SACMI technology for a sustainable ceramic process

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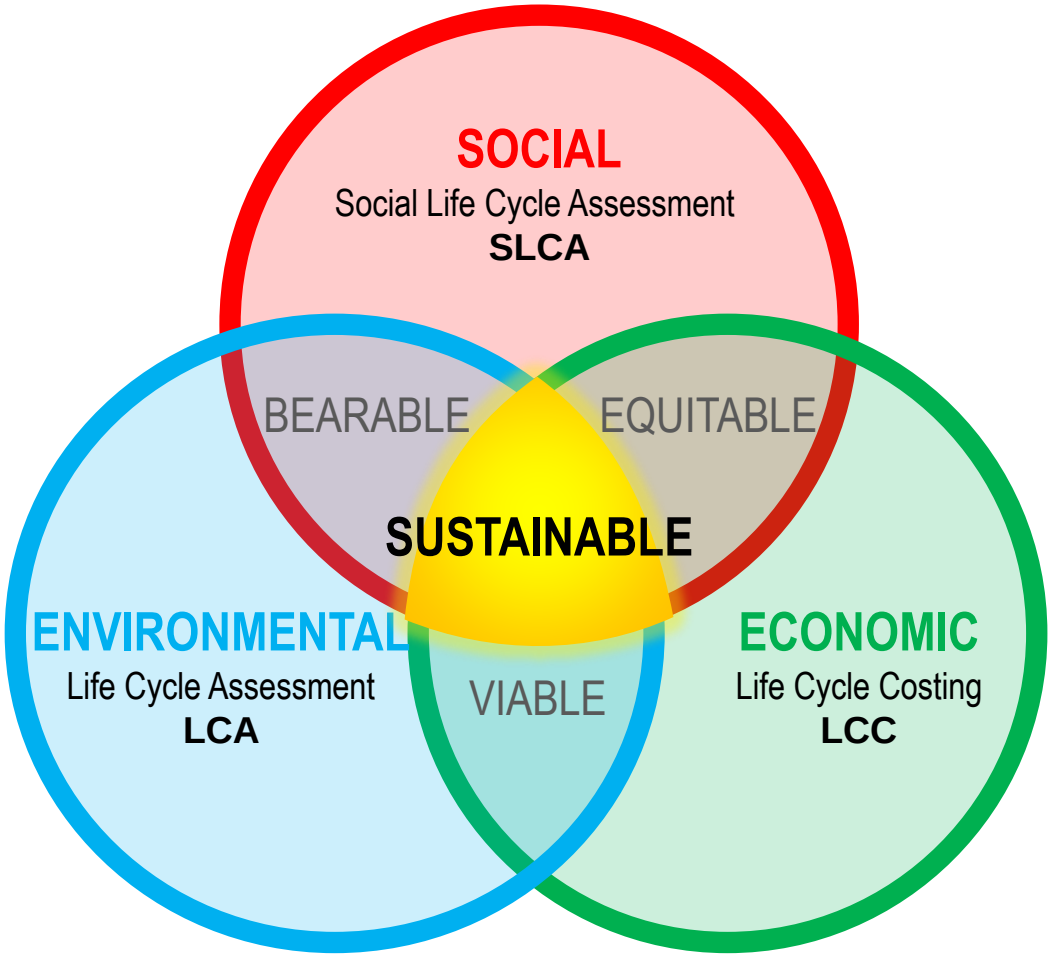
The LCA method

