EReTech

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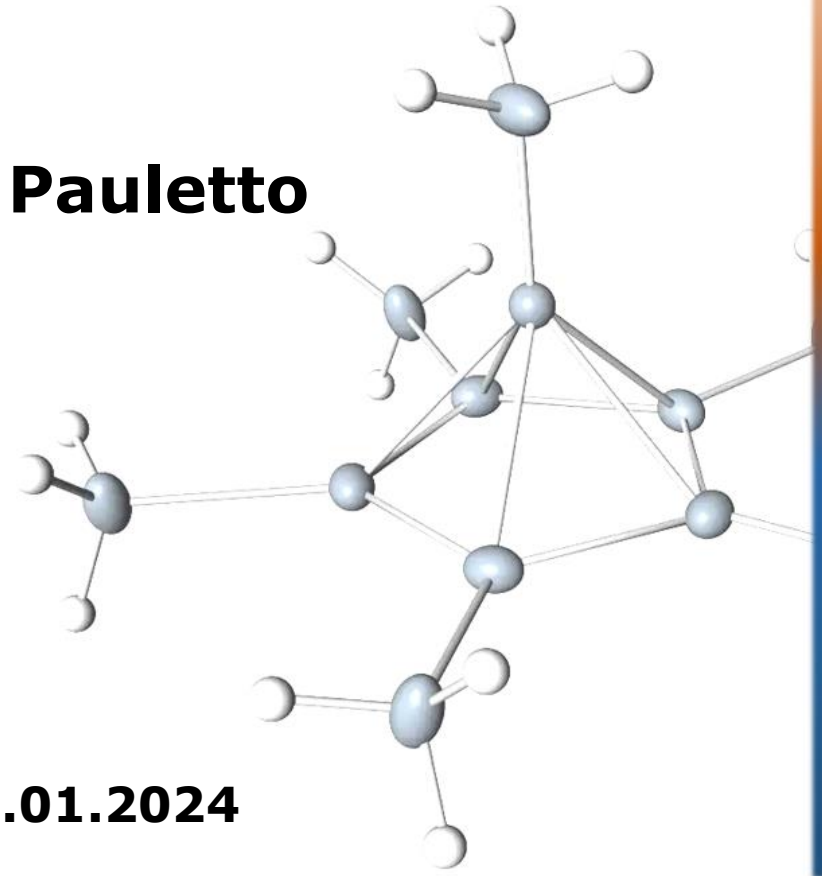
SYPOX



