A novel multi-stage steam gasification and syngas purification demonstration plant for waste to hydrogen conversion

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Clean Hydrogen Partnership

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The HYIELD project has received funding from the European Union's HORIZON-JTI-CLEANH2-2023-01-05 program under grant agreement Nº 101137792. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CHP. Neither the European Union nor the granting authority can be held responsible for them.

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Before we start...

How do you say our name?
We prefer calling the project:

Hi-yield

pronounced with a nod to hydrogen and to yield

As in to increase hydrogen yields from waste conversion.

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HYIELD project

Key information

Call: HORIZON-JTI-CLEANH2-2023-01-05 - Waste to Hydrogen demonstration plant
Budget: 15M€
Grant:10M€
Schedule: January 2024 – December 2027

Description

The HYIELD project will deploy a robust **multi-stage steam gasification** and **gas separation** process that goes beyond the state of the art to overcome the current barriers facing the development of **waste to hydrogen solutions**. The solution will be demonstrated at **3MW scale** at a cement plant in eastern **Spain**, where local organic waste streams will be exploited to produce high purity H2 that will subsequently be used for **cement production**.

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HYIELD consortium

HYIELD consortium has extensive experience in innovation and development in fields including:

- Researchers' institutions and technology centers **(EUT, CSIC, SIN)**
- Technology developers **(MAG, WTE, H2S, MIN)**
- Industrial corporations **(CMX, ENG, ARC, SYN)**
- Waste managers as feedstock suppliers **(Veolia, CET)**
- Engineering and strategy consultancies **(ARI, INV)**

SPAIN
Magtel
inveniam
CEMEX
VEOLIA
WtEnergy
enagas
H2SITE
eurecat
CSIC
CETAQUA
GERMANY
Synhelion
ArcelorMittal
LUXENBURG
AristEng
FRANCE
Mincatec Energy
NORWAY
SINTEF

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HYIELD vision / motivation

Addressing the opportunity of converting waste into clean H2.

Waste disposal

Challenging in territories with limited treatment options:

- Low population density areas, islands, limited infraestructures.
- Most common methods: landfilling and incineration.

Waste generation will increase

>3.40 billion tonnes by 2050.

- Rich in energy. If fully exploited ➤ cover communities' energy needs.
- Challenges for recycling + energy generation ➤ The heterogeneity and composition variations of MSW.

De-carbonisation of hard-to-electrify sectors is still challenging - shipping, aviation, and cement industry.

SOLUTION

Gasification of waste and organic material to extract the energy content in the form of H_2.

MOTIVATION

develop a new low-cost pathway for waste management and clean h2 production.

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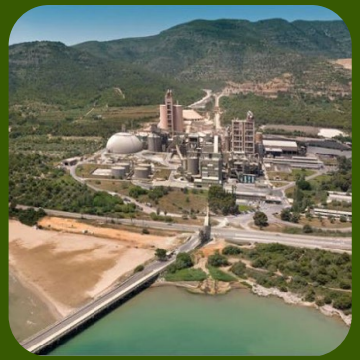
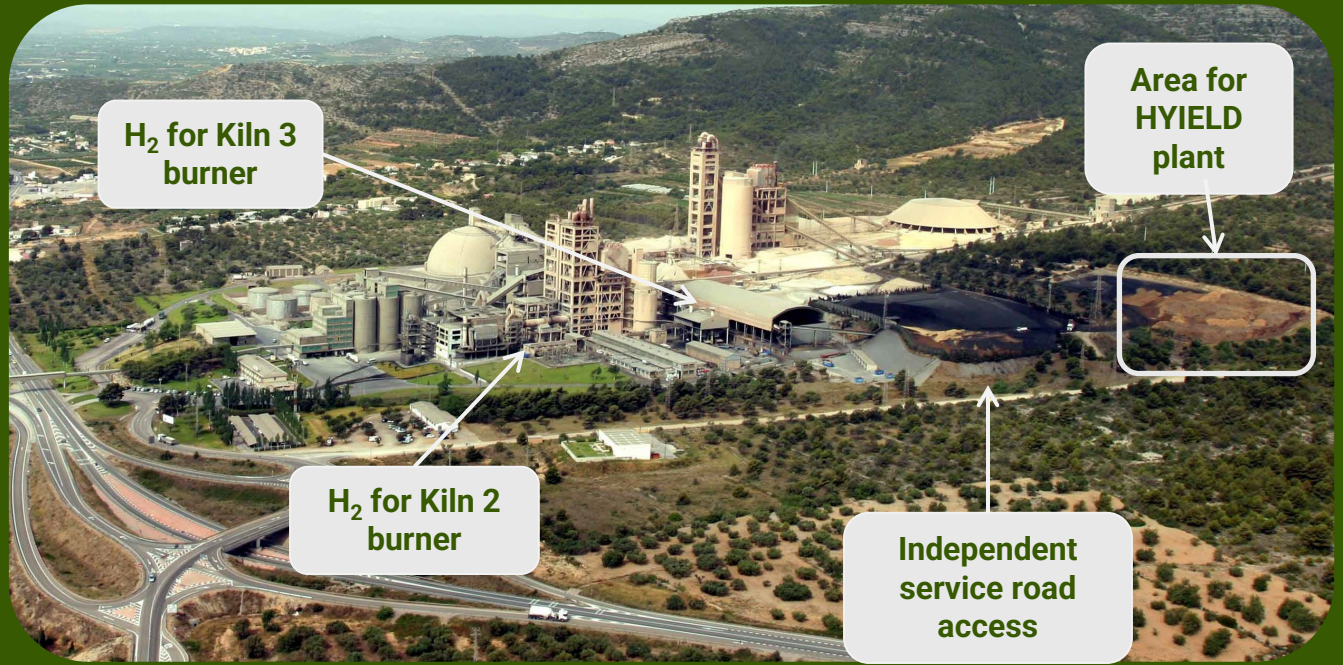
Alcanar Plant