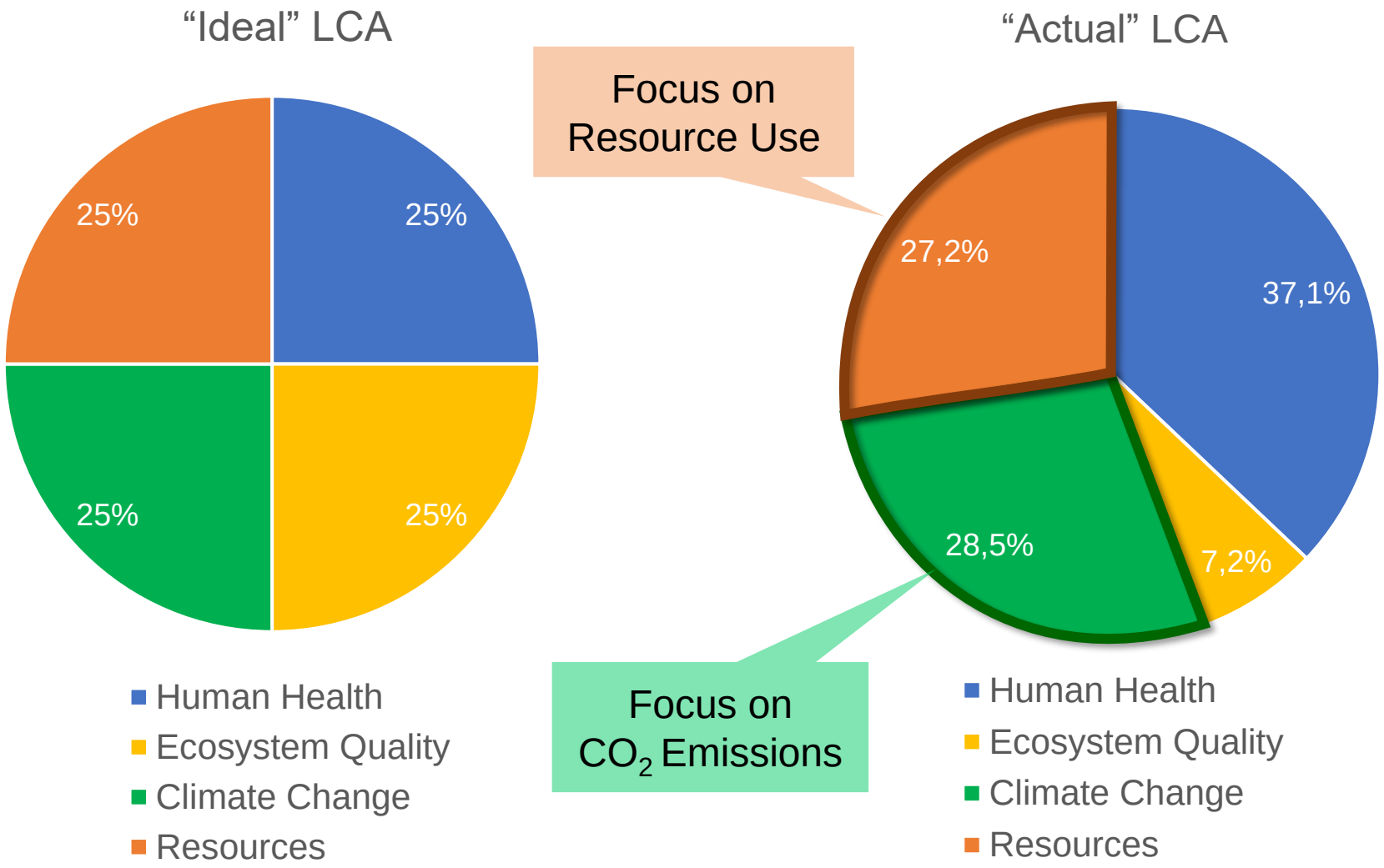


- In recent times, the acknowledgement of **environment value** led to the development of instruments for study the **environmental impact**.
- The **LCA** method (1990) established itself as efficient instrument for verifying the environmental performances of industrials products and processes.
- LCA allows to quantify the **environmental impact** of the production of an asset, evaluating the entire production chain and considering the effects over a very long time.
- The impact is expressed by the evaluation of specific **damage categories.**
- In a higher and overall vision, when we talk about **sustainability** we must consider not only the **environmental** aspect, but also the **economic** and **social** one.

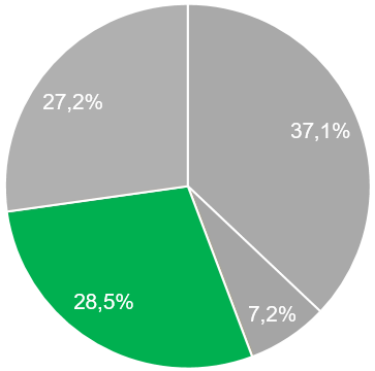
Source: https://en.wikipedia.org/wiki/Sustainability

The LCA of the ceramic tile

- As to the ceramic industry, 4 **damage categories** are considered in the LCA studies



Confindustria Ceramica - UniMoRe (2012)

