



LAYMAN'S REPORT

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THE EUROPEAN CERAMIC INDUSTRY

The European ceramic industry is **a world leader in producing high-quality ceramic products such as tiles, sanitaryware, and tableware.**

Ceramic manufacturers in the EU are mainly small and medium-sized enterprises (SMEs), often organized in districts, that can quickly respond to market demands and seize new opportunities. In the EU, the ceramic sector provides **more than 300 thousand jobs**, and its production value amounts to approximately 27 billion euros.

The ceramic sector is known to be an **Energy Intensive Industry (EII)** characterized by high levels of thermal and electric energy consumption along its production chain and an increased risk of carbon leakage.

The two main sectors that the Rapid Dry project focuses on, i.e., the sanitaryware and tableware markets, consist **in Italy of about 40 companies**, most of which are in Civita Castellana (VT).

As of today, the European ceramic industry faces three main threats:



**THE COMPETITIVENESS
OF EMERGING
ECONOMIES,**
capable of producing
large volumes
of products
at low-cost



The increasingly
demanding
**ENVIRONMENTAL
LEGISLATION**, which
conflicts with the
characteristics of the
traditional production
process



**THE GROWING
ENERGY PRICES**
and the reliance of the
ceramic sector on
RAW MATERIALS
from non-European
countries

Thus, the main challenges that the European ceramic industry needs to face in the future are **to reduce its dependence on imported raw materials and decrease its energy consumption and environmental impact.**

CHAMBER DRYERS FOR CERAMIC PRODUCTS

The production of ceramic goods involves several phases, one of which concerns drying, that is, **when the not chemically bonded water is removed from the ceramic body by evaporation**. Drying is a particularly critical stage in ceramic manufacturing as it can provoke stress in the ceramic pieces as well as future damages during the firing procedure. The process must be slow to prevent the body pieces from warping and cracking while, at the same time, complete drying must be ensured.

If a part is not completely dry before the firing, it will break, warp, or even explode, risking ruining other pieces in the kiln as well. On the other hand, if the body has been dried too quickly in a drying chamber, cracks will form, and the piece will be destroyed during firing in the kiln.

Typically, a drying cycle in a traditional chamber can last around **14 hours**, during which the temperature gradually increases from 50°C to 90°C. Because it requires such long cycles, the drying process alone is responsible for about **23% of the total thermal power** needed for the whole production process.

Despite this, technological innovation to reduce consumption has focused more on the firing phase, leaving the drying process in the background. This situation is particularly evident in the sanitaryware and tableware fields. Unlike the tile sector, these two sectors have been less affected by the introduction of new technologies to reduce consumption, as human labour is prevalent and represents the first cost item. At the same time, energy costs are much lower and therefore do not generate a sufficient boost to innovation.

The main **critical points** that characterize **traditional dryers** are:



Temperature is the only controlled parameter



Absence of a drying curve



Very low drying homogeneity



Significantly long drying cycles



The operation requires large fans and burners

THE RAPID DRY PROJECT

The RAPID DRY project aims **to optimize the drying process by reducing energy consumption and pollutants emissions** (such as CO₂, NO_x, HF, and SO_x) while preserving product quality.

To this end, the project has developed **a new, fully automated chamber dryer** that reduces energy consumption.

The innovative characteristics of this dryer allow its adoption in **all ceramic sectors except tiles**, promoting the renewal and increased competitiveness of the European ceramic industry.

The innovation process had three main objectives:



TO REDUCE THE ENVIRONMENTAL IMPACT

of ceramic goods production thanks to reduced pollutants emissions, such as CO₂, NO_x, HF, SO_x, and particulate matter



TO INCREASE THE COMPETITIVENESS

of the European ceramic industry thanks to lower production costs and greater flexibility



TO IMPROVE THE QUALITY OF THE WORKING ENVIRONMENT

by reducing the noise and the duration of drying cycles, which strongly affects the shifts of the staff

The project complemented the new chamber dryer with **new ceramic slips**.

A close relationship exists between drying, the particle size of the granules, and their mineralogical composition.

Therefore, optimizing slip formulations is one of the best ways to improve drying. In addition, the creation of ceramic bodies still depends on virgin raw materials from mining, while the amount of recycled ceramic waste is still low.

