

## CIRCE FOUNDATION

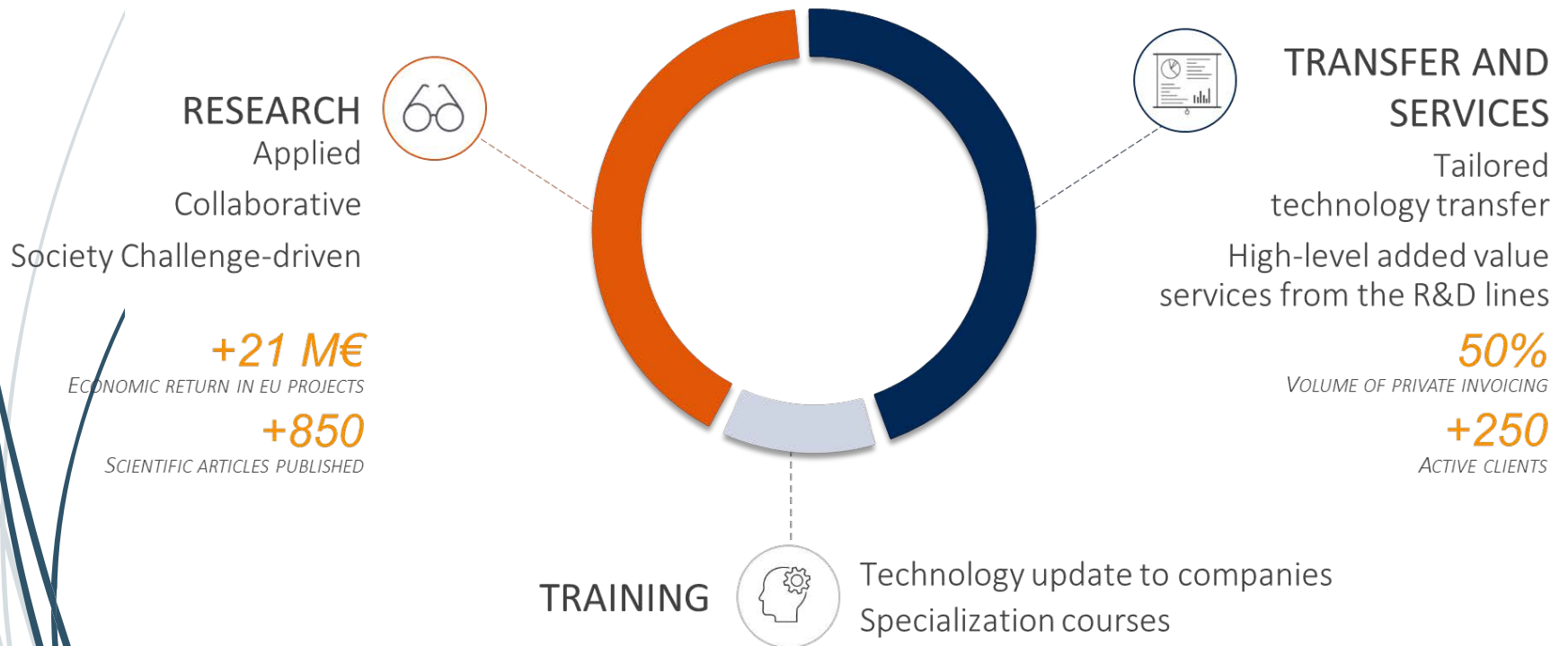
Novel integrated refurbishment solution as  
a key path towards creating eco-efficient  
and competitive furnaces

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## CIRCE – An innovative Model of Research Centre

R&D&i: “Knowing how, teaching how”