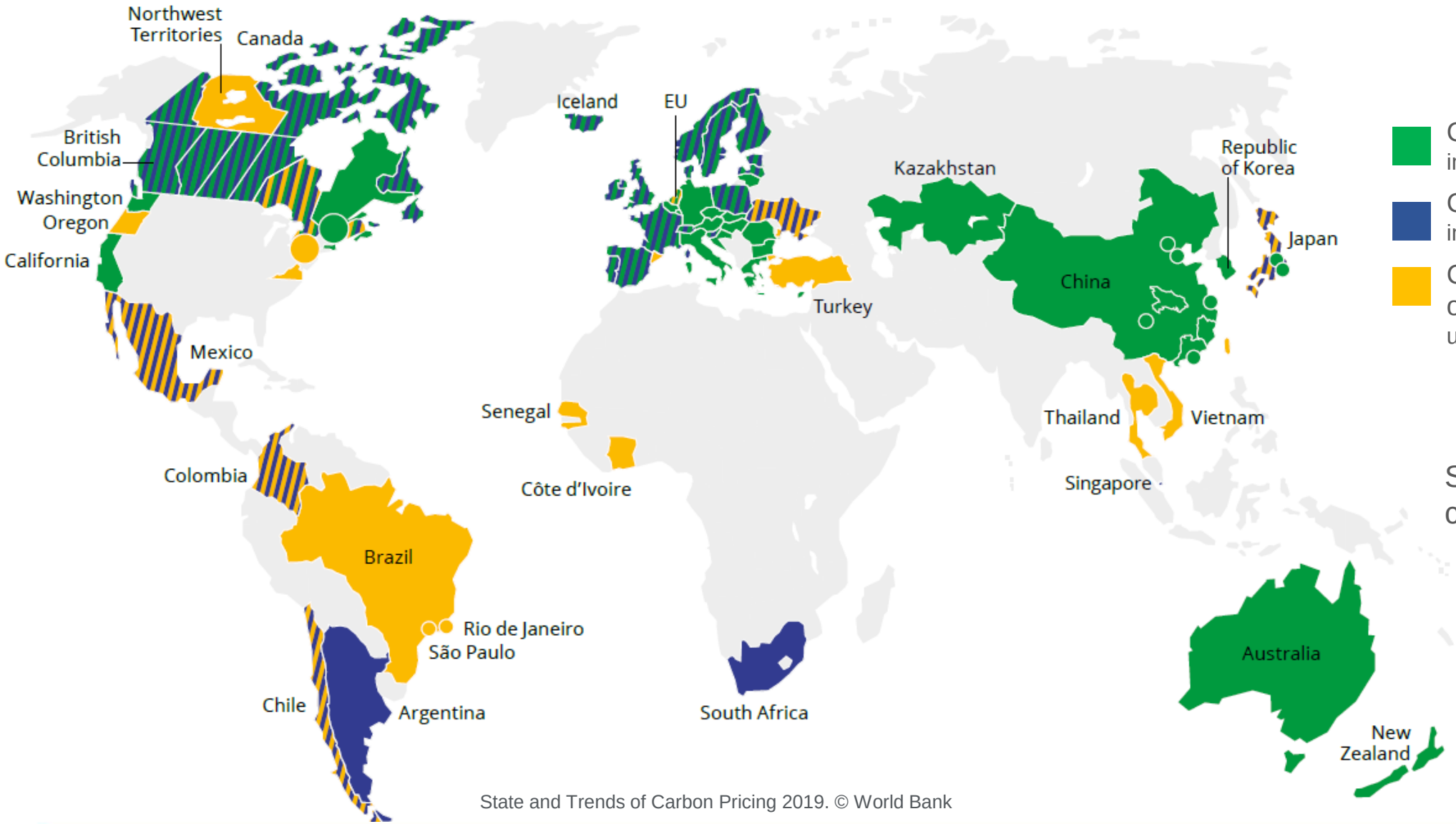


Focus on CO_2 Emissions

The mechanisms opposing Global Warming

- The Kyoto Protocol (1997) and the next deliberations in contrast to **Global Warming** impose a progressive «decrease» of CO_2 emissions originated using fossil energy sources (not carbon-neutral).
- The international Organisations and the single national Governments are dealing with this problem, even if with different strength and speed. The EU has established the ETS (**Emission Trading System**) for controlling and reducing industrial emissions, since 2005.
- In addition, the increased **sensitivity of the public opinion** (especially among young people) to environmental subjects and global warming must be considered.
- The closest official target for the EU set by the Paris Agreement (2015) was to reduce CO2 emissions by **40% by 2030** (compared to 1990 values).
- The **European Green Deal** has brought the **reduction to 55%** by 2030, with the final goal of **climate neutrality by 2050** (net-zero GHG emissions).

Emissions control systems around the world (2019)



Carbon emission trading
implemented or scheduled

Carbon tax
implemented or scheduled

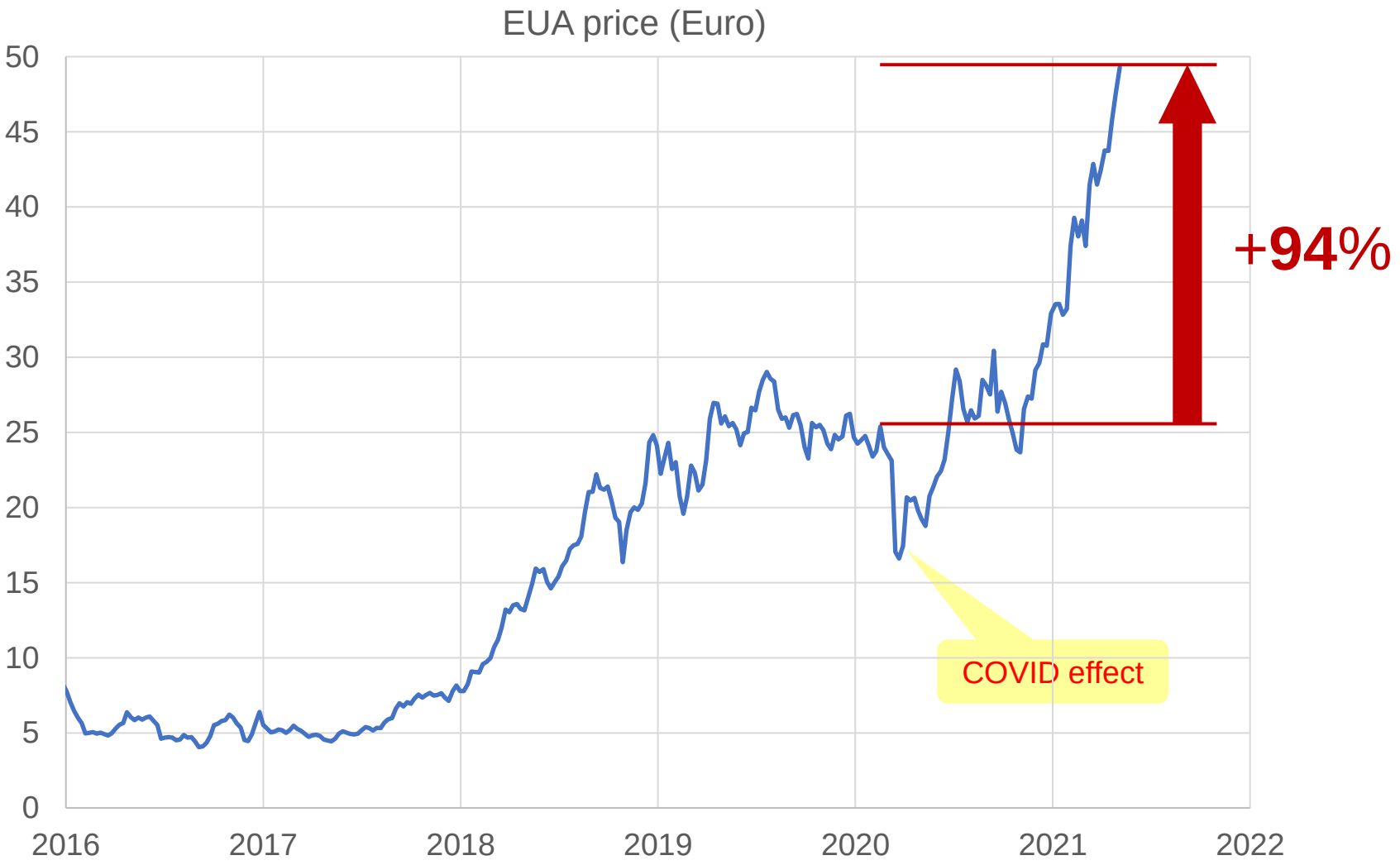
Carbon emission trading or carbon tax
under consideration

