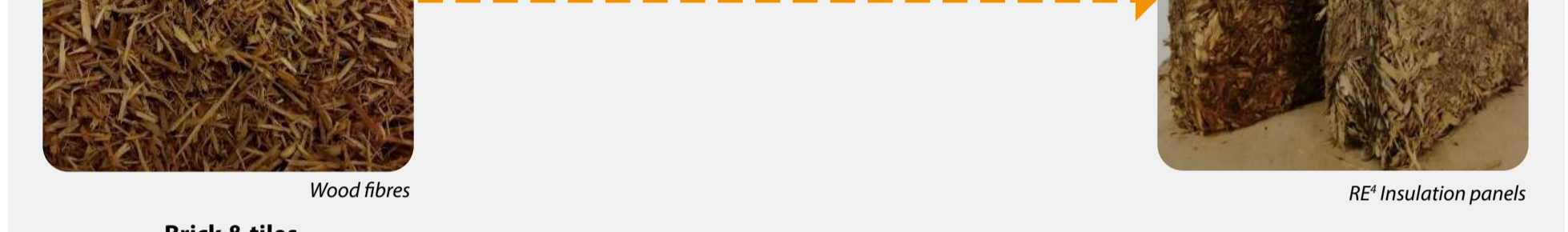
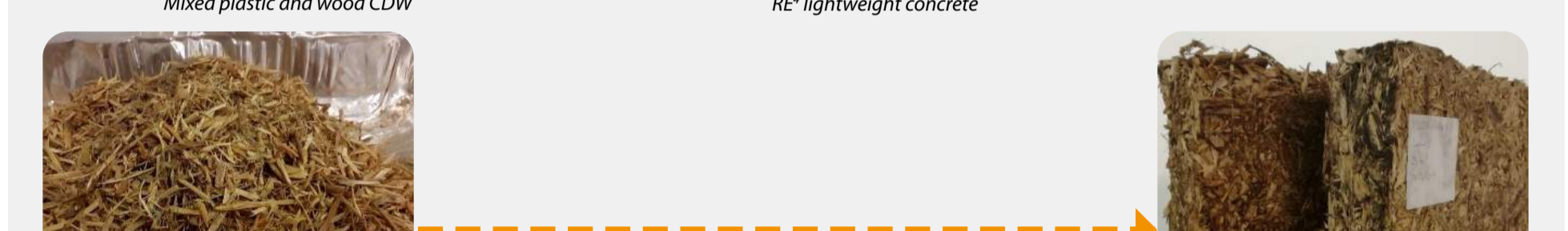
Fig. 2: Constituent classification of 8/16 mm sorted CDW from southern Europe. Following procedures of EN 206:2013 existing (green) and proposed by RE⁴ consortium (orange) quality classes: Type A+ mineral aggregate to be used in non-structural and structural concrete.

RE⁴ ECO-SUSTAINABLE COMPONENTS NOW AVAILABLE FOR YOUR GREEN BUILDING

Several sustainable building materials and components incorporating up to 100% of CDW (such as mineral aggregate of various size fractions, wood fibres, rigid plastic particles, bricks & tiles particles as well as large pieces of timber) were validated on lab scale:

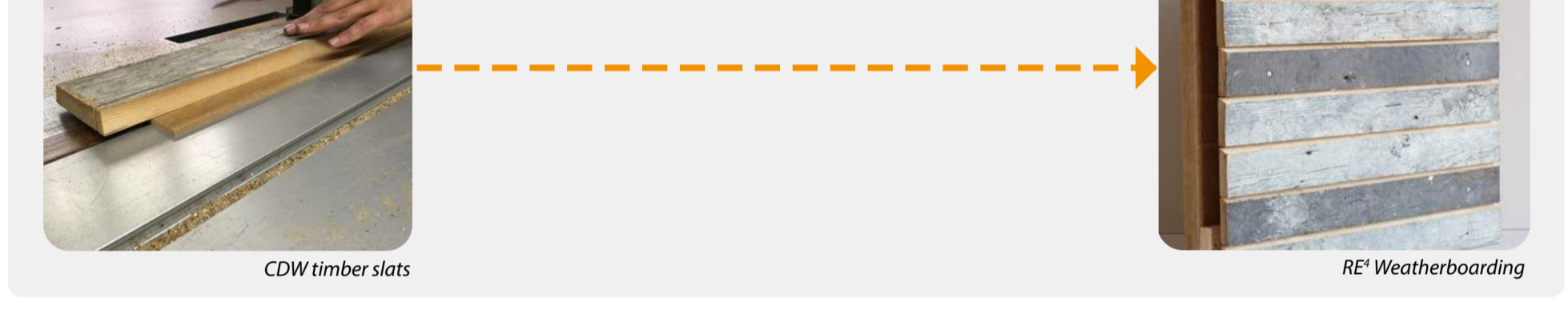
- self-compacting and vibrated concretes with mineral CDW aggregates and ordinary Portland cement;
- vibrated concretes with mineral CDW aggregates and alkali activated binders of different origin;
- lightweight concretes with CDW aggregates of different composition and ordinary Portland cement;
- earthen building materials with fine CDWs;
- concrete building blocks;
- reconstituted tiles;
- wood and plastic insulation panels;
- timber beams, columns and weatherboarding.

The general approach consisted in the optimization of innovative building solutions suitable for industrial applications aiming, at the same time, at the maximization of RE⁴ CDW usage. RE⁴ CDW has the potential to be used for green building materials and prefabricated components complying with target requirements set for industrial production. The physical and mechanical properties of RE⁴ materials and components comply with the requirements set by **European Standards and National Building Codes**.



* Other load bearing and non-load bearing components are under development.

SOCIAL MEDIA



Click on the picture and access the newest **interview about the RE⁴ project** with Professor Marios Soutsos from the Queen's University Belfast.

FENIX TNT created the **very first graphic video** describing the RE⁴ project, our goals, partners, products, sorting system and much more. Click on the picture and access the project YouTube channel.

RE⁴ project is on **Instagram** too! Find us as "re4_project" and give us a follow!

PARTNERS



YOU CAN ALSO FIND US ON: www.re4.eu

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UPCOMING EVENTS

8th ECTP Conference
CETMA and FENIX TNT will present the RE⁴ project during the upcoming edition of the ECTP conference "When EU Construction Industry shapes high-tech Sustainable Built Environment". The 8th ECTP open Conference will take place in Brussels on 13th-14th November 2018, and will be dedicated to presentation and discussion of current and anticipated innovation in the built environment field.

SeRaMCo Conference
CETMA will attend the SeRaMCo: "Secondary Raw Materials for Concrete Precast Products" conference and introduce the RE⁴ project there. Initiated in 2017 with 10 European partners, SeRaMCo aims to replace primary raw materials with the high-quality materials recycled from construction and demolition waste. The conference will take place on 28th - 29th November 2018 in Luxembourg.

BAMB Final event: Buildings as Material Banks – A Pathway for a Circular Future
The partners from ZRS Architekten will present our project at the BAMB's final event "BUILDINGS AS MATERIAL BANKS – A PATHWAY FOR A CIRCULAR FUTURE" that will be held in Brussels on 5th to 7th February 2019. The BAMB final event is part of the worldwide prestigious SBIE19 Conference Series.

Circular Hub: Circular economy in the construction sector
RE⁴ project was presented during the event co-organised by FENIX TNT "Circular Hub: Circular economy in the construction sector" on 20th September 2018 in Prague, Czech Republic. FENIX TNT had a chance to introduce the RE⁴ project to more than 70 attendants from various fields: industry, ministry representatives, municipality representatives, architects, associations, universities, etc.

International Symposium on Earthen Structures (ISES2018)
Our project was also introduced outside Europe; partners from ZRS Architekten had a chance to share the project with the participants of the International Symposium on Earthen Structures in Bangalore, India on 22nd- 24th August 2018. The symposium provided an international forum for information dissemination and exchange, discussions and debates on research and sustainable practice in the broad field of earthen structures, including materials, building techniques, climate responsive architecture, building-comfort, energy in buildings, climate-change mitigation and emission reduction.

