Design for Resource and Energy efficiency in cerAMic kilns

Project Overview

Finance for Innovation:
Towards the ETS Innovation Fund
Workshop 3: Glass & Ceramics
6 April 2017

Luis Guaita

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723641

BASIC FACTS

Total cost: EUR 5 076 105 **EU contribution:** EUR 5 076 105 **Coordinated by:** SACMI FORNI SPA	**Topic(s):** SPIRE-04-2016 - Industrial furnace design addressing energy efficiency in new and existing furnaces **Call for proposal:** H2020-SPIRE-2016 **Funding scheme:** RIA - Research and Innovation action	**Start date:** 2016-10-01 **End date:** 2019-09-30 **Total duration:** 36 months

SPIRE
Sustainable Process Industry through Resource and Energy Efficiency

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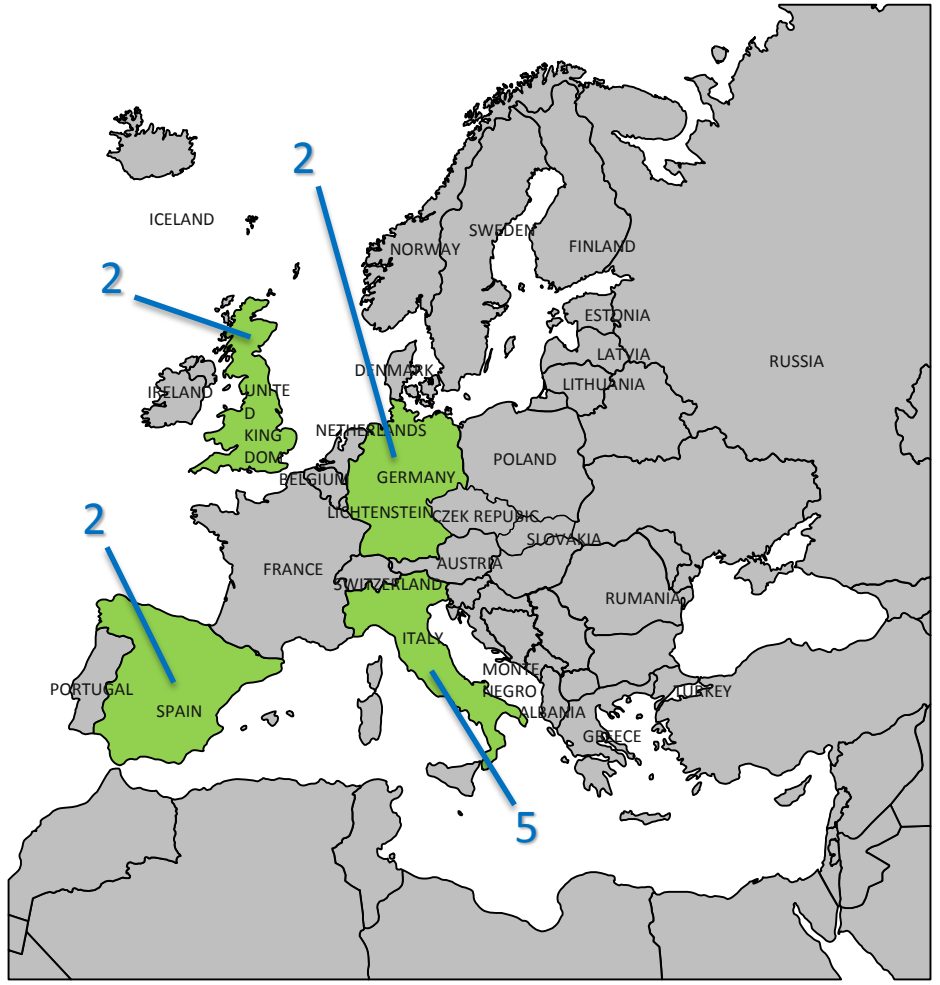
CONSORTIUM