Share of GHG emissions covered (2020):

20%

State and Trends of Carbon Pricing 2019. © World Bank

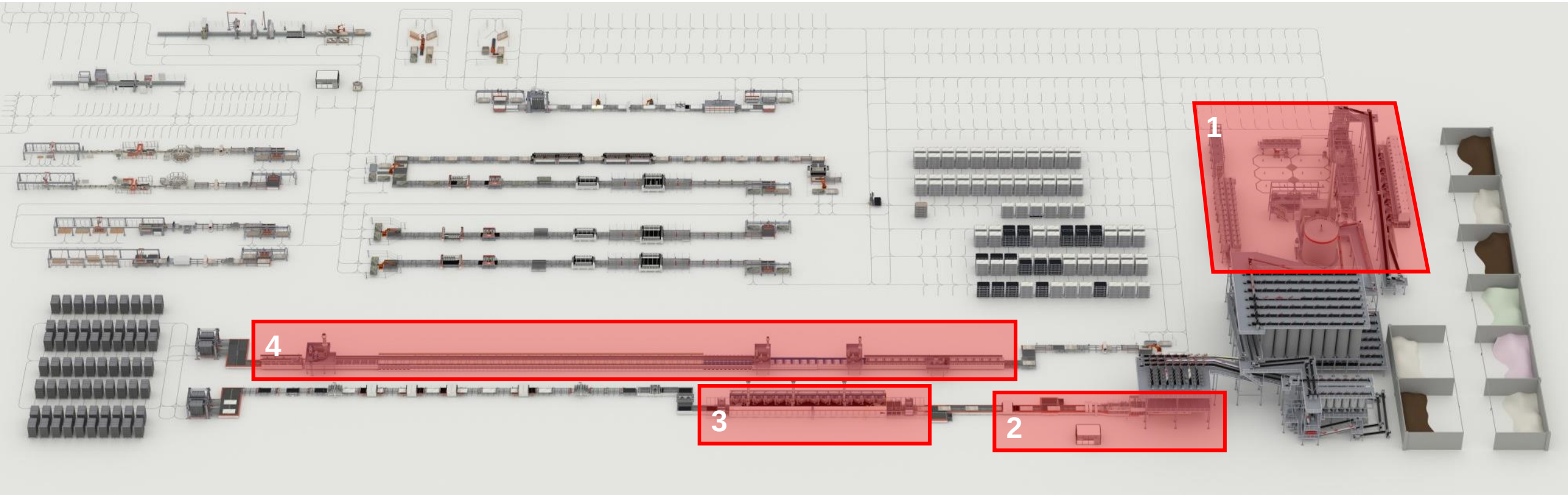
Emissions Trading System carbon market price



https://ember-climate.org/carbon-price-viewer

- The ETS sets an authorized cap for «large emitters» (like ceramic industries). Besides, such authorizations are progressively reduced (-2,2% per year).
- This involves a **trend increase** of the emission allowance price (1 EUA = 1 ton CO_{2eq}).
- In the last year, **increase** was **+94%** (excluding first COVID effect).
- With this trend, the emissions cost in Europe will become **unbearable** for most of emitting industries.

SACMI proposal for CO_{2eq} emissions reduction



In order to reduce CO_2 emissions, caused by the use of fossil fuels and non-renewable electrical energy, solutions have been studied with reference to those **depts**. which require more energy (representing 85% of total emissions):

1. Body preparation
2. Forming
3. Drying
4. Firing

SACMI proposal for CO_{2eq} emissions reduction

- As to each **department**, **three scenarios** are presented:

2015 represents the present state of the art of the existing plants (some years life)

2021 represents the level of emissions control as best as possible **today**

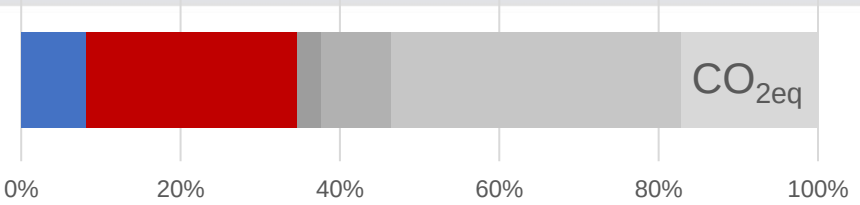
2025 represents a **reasonable** future target, which SACMI is already working on, with important innovations especially in «green» fuels and renewable energy

- Even the mix at the power station (for electrical energy production) was taken into account for each scenario
- The indicated variations (in %) are calculated with respect to the scenario of **2015**, taken as reference
- Of course, it deals with a simulation carried out for a certain plant/product typology. Therefore, the values must be considered as indicative and may vary case by case.

