



# Hydrogen and Technologies for the sustainability of ceramic processes

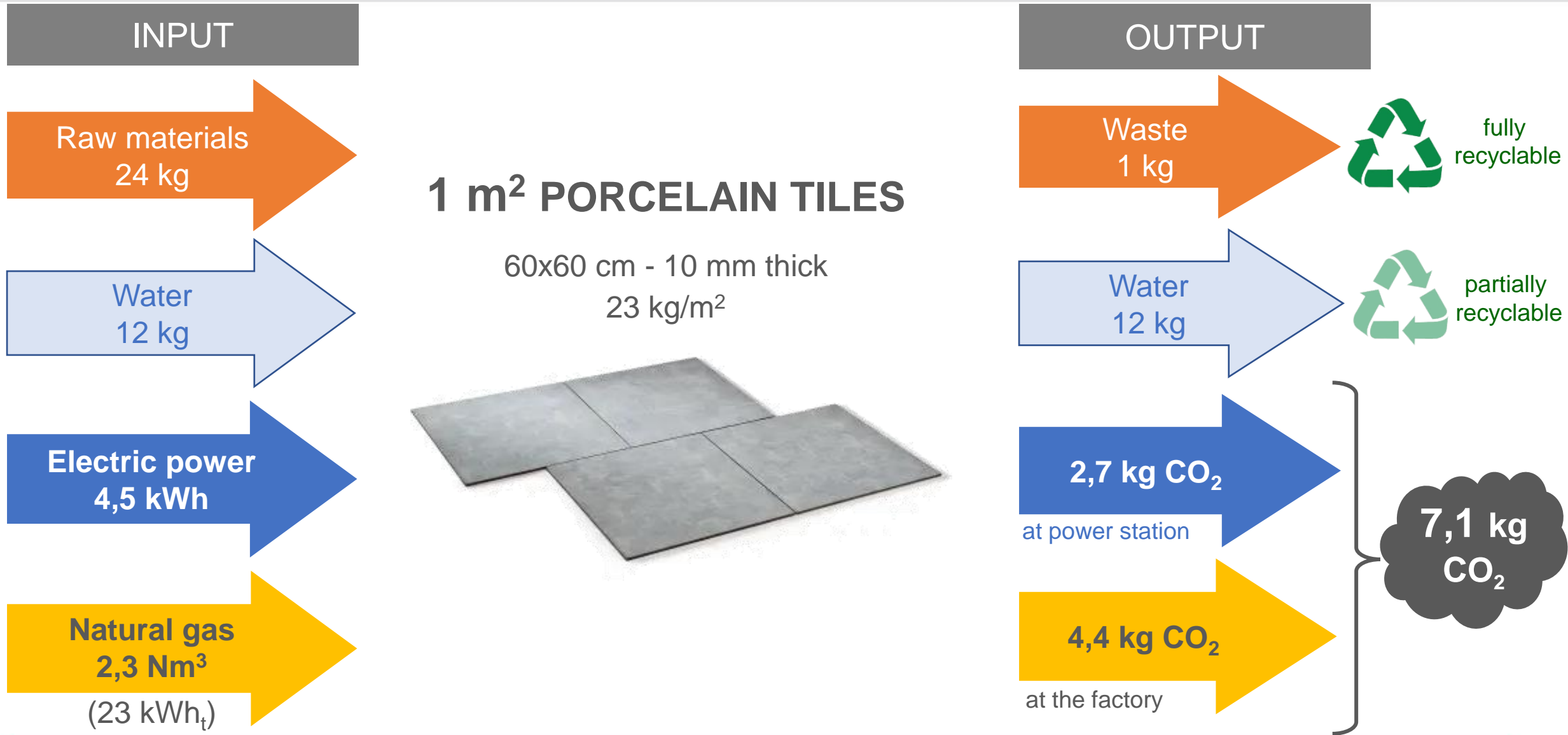
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# Mass and energy balance of the ceramic production process



Production (2019) (*)		Raw materials	Water	Electric power	Natural gas	CO <sub>2</sub>
	Mm <sup>2</sup>	Mton	Mm <sup>3</sup>	TWh	Gm <sup>3</sup>	Mton
Italy	416	10,0	5,0	1,9	1,0	3,0
Spain	530	12,7	6,4	2,4	1,2	3,8
<b>Europe</b>	1.185	28,4	14,2	5,3	2,7	8,4
China	5.680	136,3	68,2	25,6	13,1	40,3
<b>World</b>	<b>13.099</b>	<b>314,4</b>	<b>157,2</b>	<b>58,9</b>	<b>30,1</b>	<b>93,0</b>