## Leaders in Applied Collaborative R&D

**14** National projects

> Funded by Spanish Government

**32** Horizon2020 Programme

> 9 Coordinated

Participation in other European Projects

> LIFE+

> Regional Funds

**70 million €**

*for our partners in the 7FP  
and H2020 projects that we coordinate*

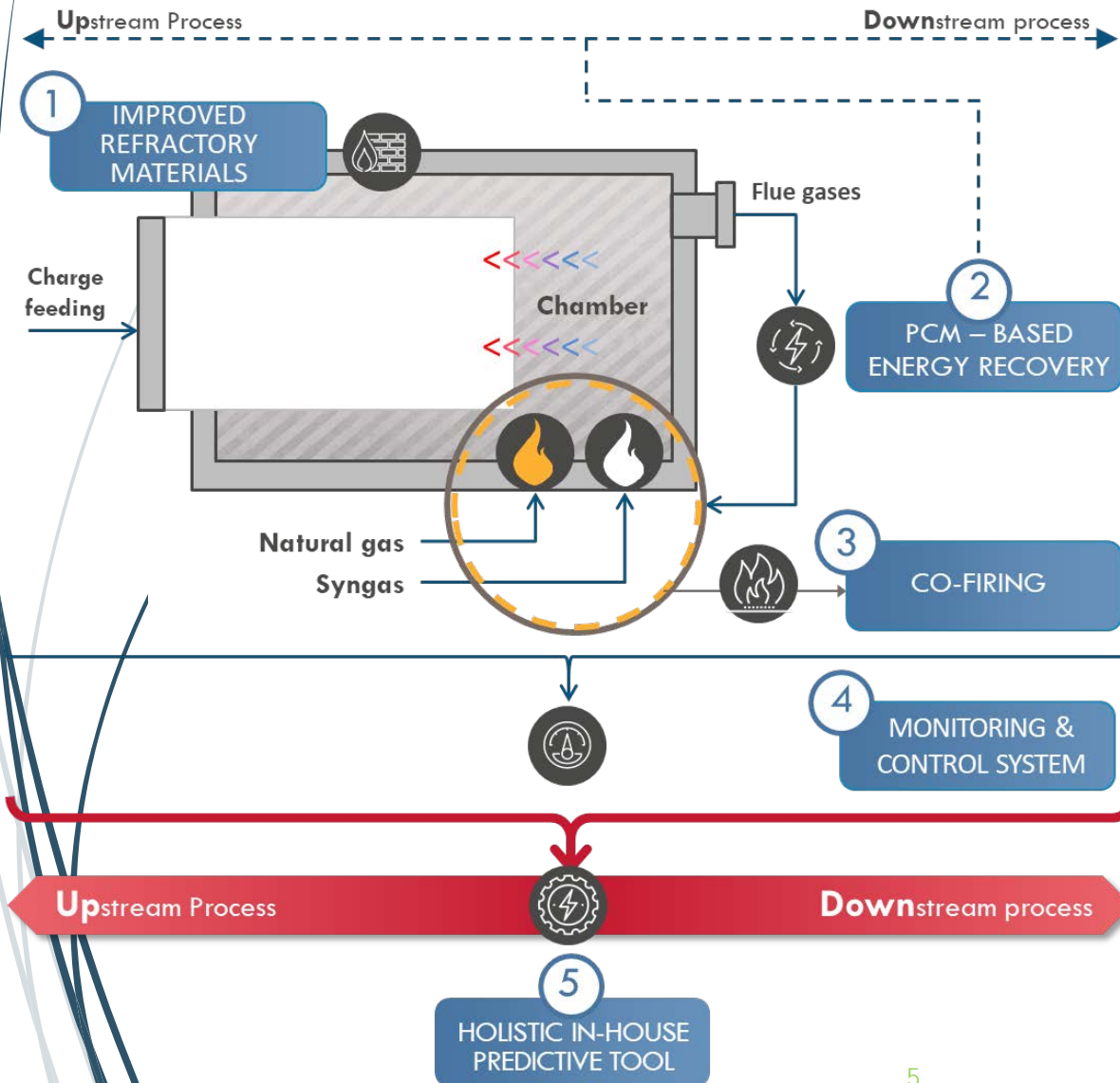
## Leading the Change Towards Eco-Efficient Furnances

VULKANO project will develop, implement and validate an **advanced retrofitting integrated solution** to increase the energy and environmental efficiency in existing preheating and melting industrial furnaces currently fed with natural gas.