Electrical energy	
Scenario	Fossil amount
1990	120% (*)
2015	100%
2021	60%
2025	50%

(*) mix with coal and oil, larger CO_2 emissions

1. Body preparation



The **modular continuous grinding** MMC allows a considerable reduction of the **electrical energy** for **grinding** ceramic bodies, besides better quality and process control.

In addition, a **thermal recovery** is possible, for warming up grinding water and decreasing total energy consumption.

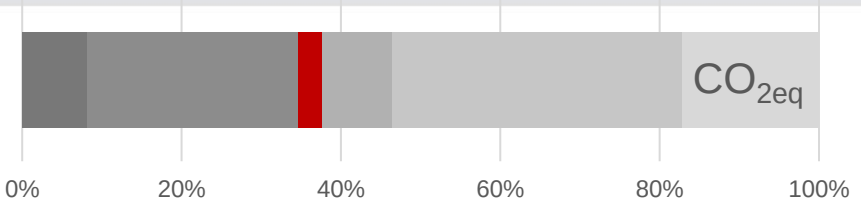
As to **spray-drying**, the study of solutions for using **hydrogen** (*) as partial replacement of natural gas (up to 50%) is in progress. This will involve a considerable reduction of CO_2 emissions.

		2015	2021	2025
Emissions reduction	CO_{2eq}	-	-20%	-47% (*)

(*) H_2 availability to be verified

The reported values must be considered as indicative
and liable to variations in function of the adopted specific production process.

2. Forming



Forming is a basic phase of the ceramic process, even if it requires rather limited energy (very high forces, but reduced movements).

CONTINUA+ technology, exclusive innovation by SACMI, already allows an outstanding reduction of the **electrical energy** employed for **compacting** the ceramic powders, compared to hydraulic presses of equal capacity.

All this occurs under conditions of very high quality of the final product and maximum throughput.

		2015	2021	2025
Emissions reduction	CO_{2eq}	-	-88%	-90%

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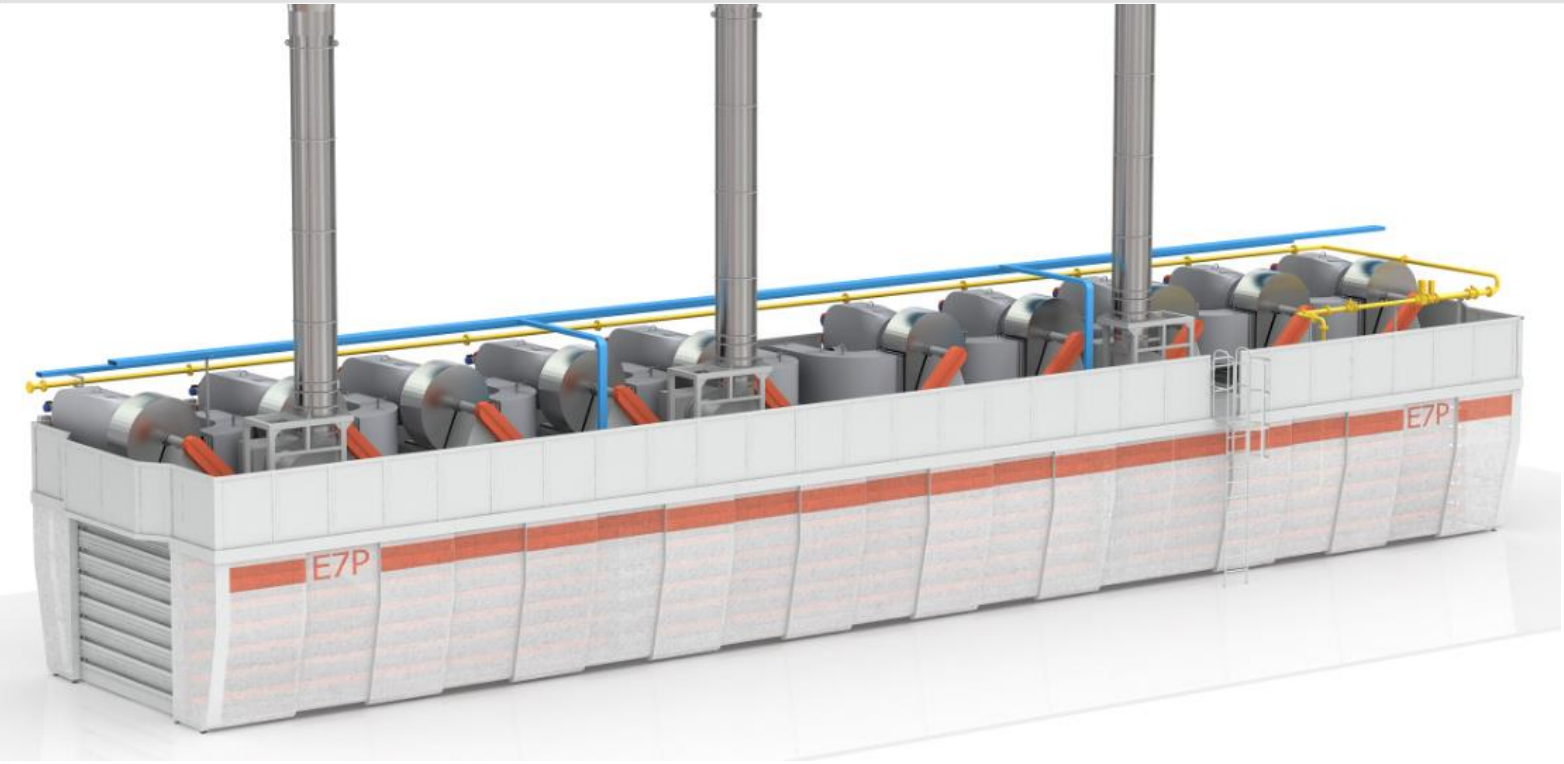
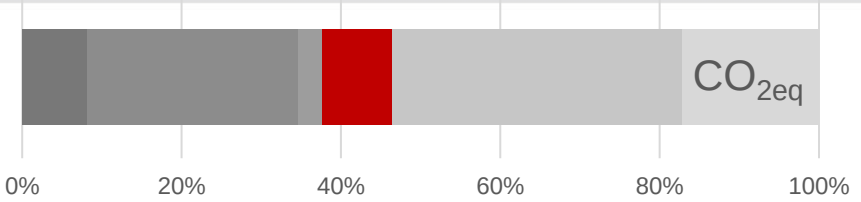
3. Drying