(\*) World production and consumption of ceramic tiles, 7th edition, ACIMAC, 2019

**18%** ~ **53 Gton**  
CO<sub>2</sub> global emissions (2019)

The time for climate action is now, BCG, 2021

**9,5 Gton**  
CO<sub>2</sub> industrial emissions

Ceramic industry  
is responsible for approx.  
**1%**  
of CO<sub>2</sub> industrial emissions

## PRODUCT OPTIMIZATION

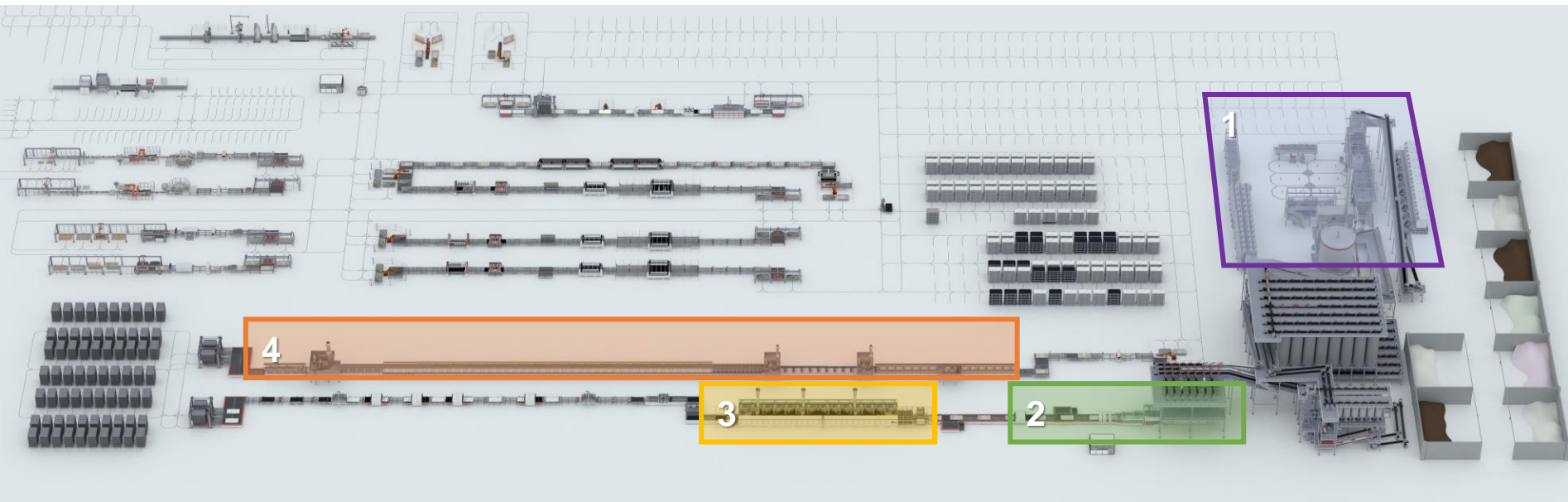
- **thickness** reduction
- **porcelain** tiles only where necessary
- use **porous body** for wall tiles
- increased use of **red body**
- increased use of **local** raw materials
- increased use of **fluxing** materials



## PROCESS OPTIMIZATION

- higher plant **efficiency**
- lower power **consumption**
- **recoveries** of thermal energy
- better combustion **control**
- use of **green energies**
- use of renewable energy