No	Participant organisation name	Acronym	Country
1 (Coord.)	SACMI FORNI SPA	SAC	Italy
2	INSTITUTO DE TECNOLOGÍA CERÁMICA	ITC	Spain
3	UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA	UMR	Italy
4	ECONOTHERM LIMITED	ECO	United Kingdom
5	SYNESIS SOCIETA' CONSORTILE A RESPONSABILITA' LIMITATA	SYN	Italy
6	FORSCHUNGSGEMEINSCHAFT FEUERFEST EV	FGF	Germany
7	RATH GMBH	RAT	Germany
8	BRUNEL UNIVERSITY LONDON	BRU	United Kingdom
9	CENTRO DI RICERCA E INNOVAZIONE TECNOLOGICA SRL	CRI	Italy
10	KERABEN GRUPO SA	KER	Spain
11	MIRAGE GRANITO CERAMICO S.P.A.	MIR	Italy



The multidisciplinary consortium comprises **11 partners**:
6 Industrial partners closely collaborating with group of
5 Research organizations.

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OBJECTIVES

- To design, develop and demonstrate a **RADICALLY IMPROVED ARCHITECTURE FOR CERAMIC INDUSTRIAL FURNACES**, characterised by:
  - optimised **ENERGY** consumption
  - reduced **EMISSIONS**
  - lower operating **COSTS**
- DREAM specific objectives:
  - O1 – To design innovative hardware furnace components improving energy efficiency (biofuel-fed CHP unit, heat pipes, emission abatement system)
  - O2 – To introduce substantial improvements on current hardware-software kiln parts (kiln control tool, refractory materials)
  - O3 – To test the DREAM solutions in a variety of industrial settings (retrofitting and pilot kiln demonstrators)
  - O4 – To pave the way for a full seizure of DREAM related market opportunities (dissemination, exploitation within the ceramic sector and market replication)

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AMBITION

- DREAM will develop and demonstrate technologies enabling a **significant advancement in the sustainability of ceramics processes**, implementing **5 synergic lines of research and 3 industrial demonstrators**, which will act as technological showcases for market deployment. Such approach will enable to advance, in the 5 lines of research, **from TRL4 to TRL6**.

- DREAM will strongly contribute to both the sustainability and competitiveness of the European ceramics and process industries. In particular, the DREAM technologies will earn an overall **20% opex and energy consumption reduction for industrial furnaces**, with an **average investment payback time for end users lower than 3 years**.

- The DREAM coordinator and industrial partners **are technology and market leaders in the ceramics equipment field**, and this will streamline the translation of the DREAM research results into successful products and services.

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LINES OF RESEARCH

WP1 - Biofuel-fed CHP Unit
WP2 - Kiln modelling simulation and control
WP3 - Heat Pipes & Waste Heat Recovery
WP4 - Innovative solution for Refractory Materials
WP5 - Emission monitoring and abatement

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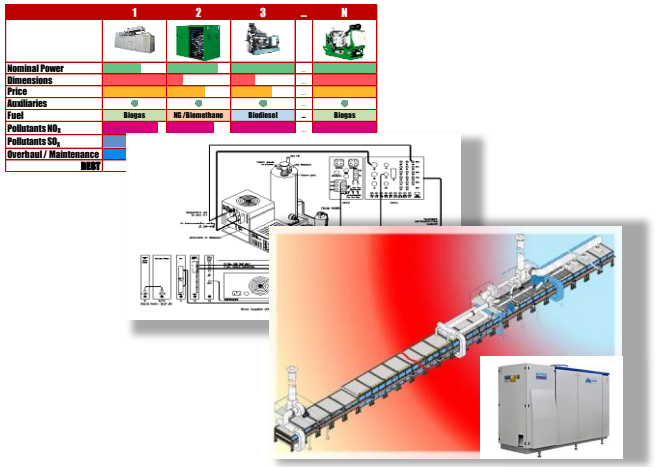
WP1 - Biofuel-fed CHP Unit

WP1 is subdivided into the following task:

- T1.1 → Tecnology benchmarking (**CRIT**)
- T1.2 → Technical specifications (**SYNESIS**)
- T1.3 → CHP installation (**SACMI**)



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WP1 - Biofuel-fed CHP Unit

WP1 will involve the following kiln area/areas:

CHP thermal power

CHP electrical power

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WP2 - Kiln modelling simulat. and control

WP2 is subdivided into the following task:

- T2.1 → Termo-mechanical product modelling (**ITC**)
- T2.2 → Thermal energy exchange modelling (**UMR**)
- T2.3 → Kiln overall simulation (**UMR**)
- T2.4 → Kiln control algorithm and tool (**SYNESIS**)