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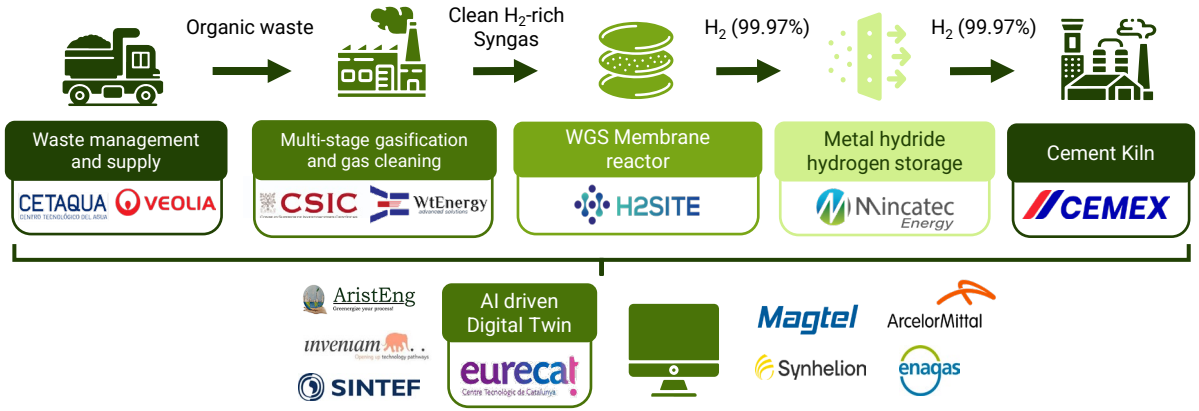
HYIELD demonstration

- CMX's Alcanar plant located in the south of Tarragona, is the selected location for a **demonstration plant**. It is well connected by road and operates a port under concession.
- The plant has integrated:
  - Environmental authorization which includes the use of waste and is ISO 9001, 14001, 45001 and 50001 certified and EMAS registered.
  - Various sources of waste heat.
  - Industrially kilns with hydrogen injection.
  - Possibility of reintegrate ashes in raw materials.



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HYIELD methodology and phases

Stage 1: Planning

- Validate process desing
- Specification and basic engineering for demonstration plant
- TRL 5-6 testing

Stage 2: Development

- Digital Twin
- Site preparation
- Waste feedstock management
- Detailed engineering, manufacture and installation

Stage 3: Demonstration

- Validation
- Extended testing period

Stage 4: Scale-up

- Techno-economic and environmental analysis
- Benchmarking with other hydrogen pathways
- Territorial scale-up and EU potential

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Where are we now?

Stage 1: Planning

- ✓ Validate process desing
- ✓ Specification and basic engineering for demonstration plant
- ✓ TRL 5-6 testing

Stage 2: Development

- ➢ Digital Twin
- ➢ Site preparation
- ➢ Waste feedstock management
- Detailed engineering, manufacture and installation

Stage 3: Demonstration

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HYIELD demonstration to market

PROJECT STARTS — 2023 — TRL4 → TRL5

LAB VALIDATION — 2025 — TRL6

PROJECT ENDS — 2028 — TRL7

2030 — TRL7

Process Desing and optimization for multi-stage plasma-assisted stream gasification and gas cleaning

System prototipe at relevant industrial scale

- Explotation of low and medium grade waste heat from industry or solar for enhanced auto-allothermal gasification
- WGS membrane reactor to separate 99.9% H2 from syngas
- Metal hybride hydrogen storage

Digital Twin for optimized design and operation

COPPER SECTOR

MARKETS

- Increase of affordability and economic attractiveness of gasification plants.
- Overall decarbonization of EU power plants.

CEMENT SECTOR

STEEL SECTOR

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Thank you for your time!

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