# New plant proposals for process decarbonization



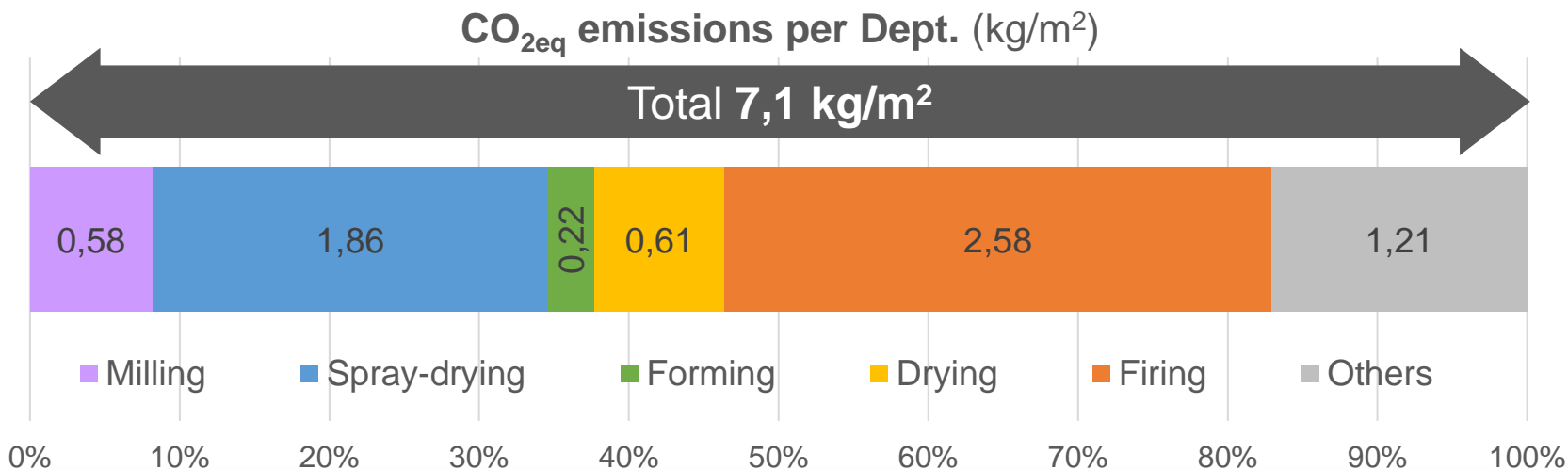
Plant for production of  
**10.000 m<sup>2</sup>/day  
porcelain tiles**  
600x600x10mm format

**CO<sub>2eq</sub> total emission**  
**7,1 kg/m<sup>2</sup>**

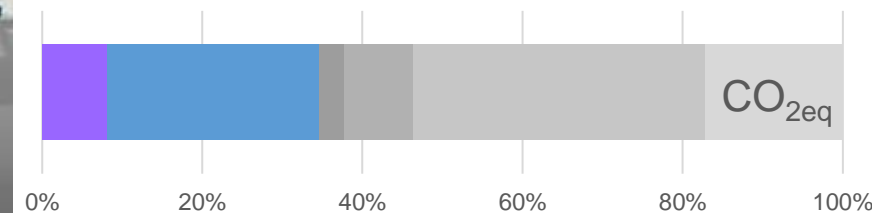
Dept. with higher emissions:

- **Firing** **37%**
- **Spray-drying** **26%**
- **Drying** **9%**
- **Milling** **8%**
- **Forming** **3%**

generating about  
**83%**  
of plant total emissions



# 1. Body preparation (Milling + Spray-drying)



**MMC**  
Continuous Modular Milling

**-36%** electric power  
42 kWh/ton → 28 kWh/ton  
(MTC) (MMC)

**SPRAY-DRYING**

Use of hydrogen blend  
**50% CH<sub>4</sub> + 50% H<sub>2</sub>**

		2022	2025
Energy consumption	kWh/m <sup>2</sup>	10,4	-15%
Emissions	kgCO <sub>2</sub> /m <sup>2</sup>	2,44	-47% (*)

(\*) assuming the availability of hydrogen

**H<sub>2</sub>**



# 1. Spray-drying



- Advanced plant solutions are in development for the use of **hydrogen** in (partial) replacement of natural gas (up to **50% H<sub>2</sub>**). This will lead to a significant reduction in CO<sub>2</sub> emissions.

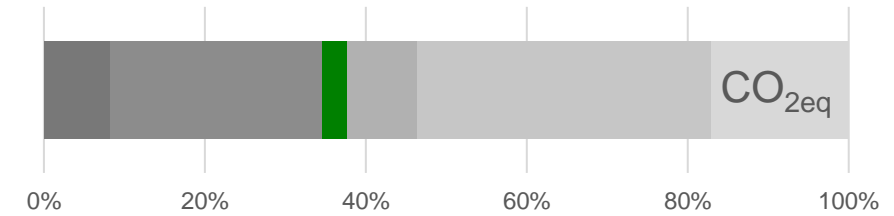


- We are also working in partnership with the world's largest burner Supplier to increase the amount of hydrogen in blend. In joint with the availability of hydrogen and the development of components, we aim to reach **100% H<sub>2</sub>**



- In parallel, we are also active in the research for **full-electric heating** systems as a possible sustainable alternative.