The Electric Decade – 17.01.2024

EReTech: Electrified Reactor Technology

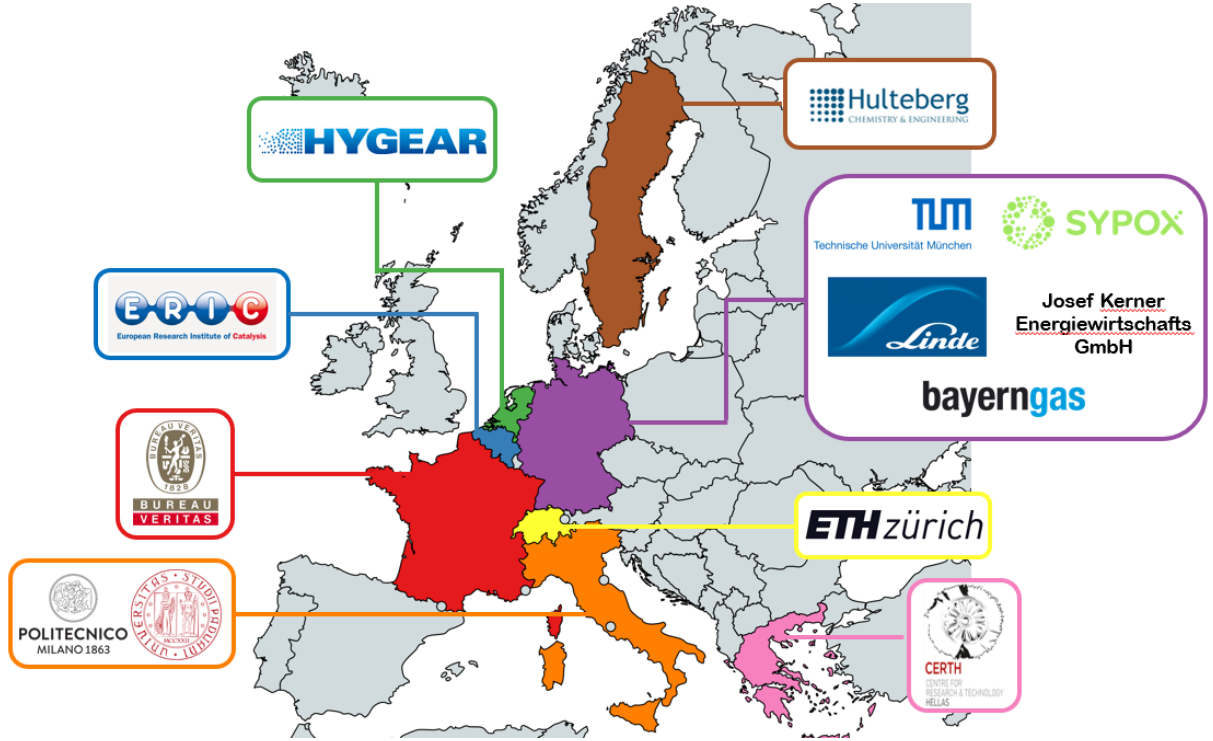
Timeline: June 2022 – November 2025

Budget: approximately 9 M€

Partners: 6 industrial partners

7 universities/research institutions

Coordinator: Technical University of Munich



Resistive heating: Reactor technologies

1

E-FURNACES

- Limited heat transfer
- No intensification

2

E-STRUCTURES

- Intensification
- New materials

3

SYPOX

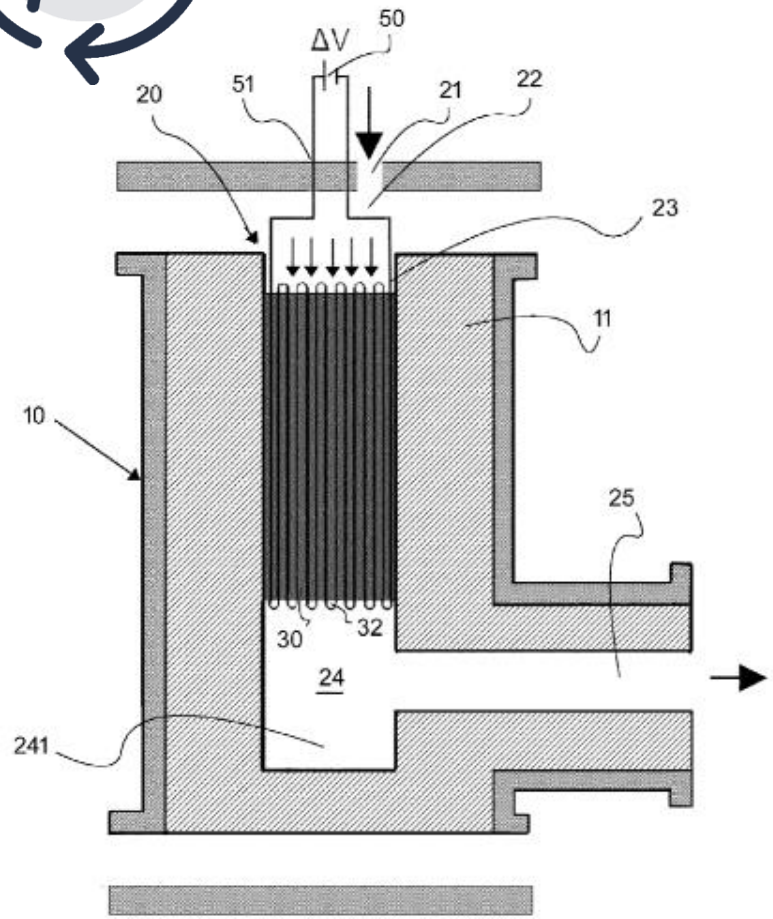
- Intensification
- Ceramic catalyst

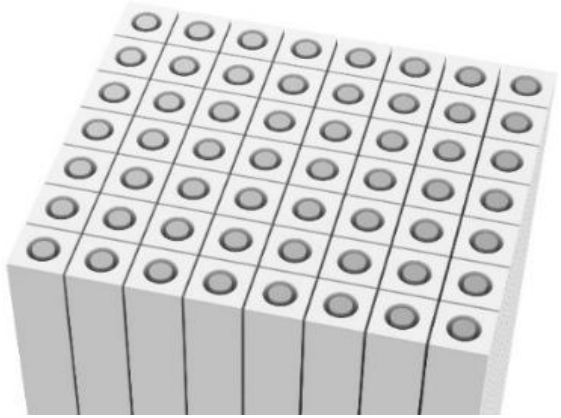
Wismann et al., Electrified methane reforming: A compact approach to greener industrial hydrogen production.Science, 2019