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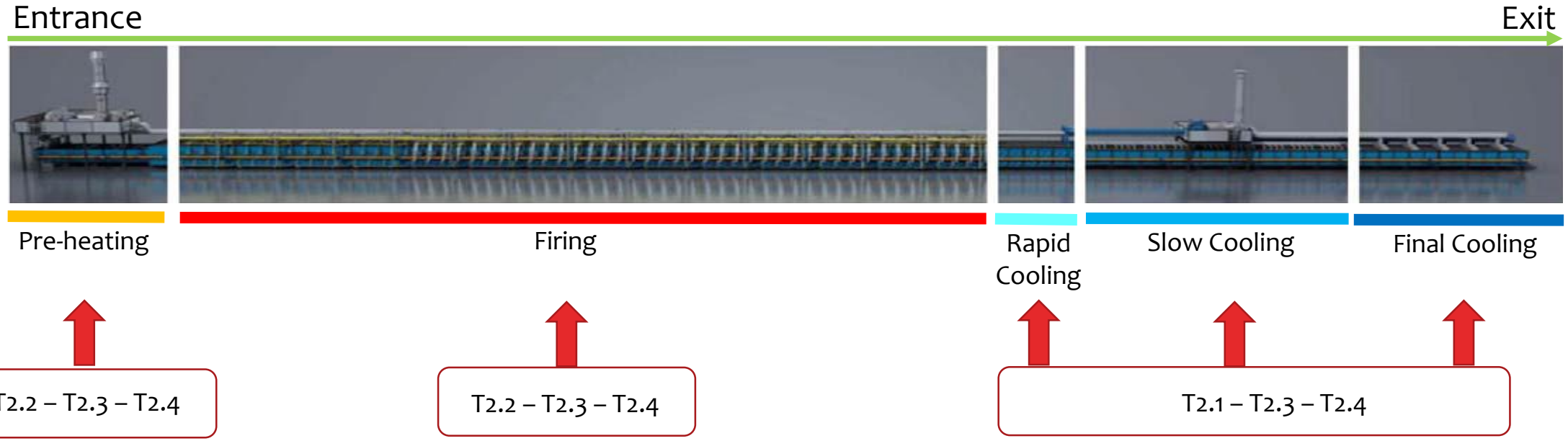
WP2 - Kiln modelling simulat. and control

The WP2 will involve the following kiln area/areas:



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WP3 - Heat Pipes & Waste Heat Recovery

The WP3 are subdivided into the following task:

- T3.1 → Thermal and chemical characterize./analysis (**BRUNEL**)
- T3.2 → Modelling design and optimiz. of a Lab-scale HPAP (**BRUNEL**)
- T2.3 → Manufacture and validation of full-scale HPAP (**ECONOTHERM)**

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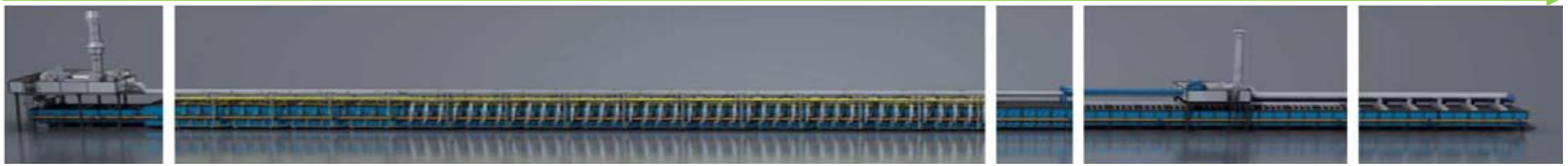
WP3 - Heat Pipes & Waste Heat Recovery

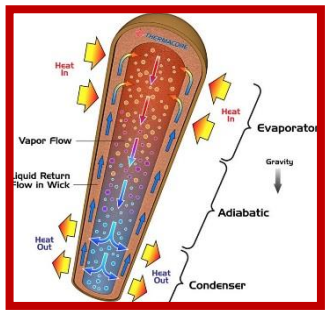
WP3 will involve the following kiln area/areas:

Entrance

Exit



Slow Cooling



Full-scale HPAP

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WP4 - Innovative solution for Refractory Materials