## 2. Forming (pressing)



### CONTINUA+ compaction system

**-80%** electric power

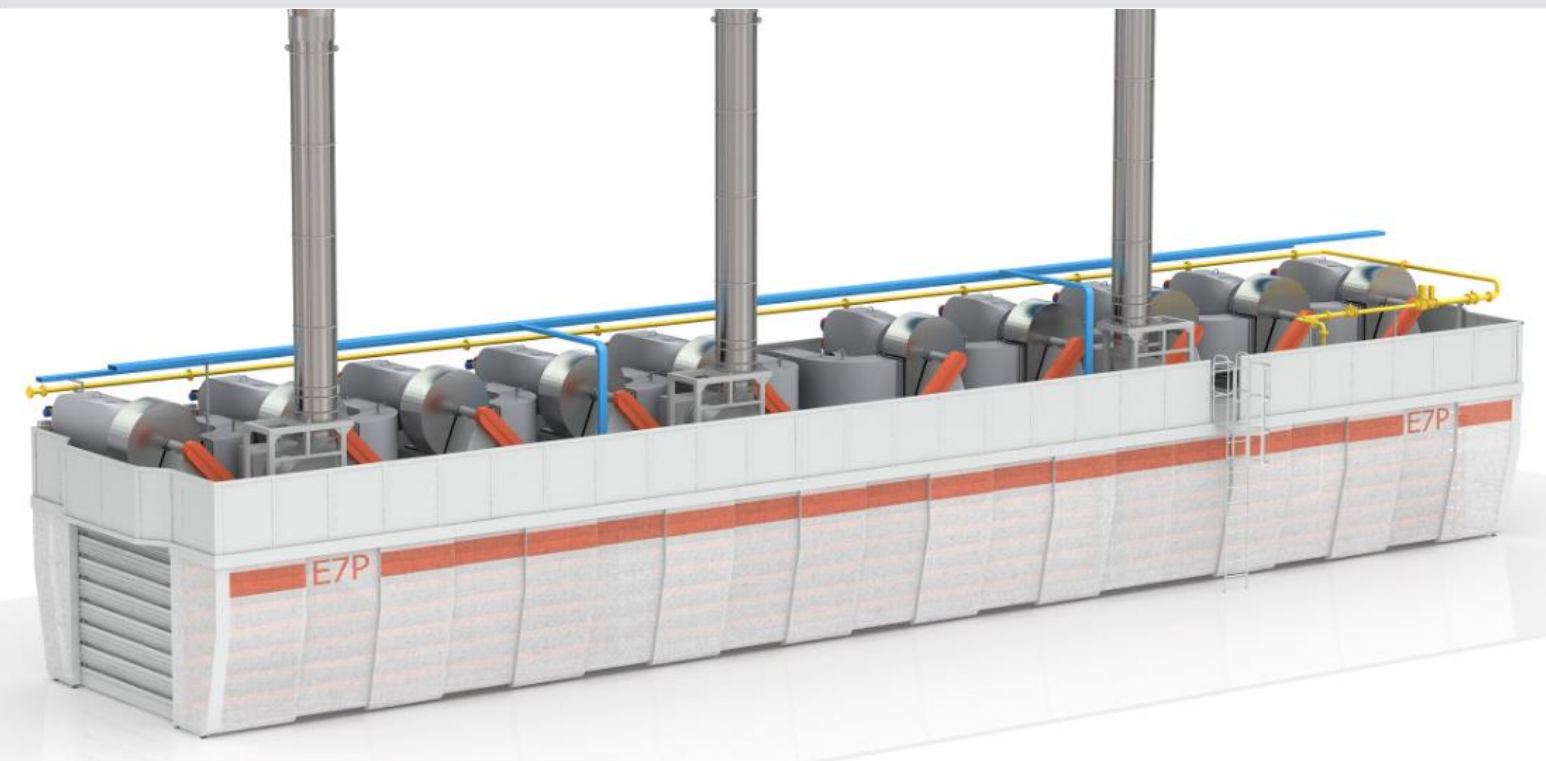
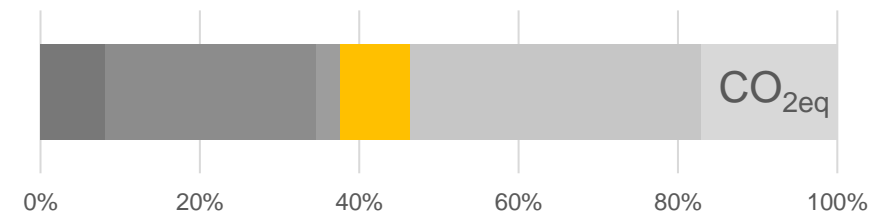
16 kWh/ton → 3,2 kWh/ton