The RAPID DRY project aims to produce **new ceramic body formulations** that are:



Capable
of **OPTIMIZING
THE DRYING
PROCESS**
by reducing
its duration



Capable
of **RESISTANCE
TO BREAKAGE** of
the ceramic pieces
during
the drying cycle



Using
**RAW MATERIALS
OBTAINED FROM
RECYCLED CERAMIC
WASTE**, therefore
limiting the use of virgin
resources, and reducing
the amount of waste



01/06/2020
START DATE



31/12/2022
END DATE



31 MONTHS
DURATION



€ 1,350,447
TOTAL BUDGET



€ 709,250
EU CONTRIBUTION



SE.TE.C. srl
COORDINATOR



LIFE CYCLE ENGINEERING srl
PARTNER



THE NEW RAPID DRY DRYER

The Rapid Dry dryer combines several original technologies that **reduce energy waste and emissions**. The most innovative one is the **PLC** (Programmable Logic Controller) **software** during operation. This new software automatically adjusts the main parameters affecting the drying process, such as temperature, relative humidity, and speed of air recycling inside the chamber. In this way, it ensures a homogeneous drying process, thus avoiding the formation of warps or cracks on the dried pieces. In particular:



The fully automated heat generator regulates the amount of heat supplied, significantly reducing methane consumption



The automatic regulation of air flows reduces electrical power, hence decreasing the consumption of electric energy



The setting of a drying curve permits controlling air temperature, humidity, and air flow in every process step, achieving perfect drying homogeneity



The recovery of humidity and heat from the exhaust fumes allows air that is already partially warm to be introduced into the dryer, thus limiting the energy required to heat it in the early stages of the process.

THE NEW RAPID DRY SLIP

The new Rapid Dry slip formulations (Vitreous China and Fire Clay) optimize the drying process:



By modifying the rheology and grain size, it is possible to improve the drying curve's efficiency and reduce the drying time



Applying the new slip formulation increases the breaking strength of the pieces during the drying process



Using recycled ceramic waste materials reduces the amount of virgin raw materials used for each piece and the amount of waste sent for disposal.

