Development of an Efficient Microwave System for Material Transformation in energy INtensive processes for an improved Yield

THE PROJECT

The DESTINY project aims to **realize a functional, green and energy saving, scalable and replicable solution, employing microwave energy** for continuous material processing in energy intensive industries. The goal is to develop and demonstrate a new kiln concept using microwave heating as an alternative and complementary energy source to the existing conventional production. The target is to develop and demonstrate a new concept of firing for granular feedstock to realize material transformation using full microwave heating as alternative energy source and complement to the existing conventional production. The DESTINY system is conceived as cellular kilns in a mobile modular plant, with significant advantages in terms of resource and energy efficiency, flexibility, replicability, scalability and a reduced environmental footprint.

The influence of the DESTINY solutions in terms of stability, process efficiency and characteristics of raw materials, intermediate/sub/final products will be investigated to improve performance of the industrial processes within 3 industrial sectors (Cement, Ceramics and Steel). New heating technologies, monitoring systems and numerical simulation tools will be used to drive the design and to excel in the outcome.

OBJECTIVES

The DESTINY project aspires to introduce a "first-of-a-kind" high temperature microwave processing system at industrial level offering a variety of vital benefits to energy intensive sectors: reduced energy consumption, lower lifetime operating costs and enhanced sustainability profile.

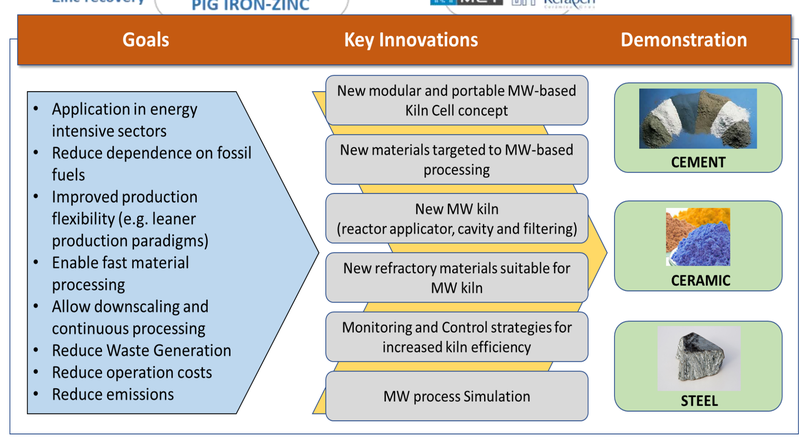
Objectives focus towards the improvement of efficiency ratios in the following areas:

- Flexibility of ±30% to energy input within RES (Renewable Energy Sources) fluctuations time frames without significant losses in specific energy efficiency
- Improvement in energy efficiency of 40% (depending on different industry and product applications)
- Improvement in terms of resource (fuel) efficiency exceeding the value of 40%

TECHNOLOGY

The aim of DESTINY is applying non-conventional energy sources to energy intensive industrial processes. The use of systems based on electricity like the MW considered in the project is a true alternative to fossil energy sources (natural gas consumption) enabling the integration of renewable electricity and providing significant advantages in terms of resource/energy efficiency and operational flexibility. An extensive list of innovations regarding various system aspects will be put in place in order to demonstrate an operational prototype of the new process in industrial scale related to:

- Reactor, feeding system and plant integration
- Microwave technology
- Concept of application
- Monitoring and control
- Industrial use

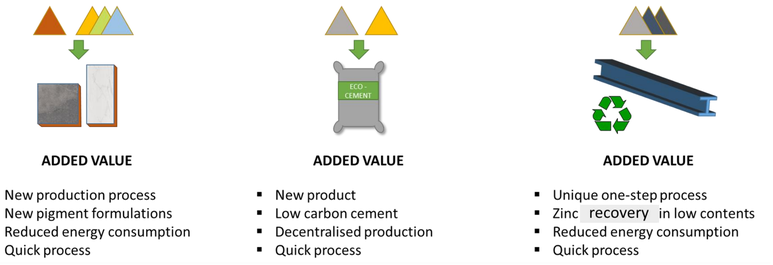


OUTCOMES & IMPACT

DESTINY aspires to introduce the "first-of-a-kind" high temperature fully MICROWAVE processing system at industrial level (TRL4 to TRL6), offering a variety of vital benefits to energy intensive sectors: reduced energy consumption, lower lifetime operating costs and enhanced sustainability profile

KEY EXPLOITABLE RESULTS (KER)

1. **Novel ceramic pigments** manufactured in MW production units
2. **New calcined clay** adapted to microwave processing
3. **Novel improved ceramic tiles**
4. **MW reactor applicator, cavity and filtering**
5. **Production plant** DESTINY system
6. **MW system control and Virtual sensors**
7. **Configuration of MW parts for each application at least 3 in total**



Ceramic Pigments

ADDED VALUE

- New production process
- New pigment formulations
- Reduced energy consumption
- Quick process

Calcined Clays

ADDED VALUE

- New product
- Low carbon cement
- Decentralised production
- Quick process

Iron & Zinc

ADDED VALUE

- Unique one-step process
- Zinc recovery in low contents
- Reduced energy consumption
- Quick process

Call Target KPIs	Project outcomes KPIs
Allowing for a -30% to +30% energy input within RES fluctuations timeframes, without significant losses in specific energy efficiency.	The system is expected to be able to achieve efficient and **problem-free operation within a window of at least ±50% of power input**
Improvement in **energy efficiency of 30%.**	DESTINY is aiming for an **average cut of required energy by 40%** considering its different industry and product applications
Improvement in **resource efficiency of 30%.**	No fuel resource is needed for heating. The indirect fossil fuel consumed for the increased electric consumption is counterbalanced by the higher energy efficiency. Estimated improvement in terms of resource (fuel) **efficiency will exceed the value of 40%.**
Decrease in CO_2 emissions by 40% (without considering the electricity generation and at steady state).	A **decrease of local CO_2 emissions > 45%** for all products considered is achievable
Decreased OPEX and CAPEX by 15%.	OPEX is equal or below conventional furnaces (depending on the industrial case). A single MW kiln cell DESTINY system has equal CAPEX with a standard furnace, for ceramics and cement application, while the up-scaled (industrial scale) version would bring a drastic reduction of up to 30%, at least for one of the products to be considered.

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STAY IN TOUCH

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