**CONTINUA+** is the most efficient compaction system available, for highest throughput and better quality of ceramic slabs and sub-formats

		2022	2025
Energy consumption	kWh/m <sup>2</sup>	0,38	<b>-80%</b>
Emissions	kgCO <sub>2</sub> /m <sup>2</sup>	0,22	<b>-80%</b>



### 3. Drying



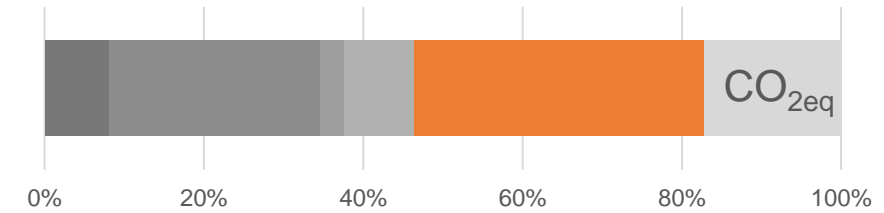
## ZERO FUEL Driers

The complete thermal energy recovery (from kilns) allows **near zero** fuel consumption

94 kWh<sub>th</sub>/ton → ~ 0 kWh<sub>th</sub>/ton

		2022	2025
Energy consumption	kWh/m <sup>2</sup>	2,60	-82%
Emissions	kgCO <sub>2</sub> /m <sup>2</sup>	0,61	-79%