The **drying** phase requires great amounts of **thermal energy** for eliminating residual water from the ceramic piece, under controlled conditions.

The traditional driers, equipped with natural gas burners, generate a considerable waste of energy and emissions.

The innovative **Zero Fuel** drier, which provides for total recovery of hot air from the firing kiln, **does not employ fossil fuels** and already allows a great energy (and emissions) saving.

		2015	2021	2025
Emissions reduction	CO_{2eq}	-	-75%	-79%

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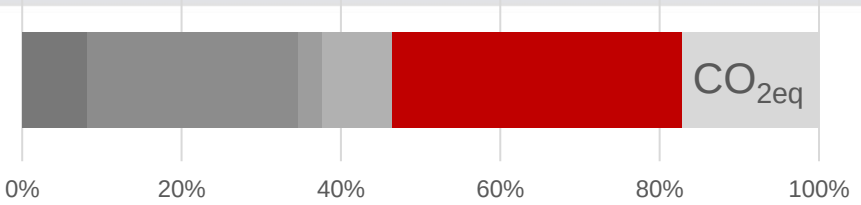
4. Firing



The **firing** phase shows the greatest consumption of **thermal energy** in the process and is the biggest in terms of emissions.

The new range of kilns MAESTRO, equipped with innovative solutions, allows reducing energy consumption and optimising combustion (digital control of combustion ratio).

In the near future, the partial conversion from fossil fuels to **electrical energy** and/or **hydrogen** will allow replacing up to 50% natural gas, with considerable benefits in terms of emissions.

		2015	2021	2025
Emissions reduction	CO_{2eq}	-	-8%	-33% (*)

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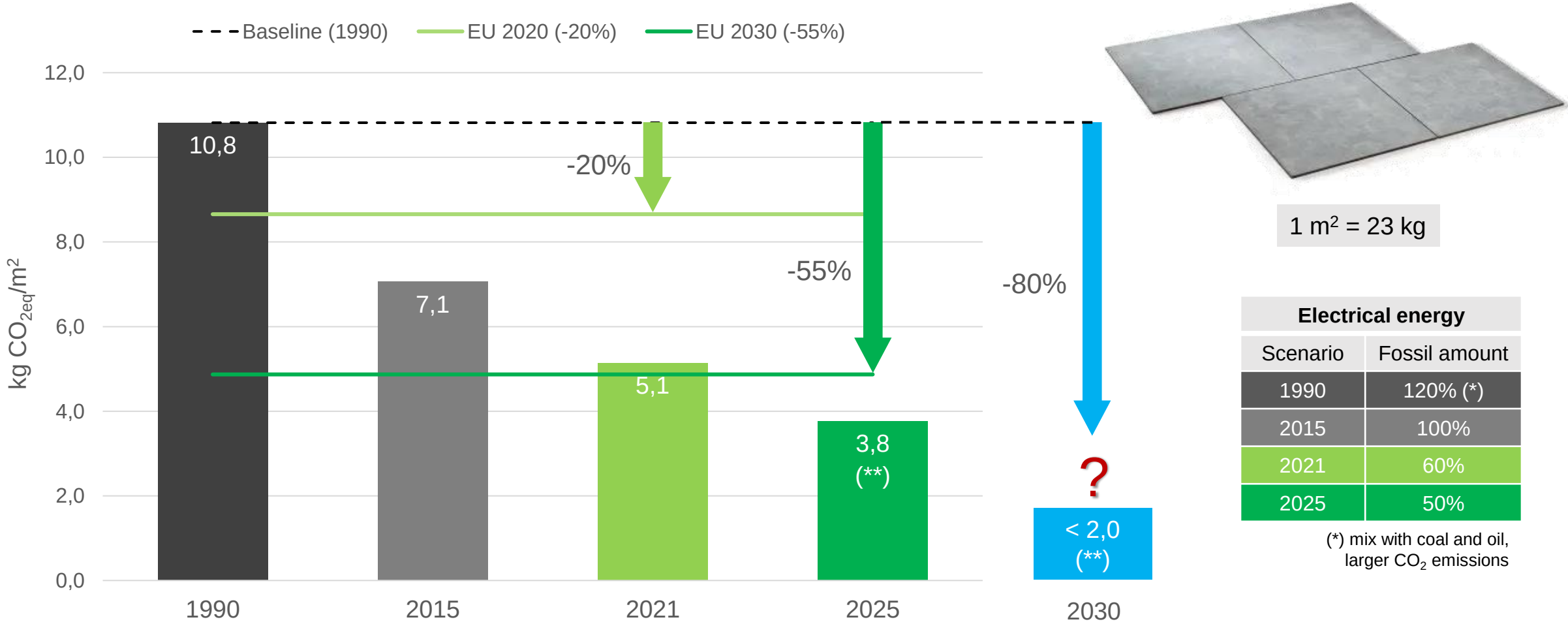
(*) H_2 availability to be verified

