Nuovi sviluppi per i materiali per l'edilizia
Lecce, 1st July 2015

ECO-Binder

INSULATING CONCRETE SYSTEMS BASED ON
NOVEL LOW CO_2 BINDERS

Rossella Modarelli
D'Appolonia SpA

"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 637138."

The Origin

The Project derives from previous work performed by 3 of the **world's largest building materials companies:**

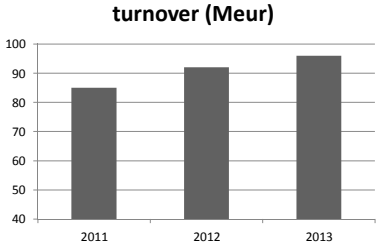
- **Heidelberg Cement,**
- **Lafarge**
- **Vicat**

	Heidelberg Cement	Vicat	Lafarge
Sales 2014 (billion)	12,6	2,4	12,8
Employees	44.900	7.750	63.000
Countries	40	11	61

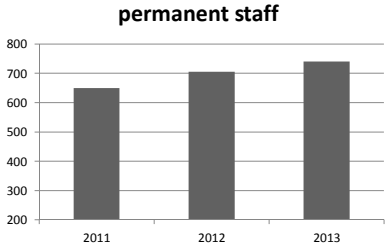
D'Appolonia

A team of engineers, consultants, designers, planners and specialists supporting Clients from concept to decommissioning, through consultancy, design, management and operation & maintenance engineering

D'Appolonia



95,2 M€ turnover in 2013



1,4 Million hours per year

20 OPERATING OFFICES WORLDWIDE

D'Appolonia

ENERGY

TRANSPORT & INFRASTRUCTURES

IFIs & INVESTORS

ENVIRONMENT & SUSTAINIBILITY

HEALTH, SAFETY & LOSS PREVENTION

MARINE & TERRESTRIAL GEOSCIENCES

ELECTRONICS

MOBILITY & LOGISTICS

SPECIALISED STUDIES & MODELLING

PROJECT & CONSTRUCTION MGMT

MULTIDISCIPLINARY DESIGN

OPERATION & MAINTENANCE

INVESTMENT SAFEGUARD

INNOVATION CONSULTING

Data:
sabato 04.04.2015

Il Sole 24 ORE

Estratto da Pagina:
1-2

NOI E GLI ALTRI

Fondi Ue per la ricerca, il ritardo dell'Italia

Tasso di successo dei progetti presentati sui fondi Ue e, affianco, posizione nella top 50 dei proponenti

Fonte: Commissione Ue

ENTI DI RICERCA

Posizione	Ente	Paese
1	Centre National de la Recherche Scientifique	Fr
2	Fraunhofer-Gesellschaft	De
3	Commissariat a l'Energie Atomique et aux Energies Alternatives	Fr
4	Agencia Estatal Consejo Superior de Investigaciones cientificas	Es
5	**Consiglio Nazionale delle Ricerche**	**It**
19	**Centro Ricerche Fiat Scpa**	**It**
25	**Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile**	**It**
41	**Fondazione Istituto Italiano di Tecnologia**	**It**
43	**Agenzia per la Promozione della Ricerca Europea**	**It**
48	**Istituto Nazionale di Fisica Nucleare**	**It**

UNIVERSITÀ

Posizione	Ente	Paese
1	The University of Cambridge	Uk
2	The University of Oxford	Uk
3	Imperial College of Science, Technology and Medicine	Uk
4	University College London	Uk
5	Eidgenoessische Technische Hochschule Zuerich	Ch
6	Katholieke Universiteit Leuven	Be
7	École Polytechnique Federale de Lausanne	Ch
8	Danmarks Tekniske Universitet	Dk
35	**Politecnico di Milano**	**It**
37	**Alma Mater Studiorum-Università di Bologna**	**It**

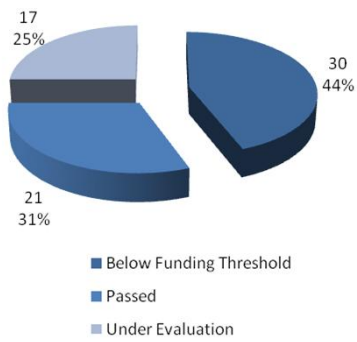
IMPRESE

Posizione	Ente	Paese
1	Atos Spain Sa	Es
2	Siemens Aktiengesellschaft	De
3	Thales Communications & Security Sas	Fr
4	**D'Appolonia Spa**	**It**
5	Telefonica Investigacion y Desarrollo Sa	Es
6	**StMicroelectronics Srl**	**It**
10	**Selex Es Spa**	**It**
18	**Engineering-Ingegneria Informatica Spa**	**It**
21	**Telecom Italia Spa**	**It**
28	**Alenia Aermacchi Spa**	**It**