# 4. Firing



## New MAESTRO kiln

Digital control of combustion  
in every firing zone of the kiln

+

Use of hydrogen blend

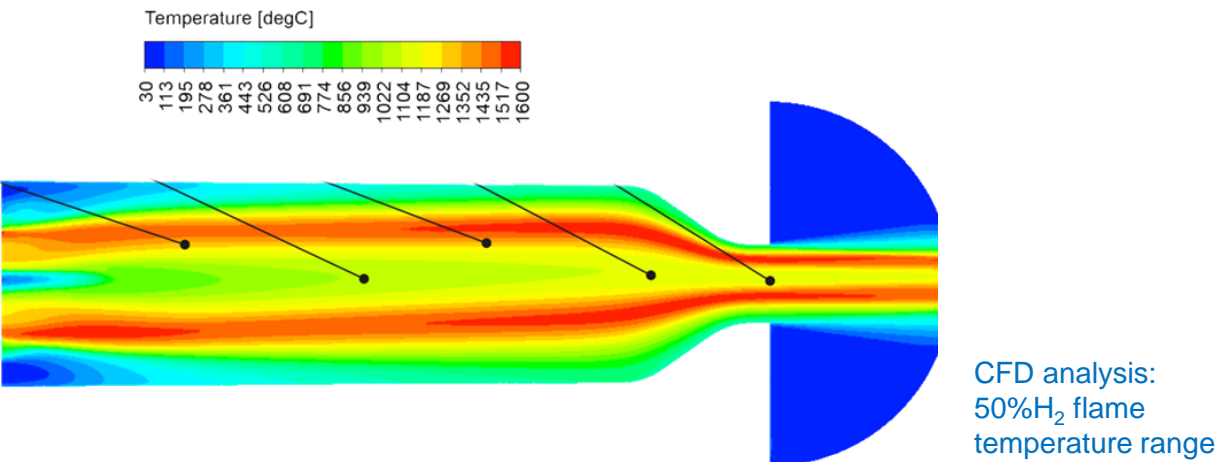
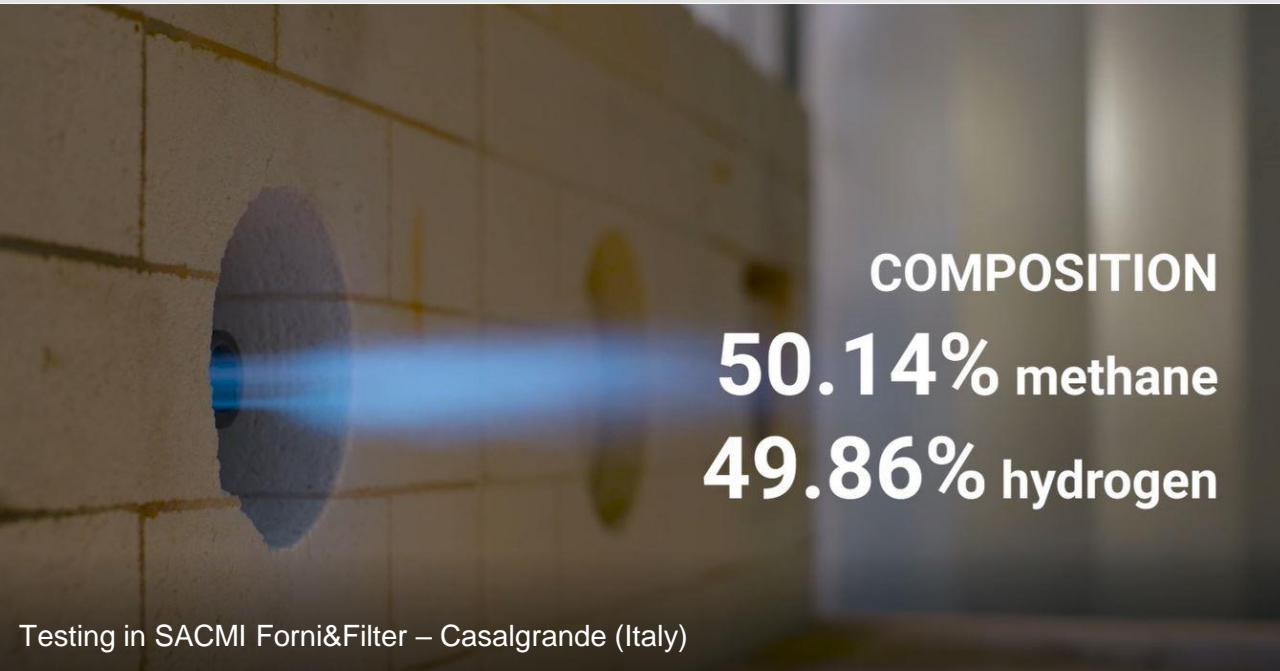
**50% CH<sub>4</sub> + 50% H<sub>2</sub>**

		2022	2025
Energy consumption	kWh/m <sup>2</sup>	12,1	-10%
Emissions	kgCO <sub>2</sub> /m <sup>2</sup>	2,58	-33% (*)