Circular Driven Economy Symposium
Two RE⁴ partners, CDE Global and Queen's University Belfast, presented the RE⁴ project during the Circular Driven Economy Symposium, which took place in London on 18th and 19th September 2018. The symposium covered a range of topics with industry experts discussing ways to explore high-value opportunities for recovered C&D waste recycling materials.

Expert dialogue: Use of Recycled Concrete (RC-Concrete) and 1st Symposium on the application of RC
Berlin's Senate Department for the Environment, Transport and Climate Protection organized the first expert dialogue focused on the use of recycled concrete. This event took place on the 18th and 19th September 2018 in Berlin, Germany. RE⁴ representatives from RISE attended this dialogue and introduced our project. Partners from ZRS Architekten also attended the symposium focused on the application of the recycled concrete and shared the project and its brochures with more than 100 participants.

ReSiELP Project: "Go to Market" Technical Workshop
CETMA has taken part in the "Go to Market" Technical Workshop of ReSiELP European Project, arranged at the offices of EIT - European Institute of Innovation and Technology - Raw Materials on 12th September 2018 in Berlin. CETMA has interacted with the participants bringing its experience on the huge potentialities of recycled materials for the building sector such as glass recovered from PV-panels, industrial by-products of different origin as well as construction and demolition wastes in the RE⁴ project.

14th International Conference on Concrete Engineering and Technology (CONCET)
Partners from the Queen's University Belfast presented our project at 14th International Conference on Concrete Engineering and Technology and Workshop on Sustainable Construction and the Ability to Deliver Climate-Resilient Infrastructure in Kuala Lumpur on 7th - 10th August 2018. CONCET is a biennial international conference organized by the University of Malaysia, Institute of Engineers Malaysia and Universiti Teknologi MARA.

RISUD Annual International Symposium 2018
From 28th to 30th July, partners from the National Taiwan University of Science and Technology presented our project at the RISUD Annual International Symposium (RAIS) Series in Hong Kong. The symposium aimed to provide an international platform for in-depth exchanges in key areas related to sustainable urban development and to serve as a catalyst for international collaboration.

International Conference on Applied Mineralogy & Advanced Materials 2018
CETMA representatives presented the RE⁴ project at the International Conference on Applied Mineralogy & Advanced Materials 2018 on 24th - 26th July 2018 at Polytechnic University of Bari (Italy). They introduced some of the results related to the development of precast components and elements from CDW and got a lot of interest and positive feedback on the presented building solutions.

Chinese delegation visit at CETMA's premises
On 5th July 2018, a Chinese delegation composed of representatives of the Industrial Association of Shanghai, entrepreneurs and journalists, visiting the Apulia region for a prospecting business travel, made a stop at CETMA's premises. The DCE Area had the opportunity to present to visitors the goals, activities and main results of RE⁴ project obtained in its first 18-month period. Although China is one of the most advanced countries in the thematic areas covered by RE⁴, the visitors have been very impressed by team capacities and project ambition.

Sustainable places 2018
On June 27th and 28th 2018, INES Research & Development hosted the Sustainable Places Conference 2018, an official EU Sustainable Energy Day aimed to foster innovative market solutions and empower synergies between Energy-efficient Buildings (EEb) and the interdependent smart grids, policies, construction actors, and forward-thinking communities. More than 165 delegates including the RE⁴ representatives from STAM participated.

Cities in Transition: The Future is Circular
Representatives of the RE⁴ project from ZRS Architekten presented our project at the "CITIES IN TRANSITION: THE FUTURE IS CIRCULAR". To exchange practical knowledge and discuss specific proposals for solutions, the symposium addressed the following topics: MATERIALS & BUILDINGS AND CITY & SOCIETY. The event took place on 27th June in Berlin. (Photo credits: Ulrich Rossmann)

China Academy of Building Research representatives visited FENIX TNT
RE⁴ project was introduced to the representatives of the China Academy of Building Research (CABR) who visited the FENIX TNT premises in Brno, Czech Republic on 26th June 2018. CABR is the largest comprehensive R&D institution in the building sector in China. Their research and business cover 70 fields of such specialties as building structure, soil foundation, earthquake-resistance engineering, building environment, etc.

