HIDROKER project, an experimental approach to the use of hydrogen for firing ceramic tiles.

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Project funded by:

GENERALITAT VALENCIANA

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Who are we? | INSTITUTO DE TECNOLOGÍA CERÁMICA. ITC-AICE

ITC is a **technology institute** that emerged in 1969, noted for pioneering the university–business cooperation system.

ITC emerged at the university, aware, owing to the proximity of the **ceramic sector**, that it could help resolve the problems and needs of ceramic companies for them to grow and become more competitive.

ITC generates **innovation** through **research**, provides technical and economical **assessment**, carries out **tailored trainings**, provides **specialized services**, and much more.

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Buildings	Towns	User	Materials
Eco-innovation	Hypocarbonic Industry	Industrial processes	Environmental Health

MOTIVATIONS

The manufacture of ceramic products is a thermal energy intensive process. Nowadays, heat needed for drying and firing is obtained by combustion of natural gas, whose combustion releases CO_2.

In 2021, near 3 millions of tons of CO_2 where released by ceramic tiles manufacturers in Spain.

The ceramic tile sector is under ETS mandatory regulations, and, although considered at risk of carbon leakage, it does not receive all CO_2 rights emitted. Hence, CO_2 emissions have become an additional cost to be considered .

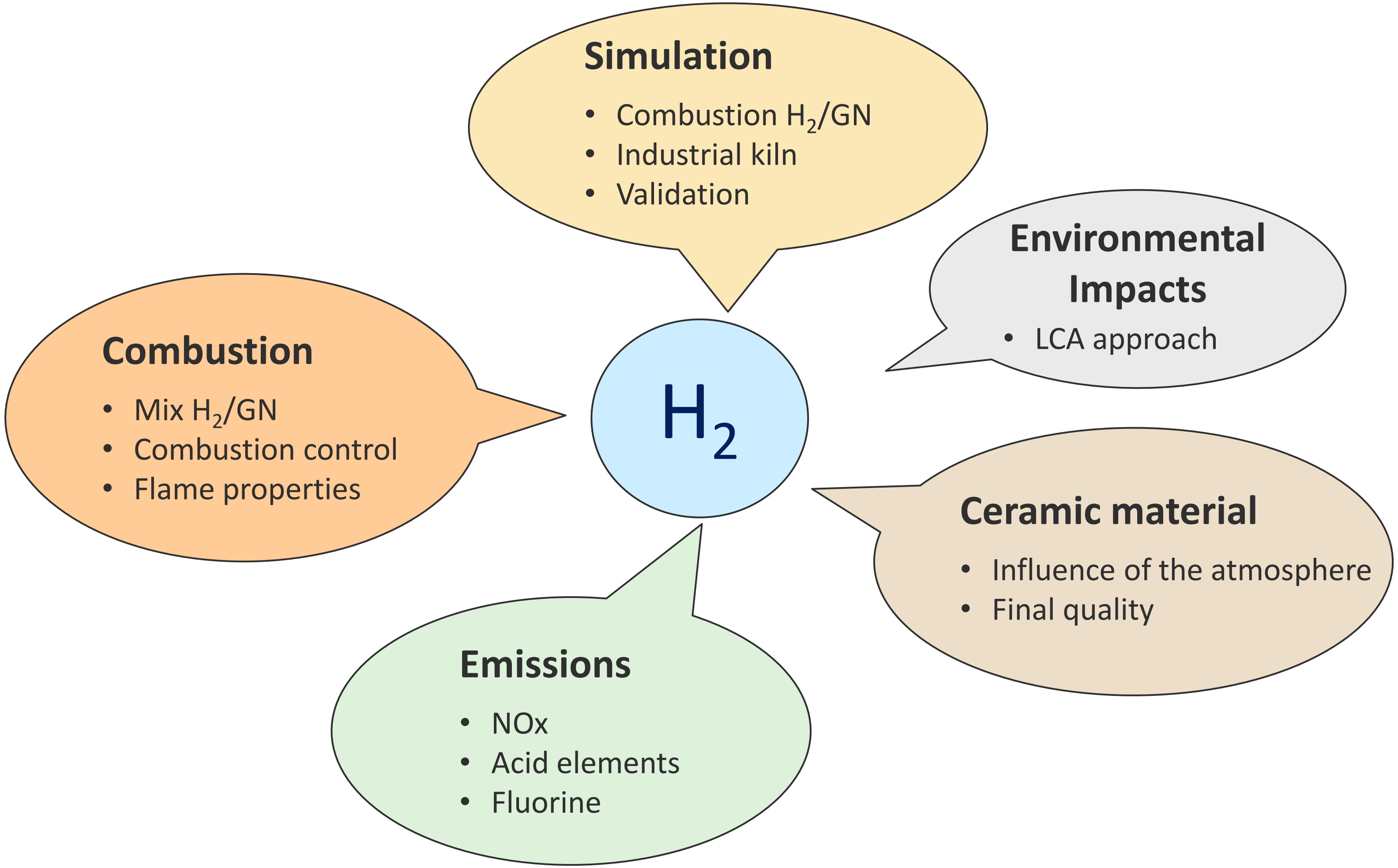
In 2020, this additional cost reached 11,25 millions € (considering 25 €/t CO_2)