PROJECT OUTCOMES

INDUSTRIAL OUTCOMES



14
TEST
CYCLES



around
7000
SANITARYWARE PIECES
successfully dried



around
1200
TABLEWARE PIECES
successfully dried



RAW MATERIALS
CONSUMPTION
-6%



GAS
CONSUMPTION
-67%



ELECTRICITY
CONSUMPTION
-86%

DRYING CYCLE IN TRADITIONAL DRYER



14h
WITH TRADITIONAL CERAMIC BODY

DRYING CYCLE IN NEW RAPID DRY DRYER



8h WITH
TRADITIONAL
CERAMIC BODY



7h WITH
RAPID DRY
SLIP



0 DAMAGED
OR BROKEN
PIECES

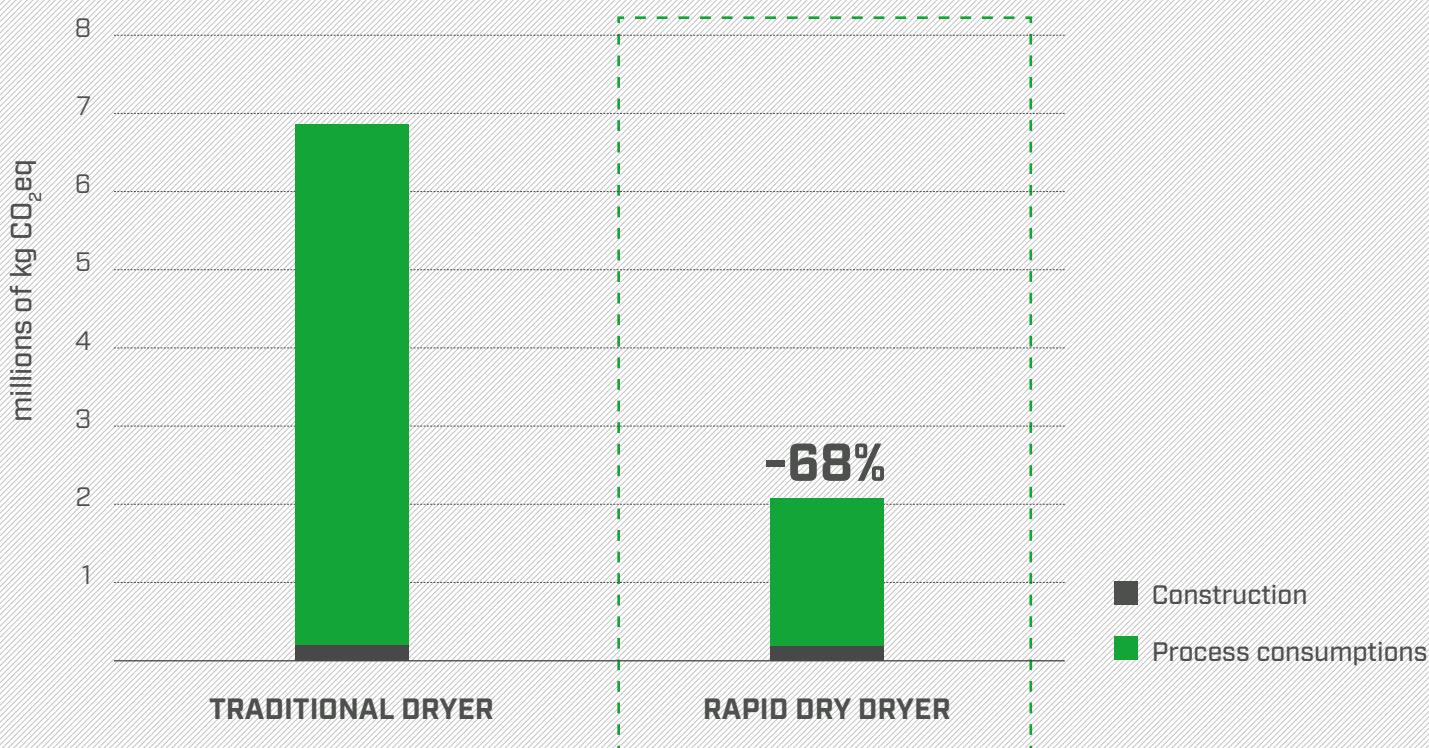
■ ENVIRONMENTAL OUTCOMES

A Life cycle Assessment study (LCA) allowed us **to compare the environmental impacts generated along the life cycle of a traditional dryer and slips with those of a Rapid Dry dryer and slips.**

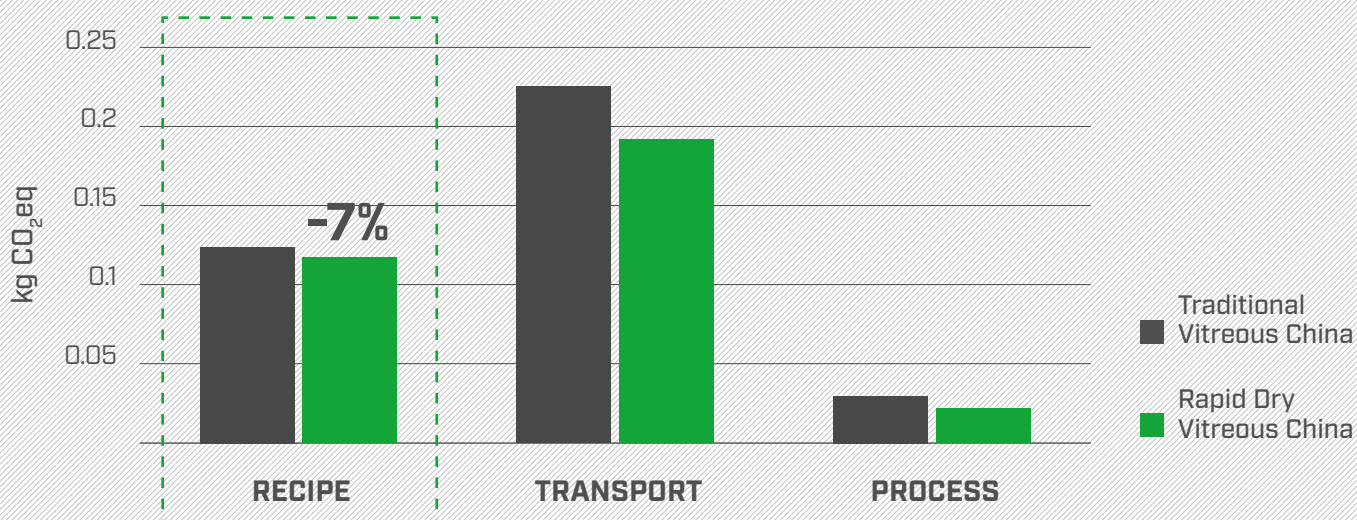
This study has shown that the industrial results are matched by positive environmental results.

The shortening of the drying cycle and the selection of raw materials in the dough led to changes in greenhouse gas emissions, highlighted in the graphs below.