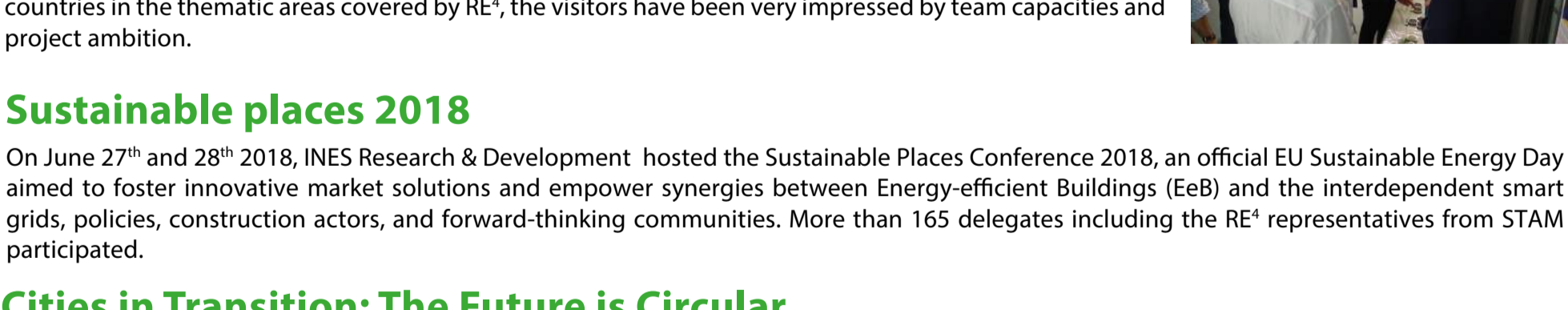
Arise Symposium at U Twente Circularity Through Design
RISE representatives presented our project during the Arise Symposium at U Twente Circularity Through Design on 31st May 2018 in the Netherlands. Arise's symposium aimed to be a highly interactive event for both seasoned experts and entry-level professionals and students. This symposium provided a unique opportunity to meet, share and discuss circularity in the field of design-research for sustainability and energy, in a forum.

International Conference on Alkali Activated Materials and Geopolymers
Representatives of the Queen's University Belfast presented the RE⁴ project at the International Conference on Alkali Activated Materials and Geopolymers: Versatile Materials Offering High Performance and Low Emissions from 27th May to 1st June 2018. This conference aimed to collect scientific and industrial contributions, to find technical solutions enabling the application of geopolymers and related materials, to reduce waste and emissions in ceramic and cement manufacturing, and to provide high-performance materials.

Oscar Masi Prize 2017
Italian Association for Industrial Research awarded the Oscar Masi Prize for 2017 to ITC-CNR (Istituto per le Tecnologie della Costruzione - Consiglio Nazionale delle Ricerche) for its activities performed in the RE⁴ Project as Linked Third Party of STRESS Scarl. The prize is dedicated to the Enabling technologies and innovative solutions for the sustainable city. The Oscar Masi prize, reserved to the associated members of the category Public Research Bodies and Universities, was assigned by a special jury composed of representatives from the association and from the Italian Ministries for University and Research and for Economic Development and presented on May the 24th 2018 during the AIRI Industrial Innovation Day.

ConWEEB Workshop
On Thursday 24th May 2018, RE⁴ project was presented at the CONWEEB Workshop in CSIC Office in Brussels. It was a great opportunity to meet professionals and representatives of H2020 European projects that are dealing with turning construction waste into energy-efficient buildings. The attendants had a chance to see not only our project but also, VEEP project, Green Instruct project and InnoWee project. RE⁴ was presented by partners from the QUEEN'S UNIVERSITY OF BELFAST, ZRS ARCHITECTEN INGENIEUR, FENIX TNT and CDE.

IBF – International Building Fair
FENIX TNT, as the dissemination leader of the RE⁴ project, represented the project at Building Fairs in Brno, Czech Republic. From 25th to 28th April 2018 more than 40 000 visitors had a chance to see a unique presentation of all aspects of housing and house constructions, building management services, technical solutions and equipment.



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