The control of CO_{2eq} emissions in the ceramic industry

Porcelain stoneware 60x60 - 10 mm



1 m^2 = 23 kg

Electrical energy	
Scenario	Fossil amount
1990	120% (*)
2015	100%
2021	60%
2025	50%

(*) mix with coal and oil, larger CO_2 emissions

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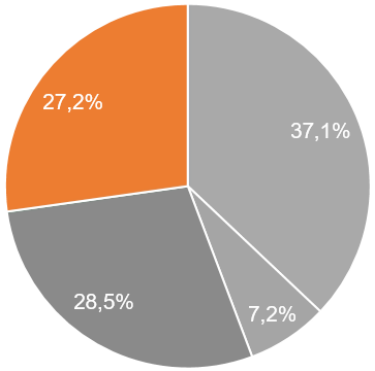


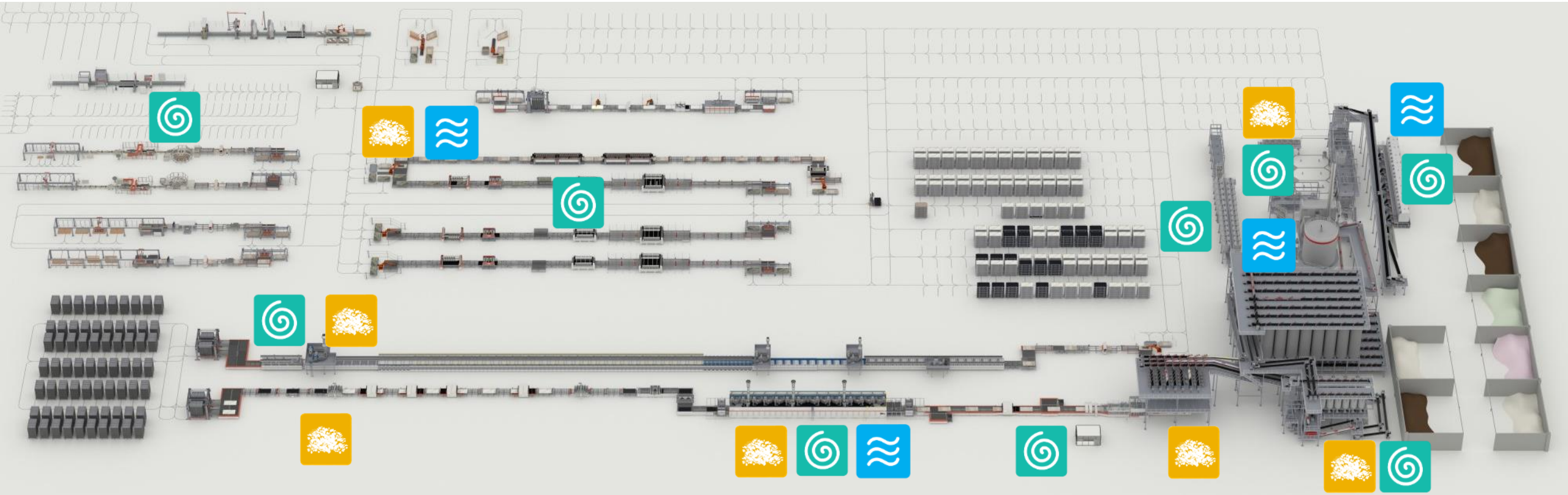
Focus on Resource use

Material recovery from the production process

Solid wastes are generated during the process. In general, they can all be re-used inside the process itself, restoring them upstream by means of opportune treatments.

Ceramics requires the use of **water**. It is important to treat it in order to recover it, for avoiding wastes and for managing natural resources responsibly.

Filtering **powders** is essential for the healthy of the working environment and for preserving the functionalities of the machines and product's quality. It allows saving on raw materials.