An option to reduce CO_2 emissions is the use of Hydrogen as a direct source of heat, as its combustion only produces water vapour. But it is not easily available, it should be produced with renewable energy (green H_2)

The production and transport of H_2 is considered an external factor, as it does not depend on the ceramic sector. But the ceramic industry should analyse the integration of this new fuel into the processes, and its impact on materials.

HIDROKER project aims at studying ceramic products firing using hydrogen as a fuel, and comprises research activities both at laboratory and pilot scale.

HIDROKER | Conceptual map



General objective:

To analyse the technical viability of the total or partial substitution of natural gas by hydrogen as a fuel for firing ceramic tiles.

Specific objectives:

O1. Analyse the influence of the atmosphere on the properties of the ceramic materials and on the quality of the final product.

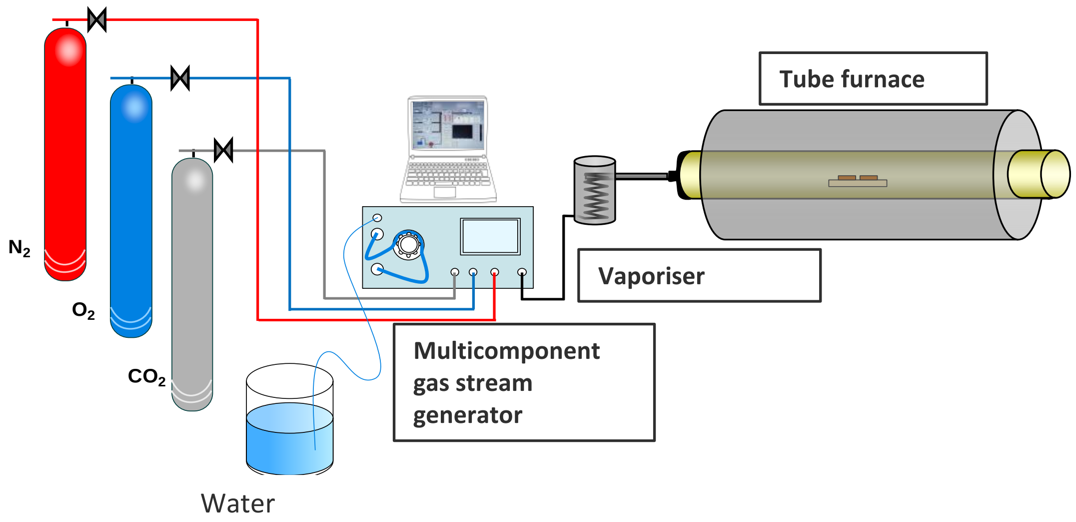
O2. To adapt an existing pilot combustion camera for burning mixtures of natural gas and hydrogen

O3. To carry out experimental research to know the influence of the combustion variables on the process

O4. To simulate the behaviour of an industrial kiln that uses mixtures of natural gas and hydrogen

O5. To study the environmental impacts with LCA

O1. Influence of the atmosphere



Atmosphere (%vol)	1 (10 % H_2O)	2 (30 % H_2O)	3 (50 % H_2O)
O_2	10	10	10
CO_2	10	10	10
N_2	70	50	30
H_2O	10	30	50