VULKANO project will contribute not only to update the mainly **old-aged furnaces** but also to create a path to follow in order to ensure a successful design in case of **new furnaces**

## Process & Demos

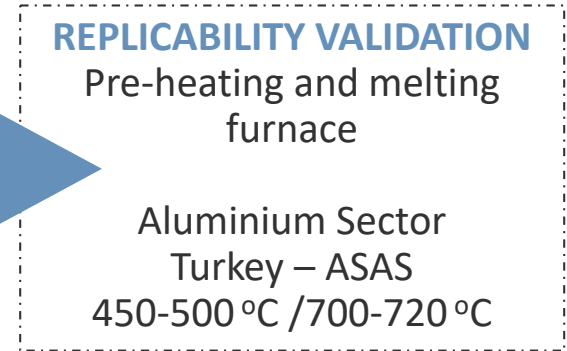
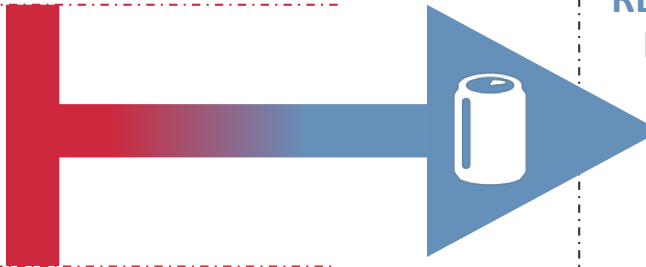
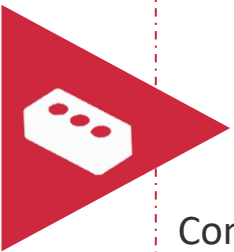
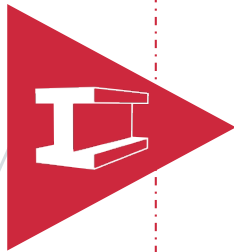