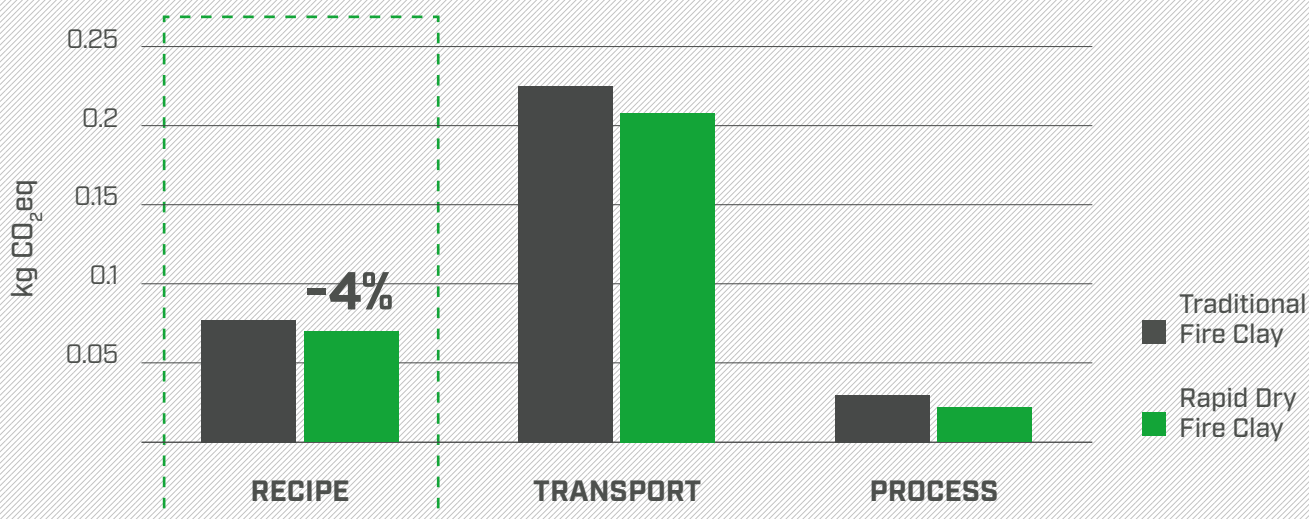
GREENHOUSE GAS EMISSIONS IN THE LIFE CYCLE OF A DRYER (30 YEARS)



GREENHOUSE GAS EMISSIONS PER 1 kg OF VITREOUS CHINA



GREENHOUSE GAS EMISSIONS PER 1 kg OF FIRE CLAY



■ SOCIAL OUTCOMES

The Social Life Cycle Assessment analysis was carried out on the new RAPID DRY dryer and the new mixtures to identify the main social benefits resulting from the introduction of the technologies developed by the project. In particular, the results highlighted a significant **reduction in noise and dust levels**, thus improving the worker's condition near the dryer.



■ ECONOMIC OUTCOMES



-25%

costs over the life cycle
of a dryer using
**RAPID DRY
VITREOUS CHINA
BODIES**



-31%

costs over the life cycle
of a dryer using
**RAPID DRY
FIRE CLAY
BODIES**



-than 1 year

the time needed to
repay the higher
investment due to the
purchase of the **NEW
RAPID DRY DRYER**

DISSEMINATION

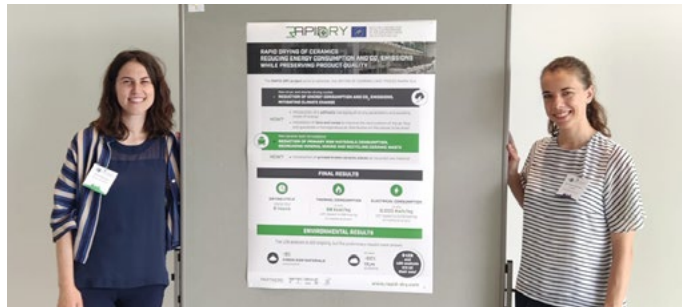
Brochures, newsletters, posters and fact sheets were distributed, also through LinkedIn, among the project's target groups and made available on www.rapid-dry.eu. The results were shared with the industry, local authorities, and students through trade fairs, conferences, and visits to the prototype.



Prototype presentation event
26 May 2022



CERAMITEC (Munich)
21-24 June 2022



3rd Life Cycle Innovation Conference (Berlin)
29 June - 1 July 2022



Seminar at the University of Tuscia
5 July 2022



TECNA (Rimini)
27-30 September 2022



Conclusive event of the project (Civita Castellana)
6 October 2022

PUBLICATIONS

TECHNICAL-SCIENTIFIC



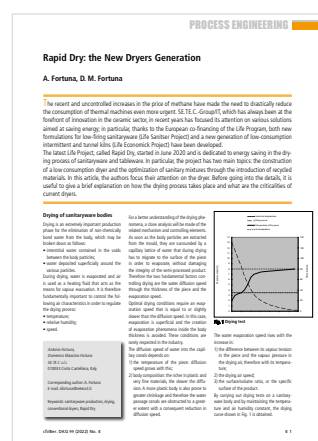
Low-energy drying of sanitaryware and tableware

Essiccazione a basso consumo per sanitari e stoviglie

The recent dramatic increase in natural gas prices have made it more urgent than ever to drastically reduce the energy consumption of thermal processes in various manufacturing processes. The same Group has long been aware of this leading to the development of a low-energy drying process for sanitary and tableware. The project has been funded by the LIFE program, which focuses on energy saving and the use of renewable energy sources. The project has been funded by the LIFE program, which focuses on energy saving and the use of renewable energy sources. The project has been funded by the LIFE program, which focuses on energy saving and the use of renewable energy sources.