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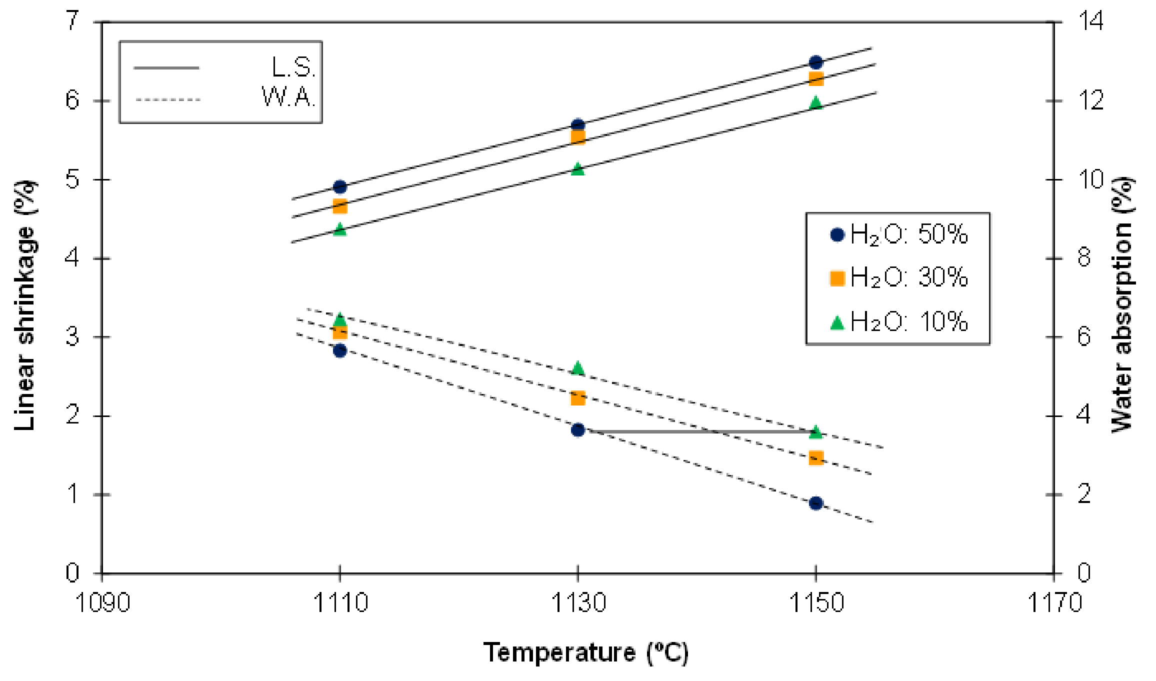
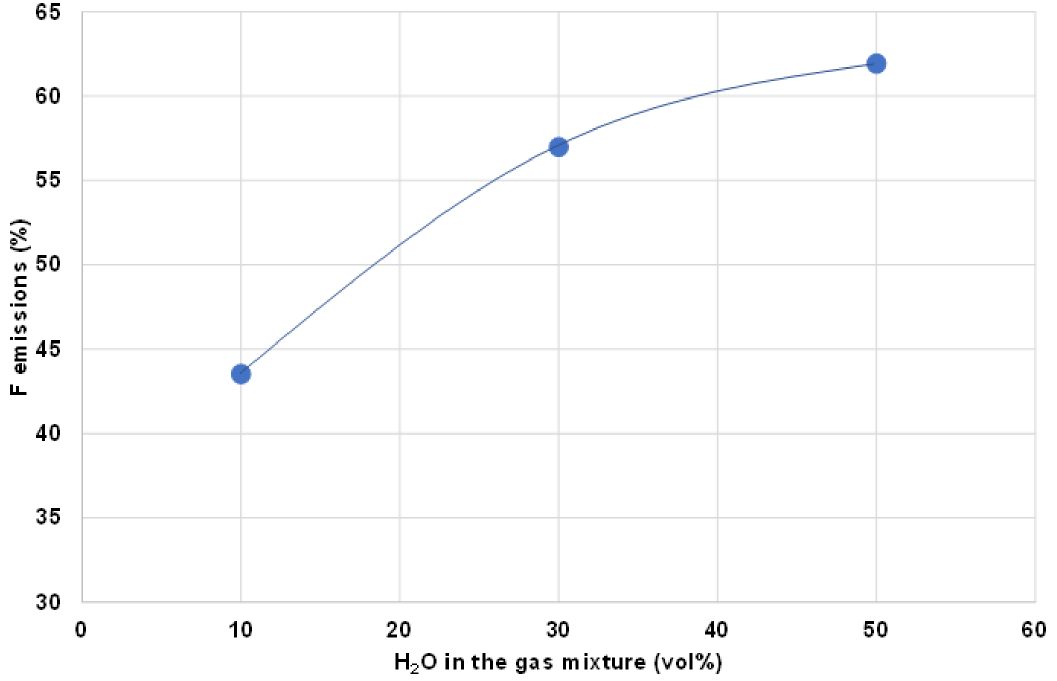
Results obtained with Red-firing stoneware tile





EFFECT OF KILN ATMOSPHERE ON THE FIRING BEHAVIOUR OF CERAMIC BODIES
M.F. Quereda, J.L. Amorós, E. Blasco, A. Saburit, I. Segura, M.F. Gazulla. Poster exhibited at Qualicer Congress, 2022.