**20%**  
Increase of the **OVERALL EFFICIENCY** in two of the main types of industrial furnaces

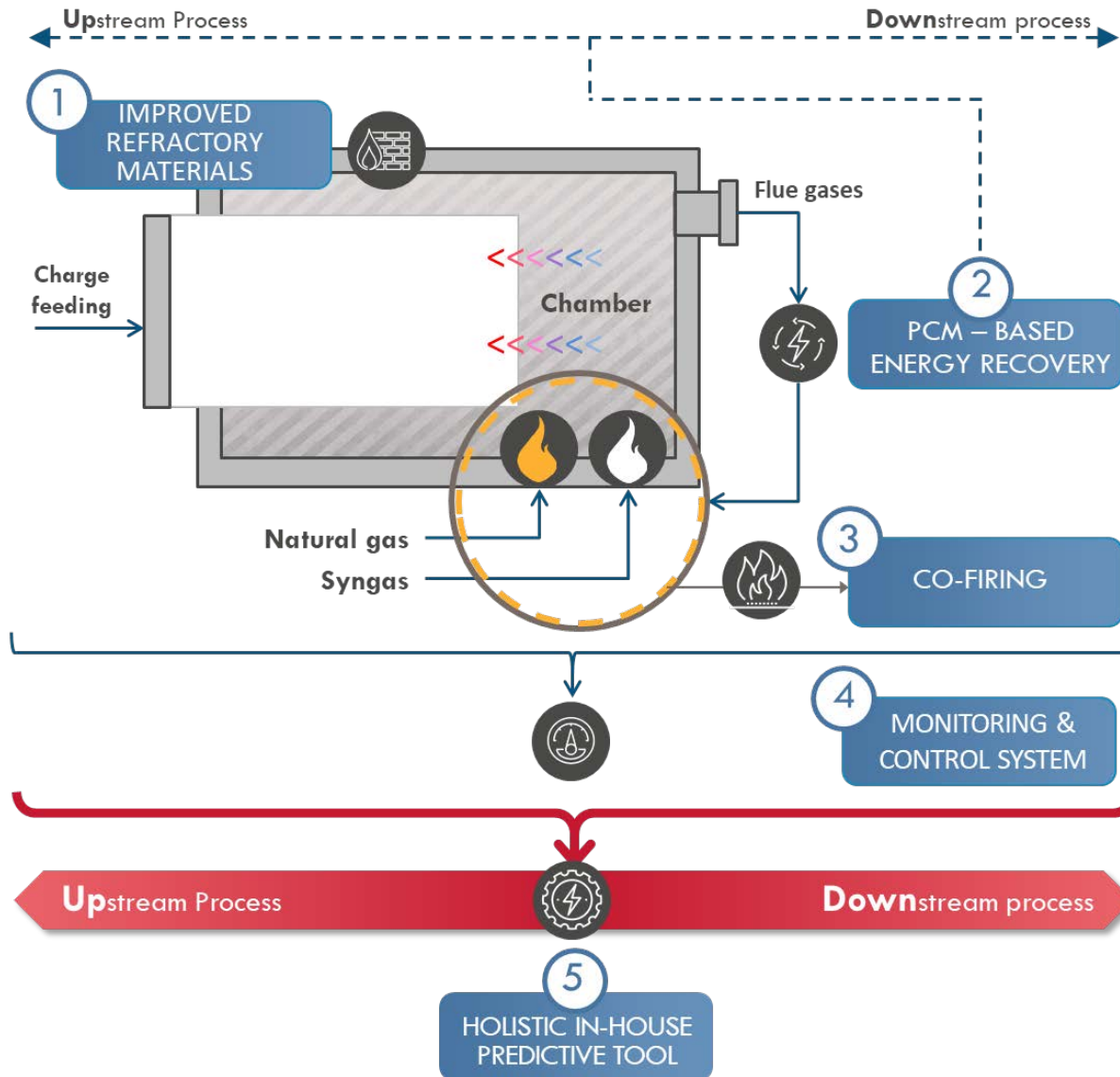
**27%**  
Savings of **FUEL CONSUMPTION** with a subsequent reduction of CO<sub>2</sub> emissions

**15-40%**  
**REDUCTION** of fossil fuel consumption

## Process & Demos



## Process & Demos



## Phase Change Materials – Based Energy Recovery

### Highlights:

- Providing an important **progress** in the knowledge of potential applications for PCM implementing these materials at **high temperature ranges**.
- **Overcoming** difficulties of commercial solutions due to **technological limits**.
- **Capture thermal energy from off-gas**, increasing around 100-200°C the current temperature reached in the air flow used in the furnace combustion process.

### Milestones achieved so far:

- **Selection of PCM system** depending on application, configuration and industrial sector.
- **Tests** at laboratory and industry scale with different PCM materials.
- **Basic engineering** of the PCM-Heat Exchanger (preliminar)



## Holistic In-House Predictive tool

### Highlights:

- Optimises the furnace design and its **energy and environmental performance**
- Considers the interaction between the furnace and the eco-innovative **retrofitting solutions** and **upstream/downstream processes** .
- A cross sectorial database structure will be developed for replication
- **Modular algorithm** based on KPIs adaptable to different retrofitting solutions.
- **Mission:** predict system performance, decision support tool for operators, feedback to the control system, optimize control efficiency.

### Milestones achieved so far:

- Selection of most relevant parameters and KPIs for the industry and the technology providers
- Creation of the baseline algorithm
- Exergy preliminary evaluation

## Expectations from the industry – Steel

Energy utilisation of  
renewables

New know-how,  
testing ground and  
demo site.