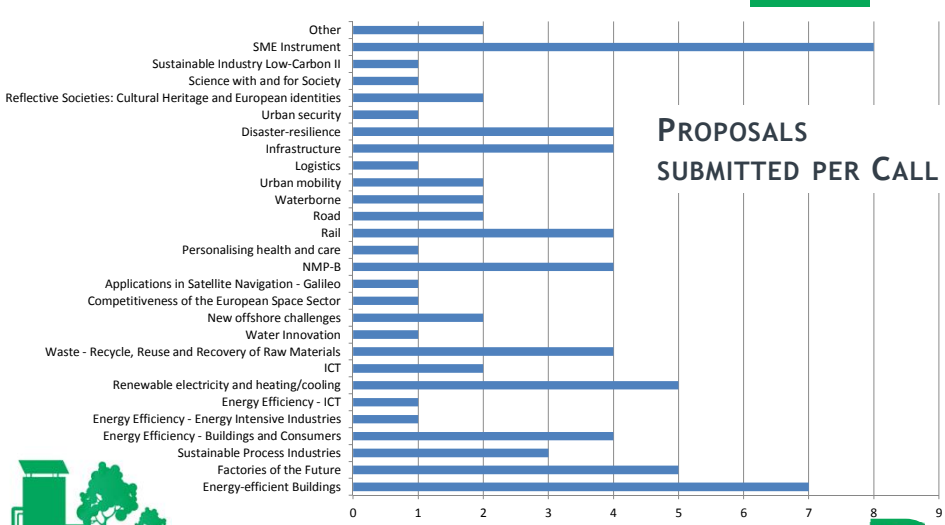
D'Appolonia - H2020

PROPOSALS SUBMITTED 68 ACTUAL SUCCESS RATE 31%

STATUS OF PROPOSALS (OVERALL)



D'Appolonia



ECO-Binder Consortium

Partner name	Country
D'APPOLONIA SPA	Italy
HEIDELBERGCEMENT AG	Germany
LAFARGE CENTRE DE RECHERCHE SAS	France
VICAT	France
BUILDING RESEARCH ESTABLISHMENT LTD	United Kingdom
TEKNOLOGISK INSTITUT	Denmark
NATIONAL TECHNICAL UNIVERSITY OF ATHENS	Greece
NOVEL TECHNOLOGIES CENTER SRL	Romania
GEONARDO ENVIRONMENTAL TECHNOLOGIES LTD	Hungary
ACCIONA INFRAESTRUCTURAS SA	Spain
NUOVA TESI SYSTEM SRL	Italy
FUNDACION TECNALIA RESEARCH & INNOVATION	Spain
FENIX TNT SRO	Czech Republic
MUNICIPIUL DROBETA TURNU SEVERIN	Romania

The Challenge

- Concrete is the most widely used man-made material on Earth (annual consumption of around **10 billion m³**).
- Traditional Ordinary Portland Cement (OPC) provides desired levels of strength and durability, however, its production is associated with **high CO_2 release**.
- The CO_2 emissions related to the fabrication of currently around **3.5 billion tons p.a.** are amounting to approximately **5%** of the worldwide anthropogenic GHG emissions.
- Prefabrication/precasting are indeed key to address the challenge of retrofitting the **210 million existing buildings** in Europe.
- Reduction of the **embodied energy** of the construction materials employed and the energy demand during the usage phase through applying better performing insulation materials and lightweight systems.

Objective of the project

- The main objective of the project is to demonstrate the feasibility of replacing **Ordinary Portland Cement** (OPC) and OPC based concrete (products) with new products based on the innovative **Belite-Ye'elimite-Ferrite** (BYF) class of low-CO_2 binders.
- ECO-Binder aims to address the vast market for envelope retrofitting and new construction with a new generation of prefabricated building envelope components with:

30% carbon footprints decreased

20% insulating properties improved

15% cost reduced

relative to current solutions based on Portland cement.

Objective of the project

In order to be cost-effective and sustainable in a highly-competitive market, the new building envelope solutions will integrate even more functions in a single product package.

HIGHER PERFORMANCES IN TERMS OF SAFETY AND COMFORT

acoustic insulation / absorption, fire and mold resistance, dimensional stability, indoor air quality

SUPERIOR DIMENSIONAL STABILITY

to allow precise dimensional fit into existing buildings while avoiding air or water leaks

REDUCED PRODUCTION COST

reduced manufacturing costs to allow affordable mass applications in building retrofitting

Concept

The project aims at developing a novel family of low CO_2 binders based on the following phases:

- **Belite,**
- **Ferrite**
- **Ye'elimite**

→ **BYF cements**

Individual carbon footprint of Portland and BYF cement phases

Phase	Phase & Cement notation	Synthesis from	tCO_2/t phase	tCO_2/m^3 phase
$3CaO \cdot SiO_2$	Alite (C_3S)	Limestone + quartz	0.58	1.82
3CaO·Al2O3	Aluminate (C_3A)	Limestone + bauxite	0.49	1.48
$2CaO \cdot SiO_2$	Belite (C_2S)	Limestone + quartz	0.51	1.68
$4CaO \cdot Al_2O_3 F_2O_3$	Ferrite (C_4AF)	Limestone + bauxite	0,36	1,29
$4CaO \cdot 3Al_2O_3 \cdot SO_3$	Ye'elimite ($C_4A_3\$$)	Limestone + bauxite + anhydrite	0.22	0.56

Concept

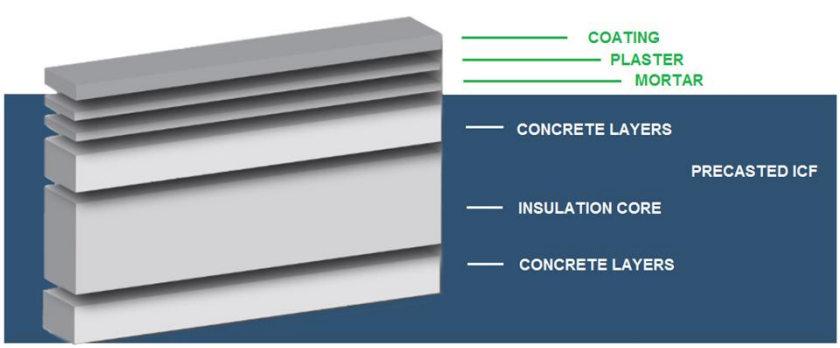
- In BYF technology, the superior early age strength contribution of **calcium-sulfo-aluminates** (CSA) is combined with durability provided by **belite**.
- The raw materials and the production process for BYF cements, are similar to those of OPC, but the CO_2 emissions are lower as shown in preliminary LCA calculations due to:
  - ✓ lower calcium content of the raw materials (less limestone usage)
  - ✓ lower clinker burning temperature of around 1250-1300°C
  - ✓ lower grinding energy demand.

  These same factors also results in a significantly **lower embodied energy** than OPC.

Concept

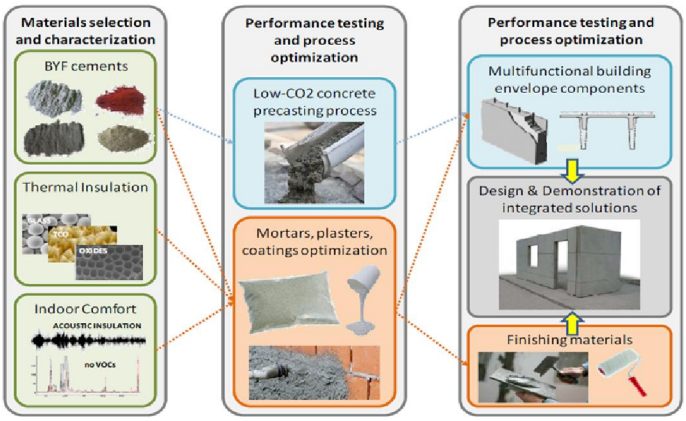
- Combining these novel binders with insulating materials and advanced functional finishing methods will permit the development of novel concrete systems with **low CO_2** and **low embodied energy** suited for a wide range of **envelope components**, without compromising technical, health and environmental standards.
- Material science research on BYF cement and concrete and on advanced finishing materials like mortars, plasters, paints or coatings, will lead to the development of concrete elements with **reduced embodied energy**, **improved insulation** properties and providing multifunctional surface properties like:
  - ✓ thermal reflection
  - ✓ antibacterial
  - ✓ anti-stain
  - ✓ self-cleaning

Insulating Concrete Forms



Methodology

- Innovation activities and bridging barriers to market for building envelope components made with low CO_2 BYF binders.

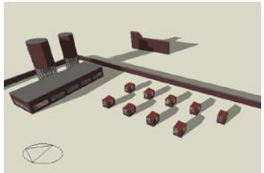


Demonstration

- Prefabricated concrete systems of different complexity (from ordinary blocks to sophisticated insulated wall panels) and end-use will be installed in **different climatic conditions** for demonstration purposes and their environmental performance will be validated through dedicated LCAs.
- Pre-cast products developed in this project are intended for new construction as well as for deep retrofitting, as for example the renovation of commercial buildings or social housing construction.
- The approach taken within the ECO-Binder project will lead to the development of a novel family of cement binders. This will enable the construction materials sector to progress towards commercializing eco-sustainable products with comparable performance to traditional products.

Demonstration

ACCIONA´s Demo-Park



Retrofitting at Tecnalia´s KUBIK

Retrofitting at Severin Municipality buildings

Durability and performance testing at BRE

Thank you for you attention

For further project information please contact:

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www.ecobinder-project.eu