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O2. Pilot combustion camera

O3. Combustion tests

COMBUSTION OF HYDROGEN-NATURAL GAS MIXTURES APPLIED TO CERAMICS FIRING: EMISSIONS AND FLAME PROPERTIES
S. Ferrer, E. Monfort, R. Pereira ,M. Gallagher, J. Viduna , J. Montolio, A. Mezquita, J. Vedrí . Oral contribution at Qualicer Congress, 2022.

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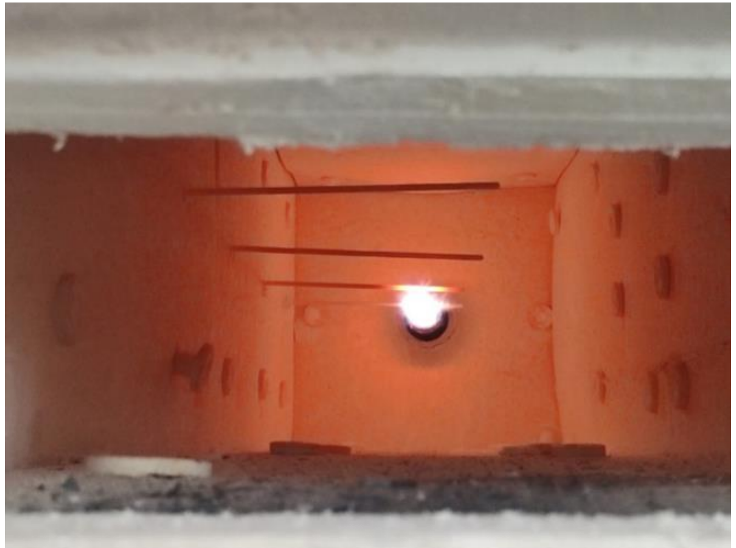
O2. Pilot combustion camera

O3. Combustion tests



O2. Pilot combustion camera

O3. Combustion tests

- ✓ Test with 20% H_2
- ✓ Combustion tests with H_2: ↑T, ↑H_2O, ↓CO_2
- ✓ Industrial pieces fired

- ➢ Measurement of flame temperature
- ➢ New burner to reach > 20% H_2
- ➢ Tests with industrial pieces to check its properties