Reducing consumption  
of fossil fuels

Advanced reuse of residual  
waste heat (increasing  
process efficiency)

Lowering heat losses  
and CO<sub>2</sub> production  
(novel refractories)

Production of alternative gaseous  
fuel from solid residual fuels and its  
use in thermal processes

Lower consumption of  
fossil fuel (NG)

## Expectations from the industry – Ceramic

### VULKANO CONTRIBUTION

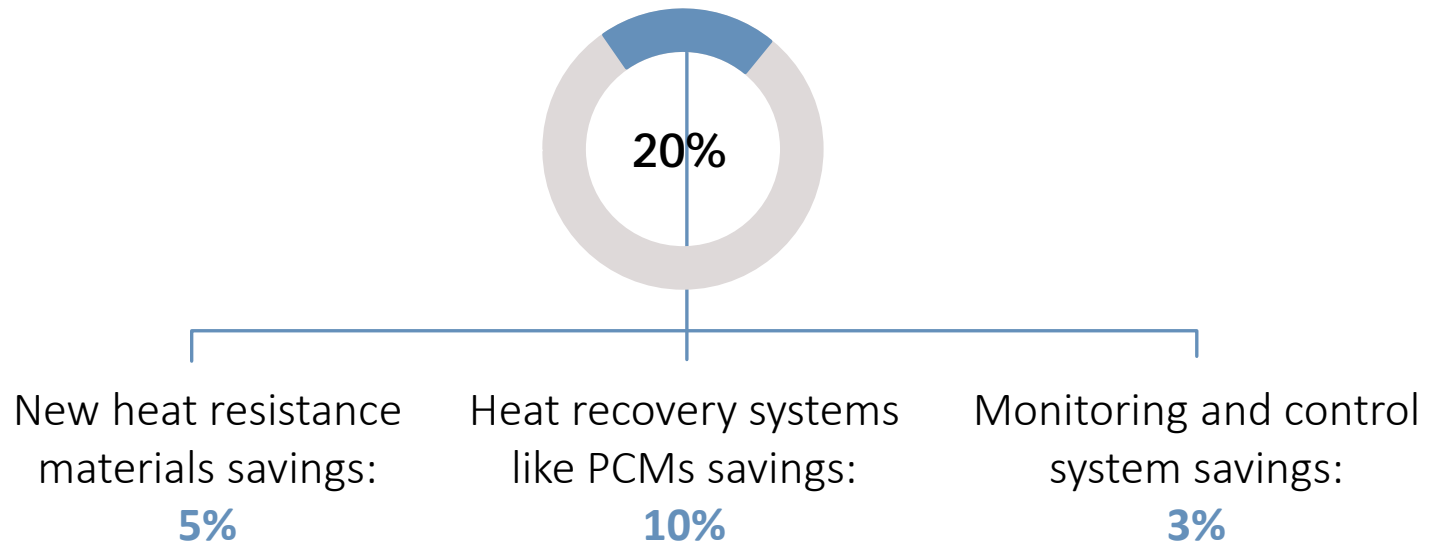
- › Novel heat processing solutions to improve efficiency of exiting burners ✓
- › Novel heat processing solutions for heat exchange
- › Novel refractories ✓
- › Burner modelization
- › Co firing of NG and BG.
- › Advanced furnace control system ✓

### WHERE TO APPLY ?

- › Frit smelter
- › Ceramic pigments sintering
- › Ceramic tile furnace ( 1200 °c)
- › Glass furnaces
- › Ceramic sanitary ware
- › Brick industry

## Expectations from the industry – Aluminium

Increasing overall efficiency in 20%



## Opportunities for industry

- ✓ **Reduce** energy consumption, operating costs and CO<sub>2</sub> emissions
- ✓ **Improve** the performance of the furnaces
- ✓ **Better market competitiveness** and eco-efficiency via non-conventional technologies.
- ✓ **Energy utilisation** of solid waste fuels after demonstrating co-firing system.
- ✓ **Coping** with future energy challenges

# THANK YOU FOR YOUR ATTENTION

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