(\*) assuming the availability of hydrogen

**H<sub>2</sub>**

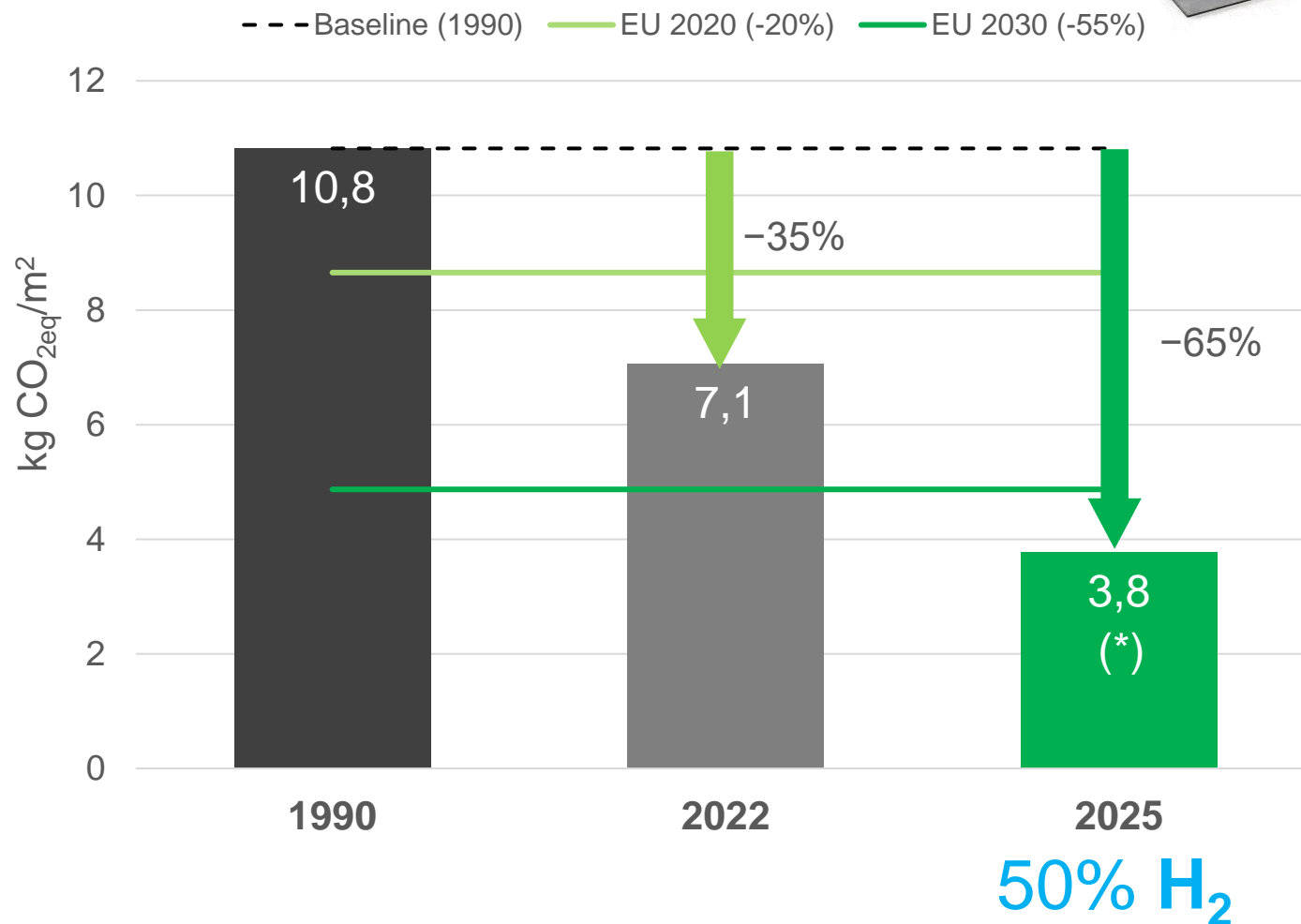
## 4. Firing



- SACMI invested more than 2 year of R&D in developing a new range of dedicated hydrogen burners
- We are currently working on a research project related to **100% H<sub>2</sub> special burners** and kilns

- All the SACMI Kilns built **after 2010** can work up to **10% H<sub>2</sub>** blend
- **New kiln** with dedicated burners and combustion systems can work up to **50% H<sub>2</sub>** blend
- Future kilns will be able to work with blend up to **100% H<sub>2</sub>**

## Porcelain tile 60x60 - 10 mm



### CO<sub>2</sub> current emissions

**7,1 kgCO<sub>2eq</sub>/m<sup>2</sup>**  
**-35%** compared to 1990



### Proposed Solutions

Target 2025 (\*)

**3,8 kgCO<sub>2eq</sub>/m<sup>2</sup>**  
**-65%** compared to 1990

(\*) assuming the availability of hydrogen

- Reducing the environmental impact, in particular **CO<sub>2</sub> emissions**, is an essential objective for the ceramics industry. SACMI is firmly committed to researching solutions for state-of-the-art, more efficient and **sustainable plants**.
- We have shown the energy consumption data of the main transformation phases and how it is possible to **reduce CO<sub>2</sub><sub>eq</sub>** emissions of **-65%** compared to 1990. This means that the ceramic industry can meet the objective of **-55%** set by the European Union for 2030 with the “Fit for 55” program.
- The environmental and energy challenges that the ceramic industry is facing require a **synergistic action** between the availability of “green energy” sources, such as H<sub>2</sub>, and the development of innovative solutions for machines and plants capable of exploiting these new energy vectors.
- The innovative technologies proposed make it possible to maintain the **high quality** of the ceramic product unchanged, a necessary step to preserve the leadership over alternative materials.





*Our challenge is sustainability  
of the ceramic industry*

MANY THANKS FOR YOUR ATTENTION