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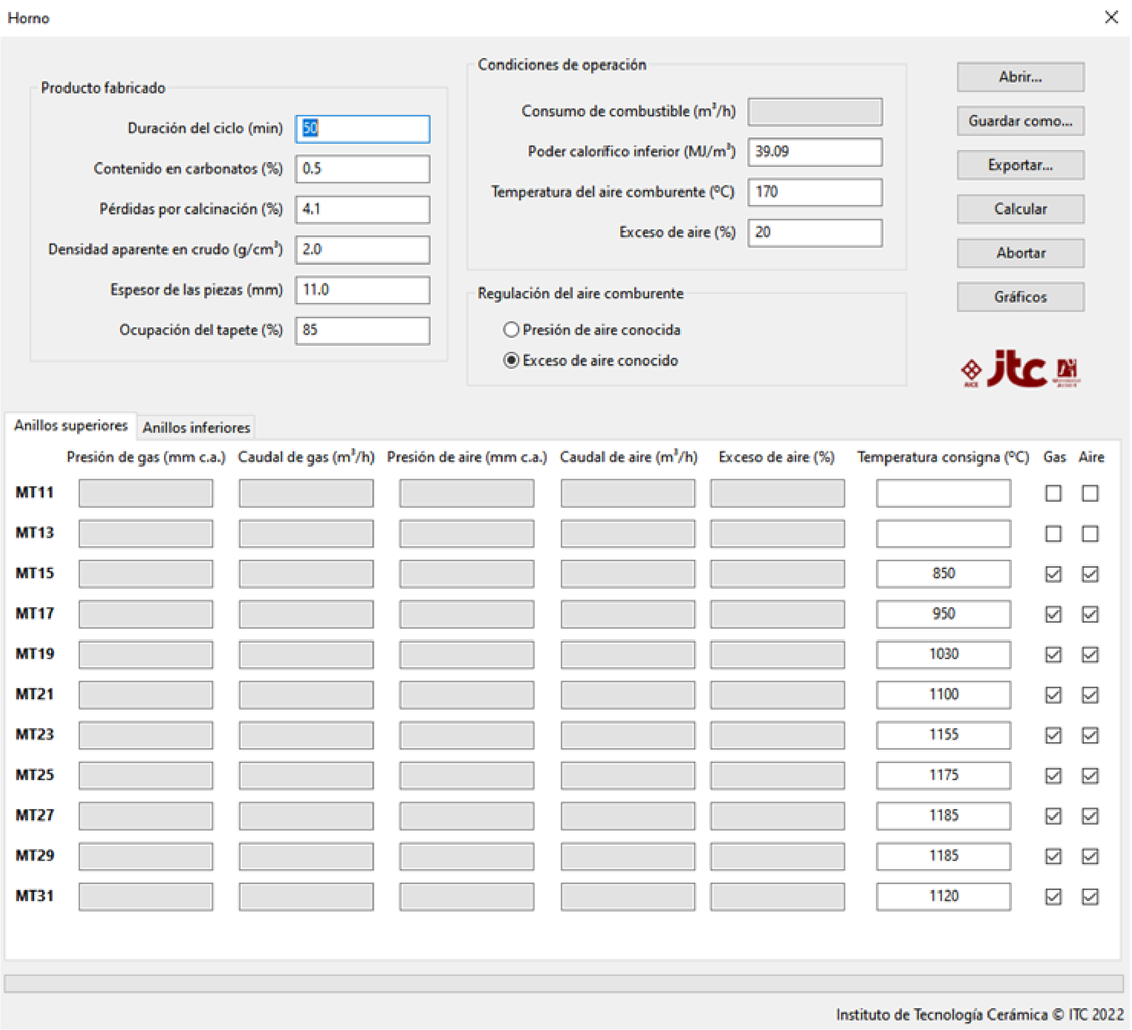