Material recovery from the production process

- The **waste** can be estimated in **about 3%** of the total material
  (about 300 kg/h solid and 300 lt/h liquid per production line, indicatively)
- The ceramic industrial process is already characterized **today** by high percentages of **internal recycling** (> 65%)
- The **recovery intensity** can be further improved by focused actions in the whole production process.
  Two scenarios, of medium and long term, are supposed:

	2021 (*)	2025	2030	Δ 2021-30
Solid waste recovery	65%	81%	91%	**+26%**
Liquid waste recovery	68%	80%	86%	**+19%**
Evaporated water recovery	0%	25%	50%	**+50%**

- The recovery of **evaporated water** (spray-drier and drier) requires a substantial modification of the machines and relevant engineering, which involves an increase of plant complexity and cost.
  By now, it could be financially sustainable in the countries where water is a precious good (i.e. Middle East, Northern Africa, …).
  It is expected that the attention to these solutions will increase even in Europe.

(*) average data of this industry

The reported values must be considered as indicative
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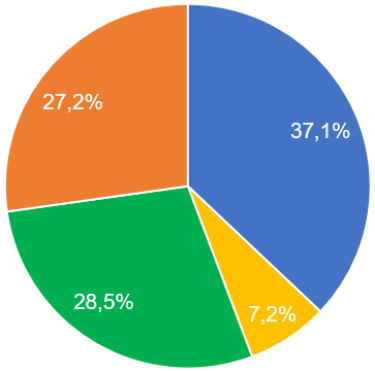
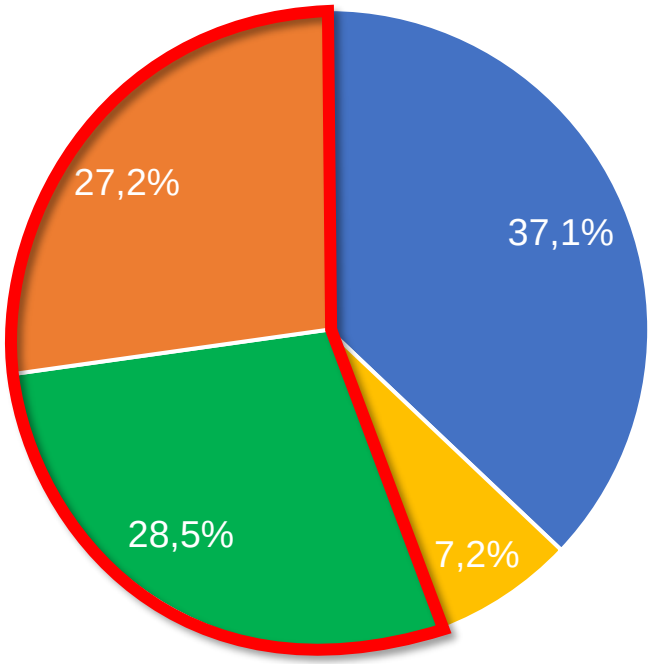


The whole picture

The whole picture

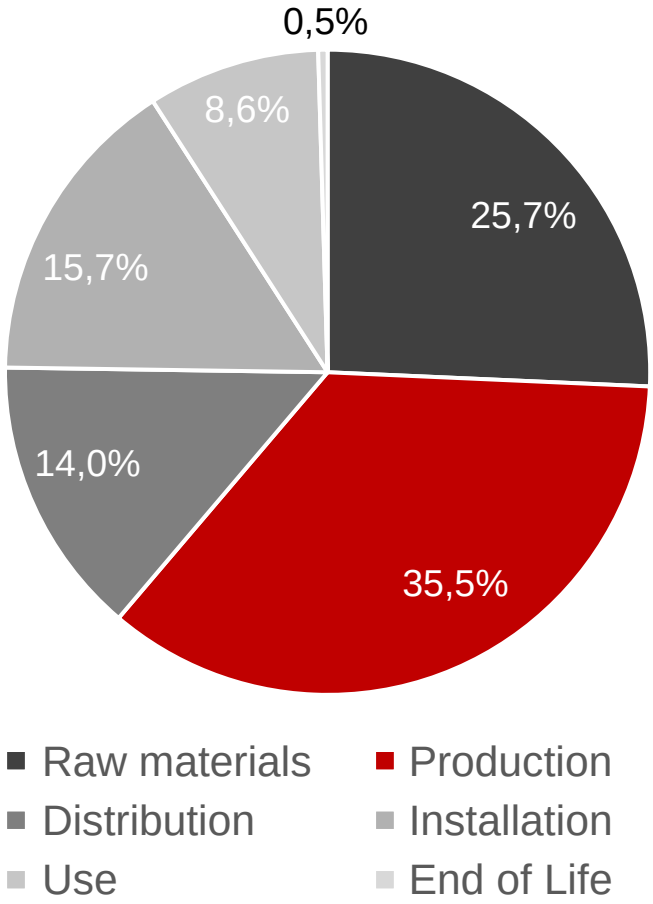
Damage Categories



Confindustria Ceramica - UniMoRe (2012)

- The LCA method provides for the analysis of **4 damage categories**
- The categories **Climate Change** and **Resources** affect for **about 50%** of total amount (ceramic industry)
- The analysis *gate to gate* (Production) concerns **about 40%** of total impact (ceramic industry)
- The presented actions refer to **about 20%** of **total impact** for the tile system
- A lot still needs to be done

LCA *cradle to grave*



Gresmalt - UniMoRe (2018)

Conclusions

Ceramic innovation cannot leave the environmental issue out of consideration

SACMI is committed next to its Customers to ensure an efficient and sustainable production process

THANK YOU FOR YOUR ATTENTION

SACMI

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