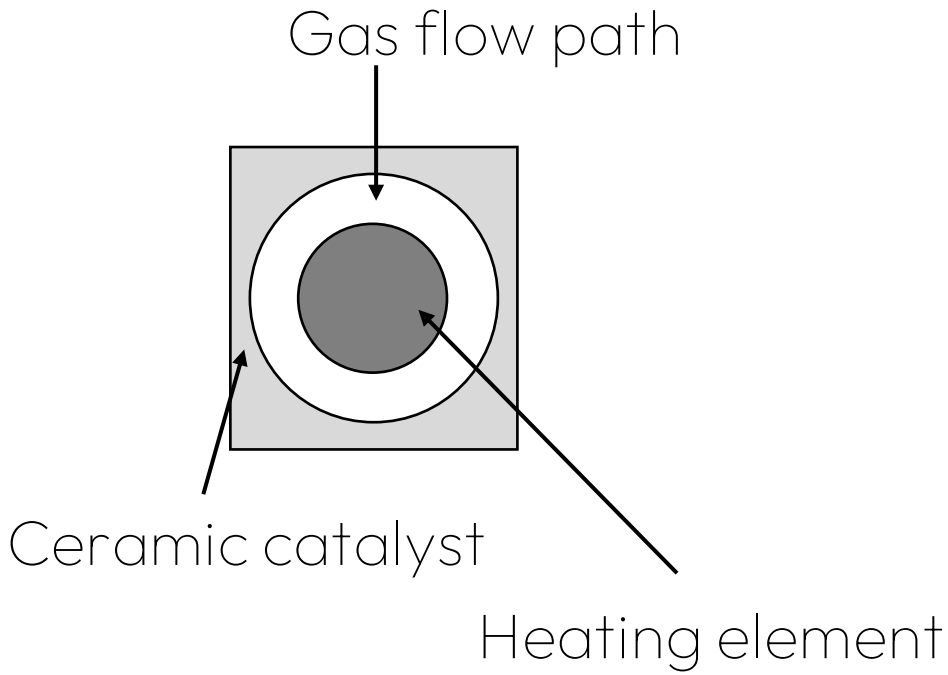
Pauletto et al., FeCrAl as a catalyst support. *Chemical Reviews*, 2020

Zheng et al., Electrified CO_2 valorization driven by direct Joule heating of catalytic cellular substrates, *Chem. Eng. Journal*, 2023