Ceramic World Web [13/04/2022]



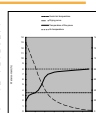
Rapid Dry: the New Dryers Generation

A. Fortuna, D.M. Fortuna

The recent and uncontrolled increase in the price of methane have made the need to drastically reduce the consumption of thermal processes even more urgent. LIFE19 CCM/IT/001243 which has already been at the forefront of innovation in the ceramic sector, in recent years has focused its attention on various solutions aimed at saving energy. In particular, thanks to the European financing of the LIFE Program, both new formulations for low firing sanitaryware (Life Sanitary Project) and a new generation of low-consumption (Rapid Dry) and tableware (Life Tableware Project) have been developed.

The latest LIFE Project, called Rapid Dry, carried in June 2020 and is dedicated to energy saving in the drying process of sanitaryware and tableware. In particular, the project has two main topics: the contribution of a low consumption dryer and the optimization of sanitaryware through the introduction of angled materials. In this article, the authors focus their attention on the dryer. Before going into the details, it is useful to give a brief explanation on how the drying process takes place and what are the characteristics of ceramic dryers.

Drying of sanitaryware bodies
Drying is a crucial process in the production of ceramic products. It is a process that involves the removal of moisture from the ceramic bodies. The drying process is a complex one, involving many factors such as the shape of the body, the material, the temperature, and the humidity. The drying process is a complex one, involving many factors such as the shape of the body, the material, the temperature, and the humidity.



The water evaporation speed (m) with the temperature. The graph shows a curve that starts at a low value and increases as the temperature rises, indicating that the drying process is more efficient at higher temperatures.

POPULAR



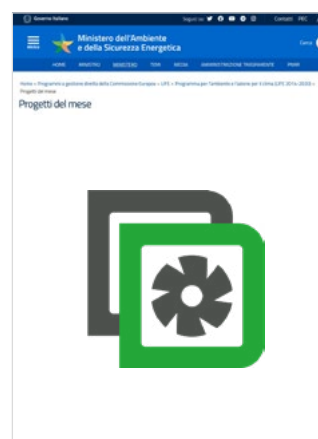
Ceramica, inventato il super essiccatoio: risparmio energetico e meno emissioni

Il progetto LIFE Rapid Dry ha collaborato anche la Cer, azienda specializzata nella realizzazione degli impianti industriali, settore ceramica. Il progetto di innovazione tecnologica ha permesso di realizzare un super essiccatoio che produce a emissioni ridotte rispetto ai sistemi tradizionali, con un risparmio energetico del 30% e una riduzione delle emissioni di CO2 del 20%. Il progetto ha anche permesso di realizzare un super essiccatoio che produce a emissioni ridotte rispetto ai sistemi tradizionali, con un risparmio energetico del 30% e una riduzione delle emissioni di CO2 del 20%.



Polo ceramico di Civita Castellana: presentato l'essiccatoio anti-consumi

Il polo ceramico di Civita Castellana ha presentato l'essiccatoio anti-consumi, un sistema di essiccazione a basso consumo energetico. Il sistema è stato progettato e realizzato dalla Cer, azienda specializzata nella realizzazione degli impianti industriali, settore ceramica. Il sistema è stato progettato e realizzato dalla Cer, azienda specializzata nella realizzazione degli impianti industriali, settore ceramica.



“Progetto del Mese”, website of the Ministry of the Environment

EXPLOITABILITY AND LONG-TERM BENEFITS

The results achieved can be used to produce all ceramic products except tiles, covering 60-70% of the entire ceramic market.

Although the new rapid dry dryer is slightly more expensive than a conventional one, it allows **more production cycles** while **reducing the staff's working time**. Overall, in addition to the savings achieved thanks to the reduction of energy consumption, it results in lower expenses.

Thanks to the innovative formulas of ceramic slips, the sanitaryware sector would save **7-8% of virgin raw materials** in the long term.

In addition, the **new dryer** would save **about 67% of gas and 86% of electricity, plus 68% of CO₂eq emissions**.



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