WP4 are subdivided into the following task:

- T4.1 → Innovative refractory materials with reduced heat transfer within the materials (**RATH**)
- T4.2 → Innovative refractory materials with reduced heat transfer from the kiln atmosph. into the refractory materials (**FGF**)

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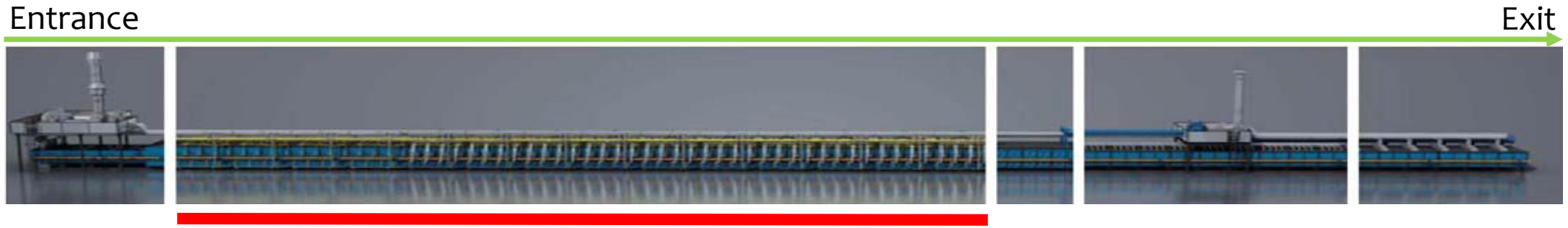
WP4 - Innovative solution for Refractory Materials

WP4 will involve the following kiln area/areas:



Innovative refractory materials

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WP5 - Emission monitoring and abatement

WP5 is subdivided into the following task:

- T5.1 → Development of emissions control strategy (**ITC**)
- T5.2 → Research and Develop. of Integrated pollutants Abatement system (**ITC**)
- T5.3 → Abatement of combustion-associated pollutant through Fine tuning of Kiln (**ITC**)

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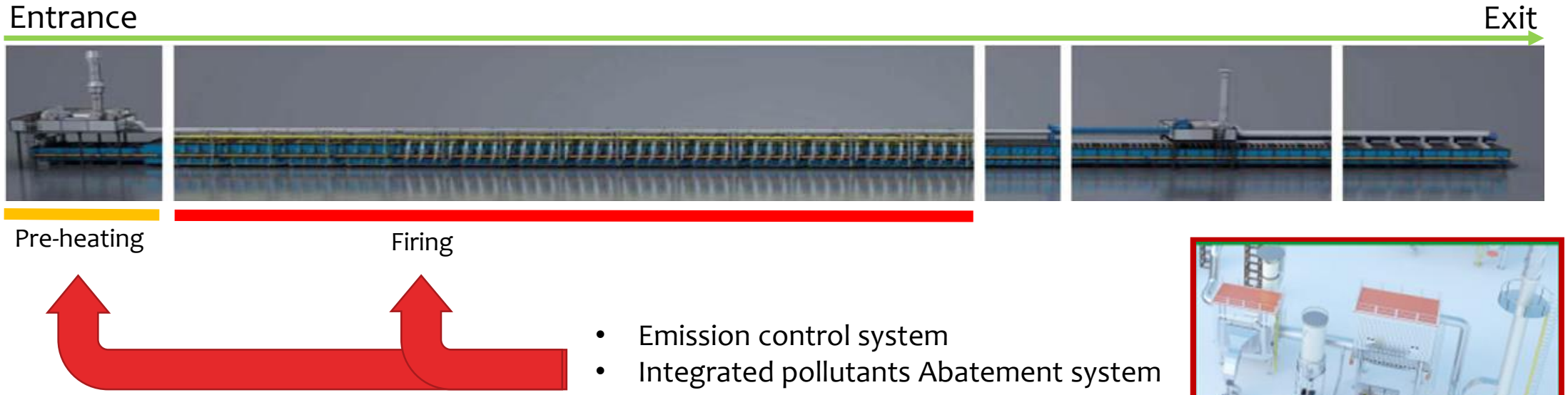
WP5 - Emission monitoring and abatement

WP5 will involve the following kiln area/areas:



- Emission control system
- Integrated pollutants Abatement system
- Fine tuning of the kiln

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WP6 - Demonstration

WP6 is subdivided into the following tasks:

- T6.0 → Requirements (**CRIT**)
- T6.1 → Demonstrator 1 - Retrofitting (**KERABEN**)
- T6.2 → Demonstrator 2 - Retrofitting (**MIRAGE**)
- T6.3 → Demonstrator 3 – Pilot Kiln (**SACMI**)
- T6.4 → LCA–LCC analysis (**SYNESIS**)

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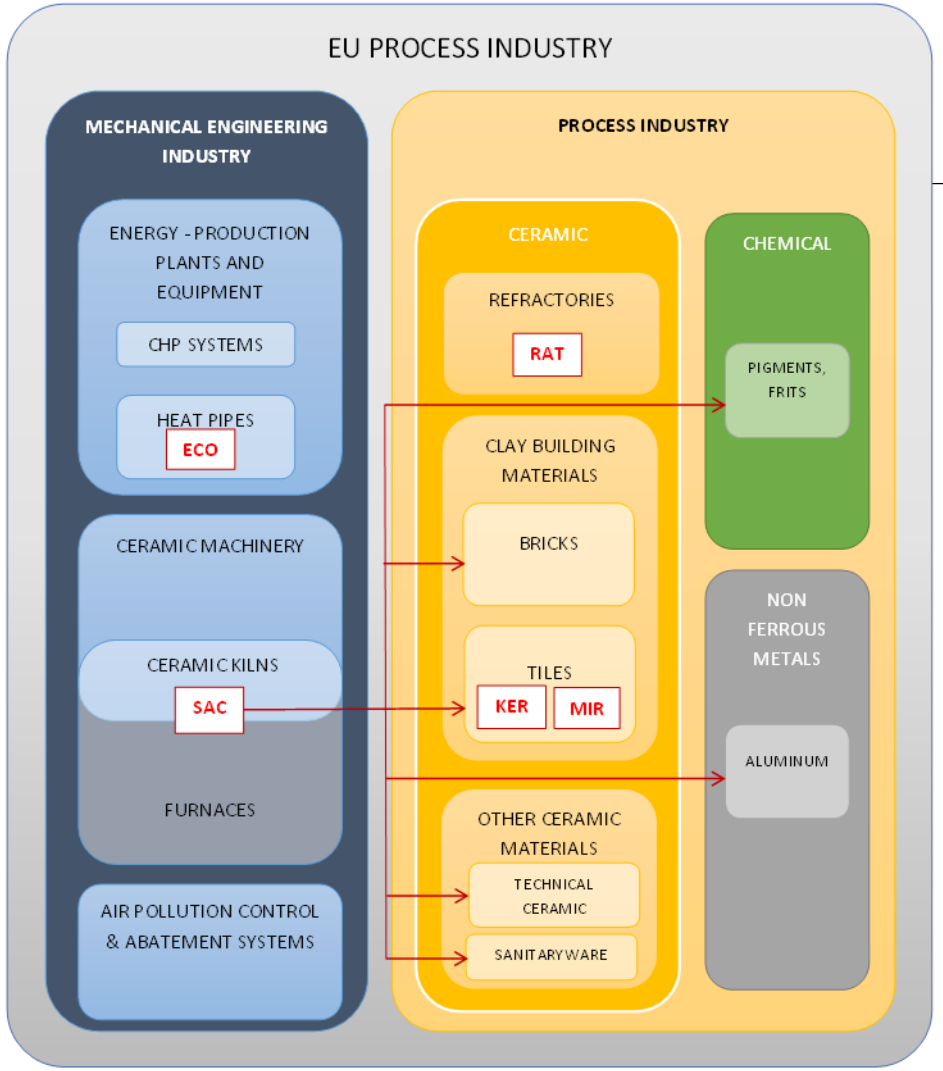
WP7 - Dissemination



Market replication vision

"To ensure that the DREAM results are adequately promoted and exploited with the widest possible horizon"

WP7 is subdivided into the following tasks:

- T7.1 → Dissemination of project results (**CRIT**)
- T7.2 → Exploitation and IPR Management (**SACMI**)
- T7.3 → Market replication (**CRIT**)

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Thank you for your attention !!!

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