EReTech technology: SYPOX reactor



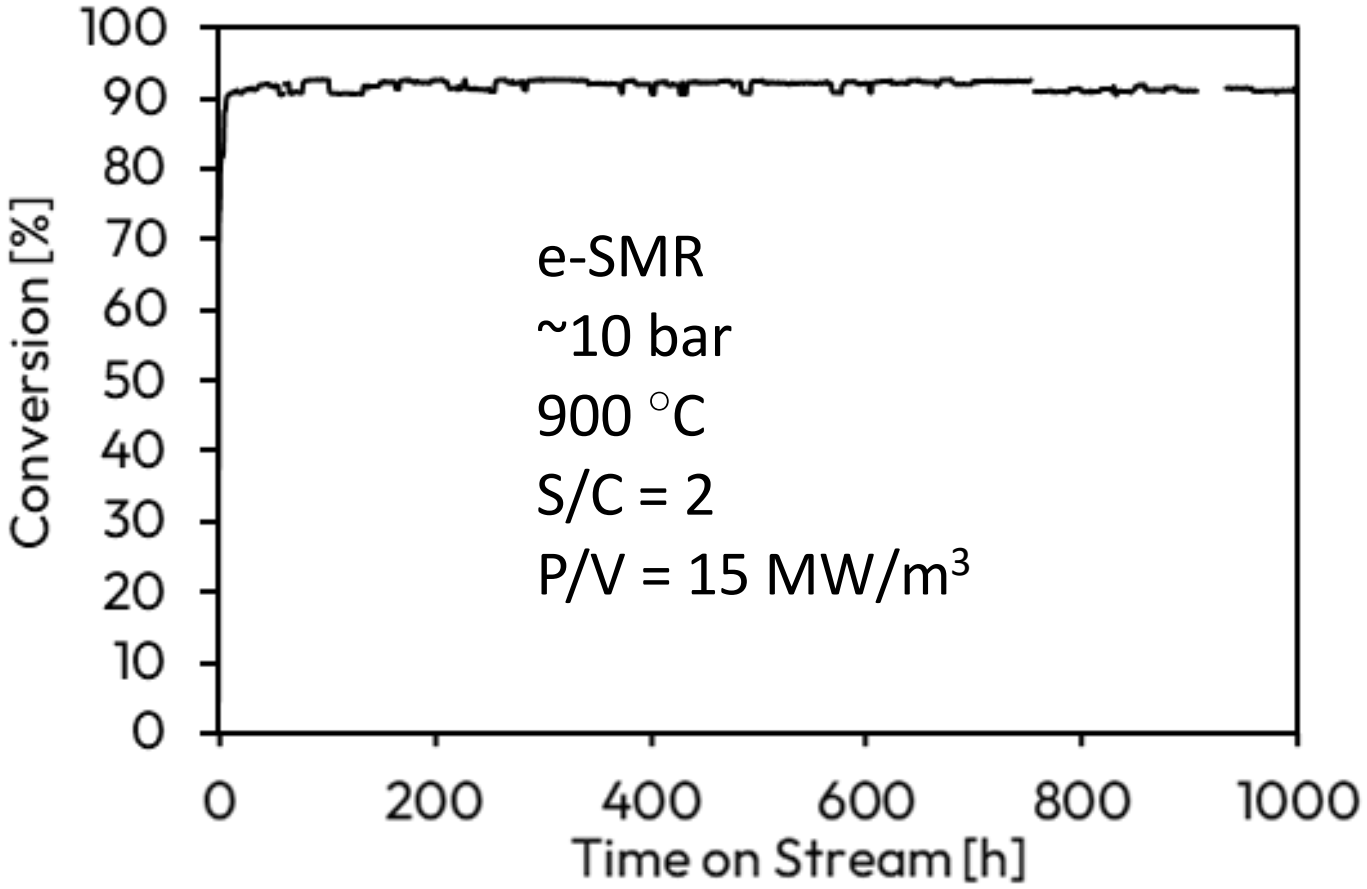




EReTech technology: SYPOX reactor

Range of operation:

- up to ~1200 °C
- up to ~25 MW/m³



EReTech starting point: 25 kW mini SMR plant

Objective: develop and validate an e-SMR

DECENTRALIZED

Biogas into Renewable Hydrogen

CENTRALIZED

Low carbon Hydrogen

Electrified Hydrogen Production: Steam Methane Refoming

$CH_4 + H_2O \rightarrow 3\ H_2 + CO$ 206 kJ/mol

$CO + H_2O \rightarrow H_2 + CO_2$ -41 kJ/mol

$CH_4 + 2\ H_2O \rightarrow 4\ H_2 + CO_2$

CH_4 (reagent) + CH_4 (fuel) + Water → 1 kg H2 + 10 kg CO_2

Electricity

6 kg CO_2

EReTech activities

1

CATALYST

- Catalyst stability and lifetime?
- Design GHSV/Power density?

2

REACTOR

- What will be the biggest e-SMR?
- Traditional economy of scale?

3

PROCESS

- Integration in chemical plants?
- Standards/conformities and LCA?

Consortium overview

Hulteberg CHEMISTRY & ENGINEERING
CATALYST MANUFACTURING

SYPOX
REFORMER MANUFACTURING

HYGEAR COST-EFFECTIVE GAS SUPPLY
DECENTRALIZED PRODUCT MANUFACTURING

bayerngas
DECENTRALIZED OPERATIONS H_2 MANAGEMENT

ETH zürich
TUM
BUREAU VERITAS
ERIC European Research Institute of Catalysis
POLITECNICO MILANO 1863
CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

Linde
CENTRALIZED PRODUCT MANUFACTURING

Linde
CENTRALIZED OPERATIONS H_2 MANAGEMENT

Pilot 1: 250 kW e-SMR

Startup: April 2024

Product: syngas

e-SMR: 250 kW

Objective:

- e-SMR scale up validation
- data for process integration

Pilot 2: 400 kg/day Hydrogen plant

Startup: March 2025

Product: fuel cell grade hydrogen

e-SMR: 250 kW

Objective:

- conversion of biogas into H_2
- business case validation

EReTech Impact

	Electricity kWh/kg_{H2}	Emission kg_{CO2}/kg_{H2}	Emission reduction kg_{CO2}/kWh
Fired SMR	-	10	-
Electric SMR	14	6	0.29 kg_{CO2}/kWh
Electrolysis	50	0	0.20 kg_{CO2}/kWh

As long as the amount of Renewable Electricity is limited, we should use this for technologies that maximize the emission reduction.

Thanks for your attention!

If you have any question just contact us!

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