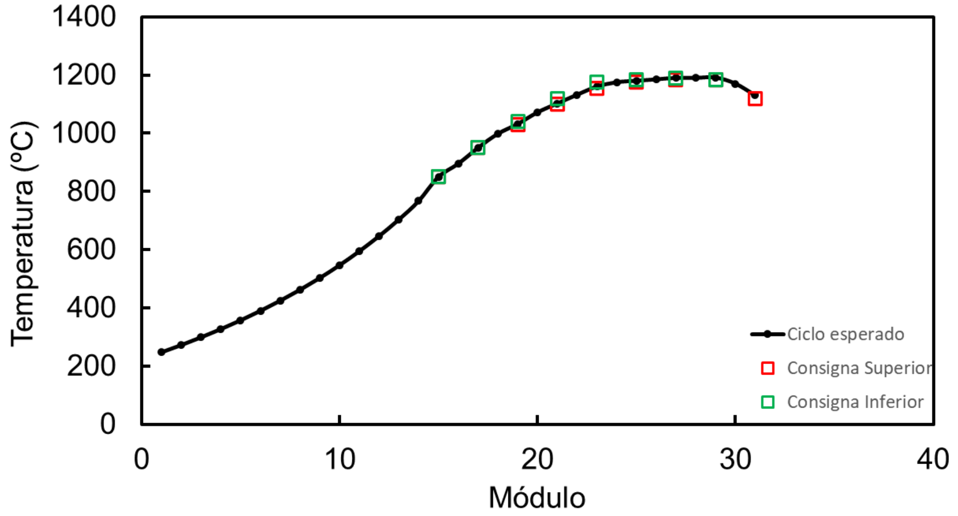

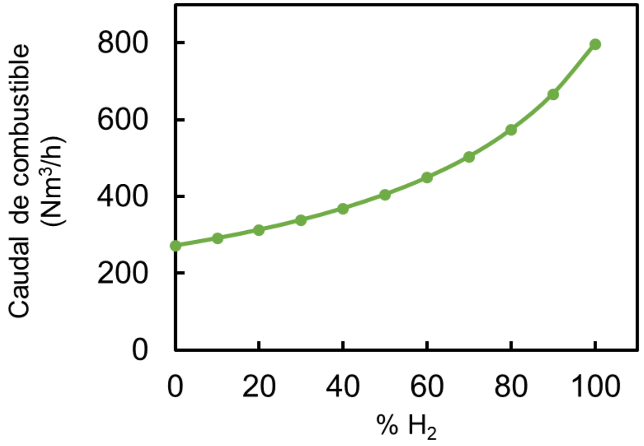

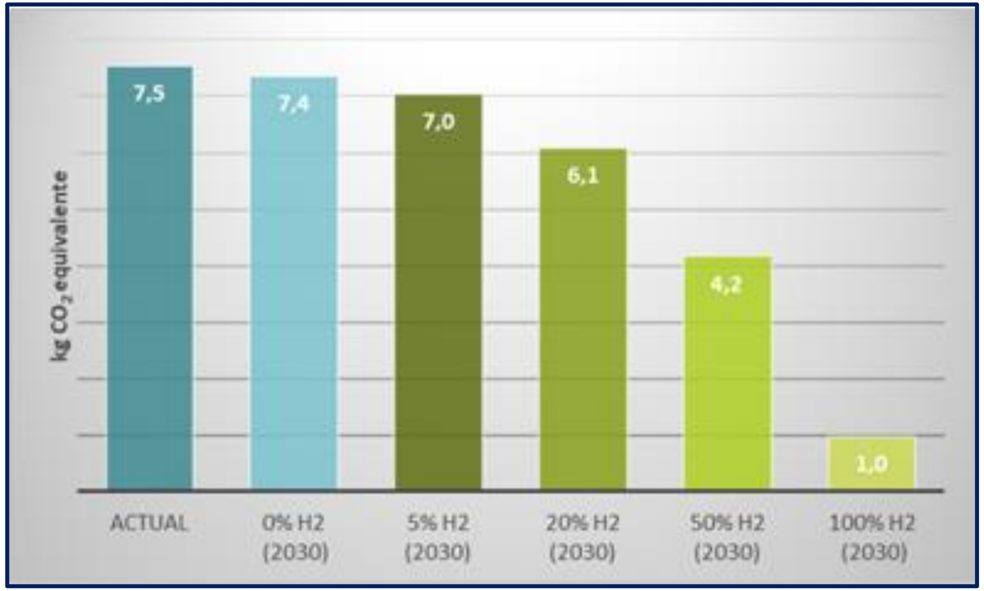

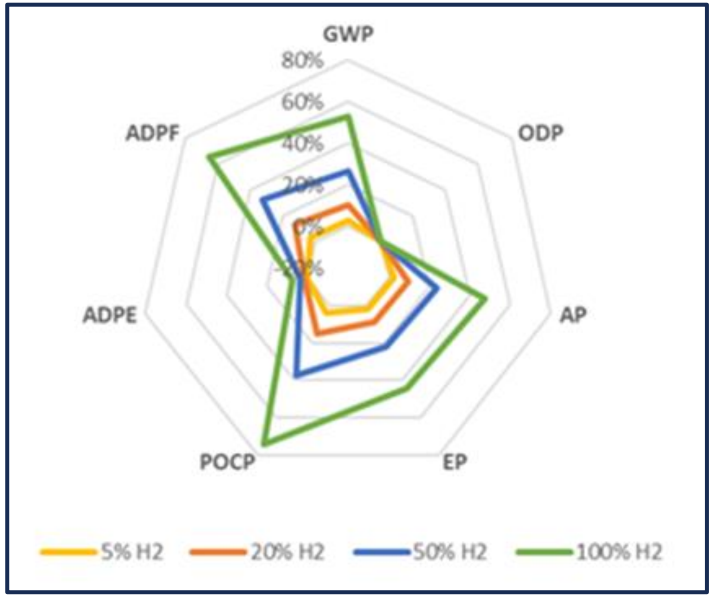

- ✓ LCA is an appropiate tool to know the environmental impacts derived from the use of green hydrogen in the ceramic sector.
- ✓ Carbon footprint could be reduced up to 13 % with a blending of natural gas with 20 % of H2, using current facilities.
- ✓ None of the studied impact categories were adversely affected by the incorporation of green hydrogen.

POTENTIAL REDUCTION OF CERAMIC TILE CARBON FOOTPRINT BY USING GREEN HYDROGEN
T. Ros, E. Monfort, C. Giner, A. Mezquita, S. Ferrer. Poster exhibited at Qualicer Congress, 2022.

Thank you for your attention

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