Fast-response Electrically heated catalytic reactor technology for CO_2 reDUCTion

Novel process and reactor for CO_2 valorisation with simultaneous sulphur recovery

presenter: Gleb Veryasov

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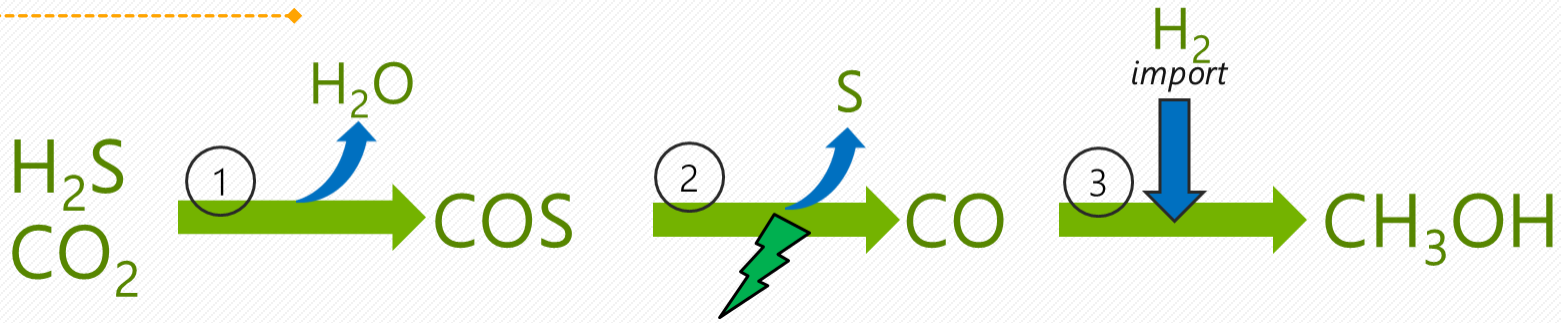
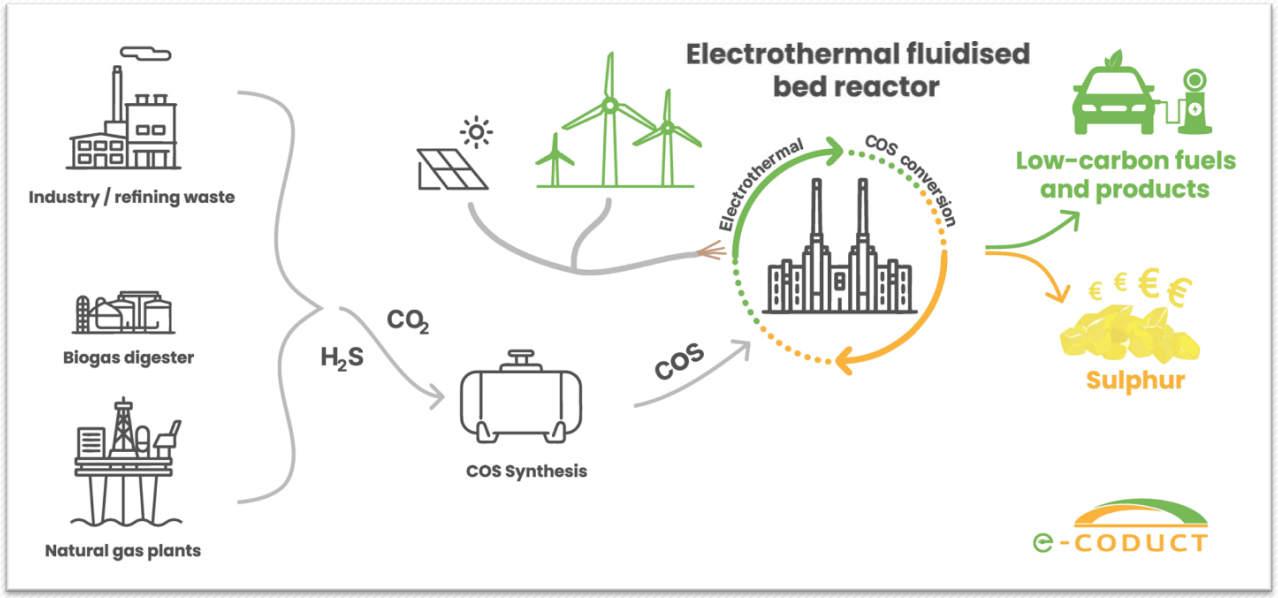
Ambitions of e-CODUCT

e-CODUCT tackles the **environmental challenge** of reducing **greenhouse gas and acid gases produced by industry**

- Only minor amounts of CO_2 are valorised by the industry and there is **no complete value chain** nor technologies to ensure circularity, reduce GHG emissions and valorise significant amounts of CO_2, which first has to be pre-treated to high purity;
- **Refining & petrochemical sector, exploration & production, and biogas production** have to handle "acid gas" (mixture of CO_2, H_2S, and other contaminants in different ratios, depending on the origin), which serves as a main source of commercial sulfur;
- Modern **acid gas treatment** approach relies on the amine wash & Claus process to recover sulphur from gas streams rich in H_2S. The latter demands additional use of fuel gas for lean H_2S sources (<55%);
- **Existing technologies** have no solution to the challenge of CO_2 conversion, which lies in the composition of streams containing other acid gases (e.g. H_2S) and the economic and environmental inefficiency;

e-CODUCT solution at a glance





e-CODUCT technology is versatile: it could be applied for low-energy production of CO as a platform molecule, which could be converted into SAF, methanol, BTX, etc.

(1) $CO_2 + H_2S = COS + H_2O$

(2) $COS = CO + S$

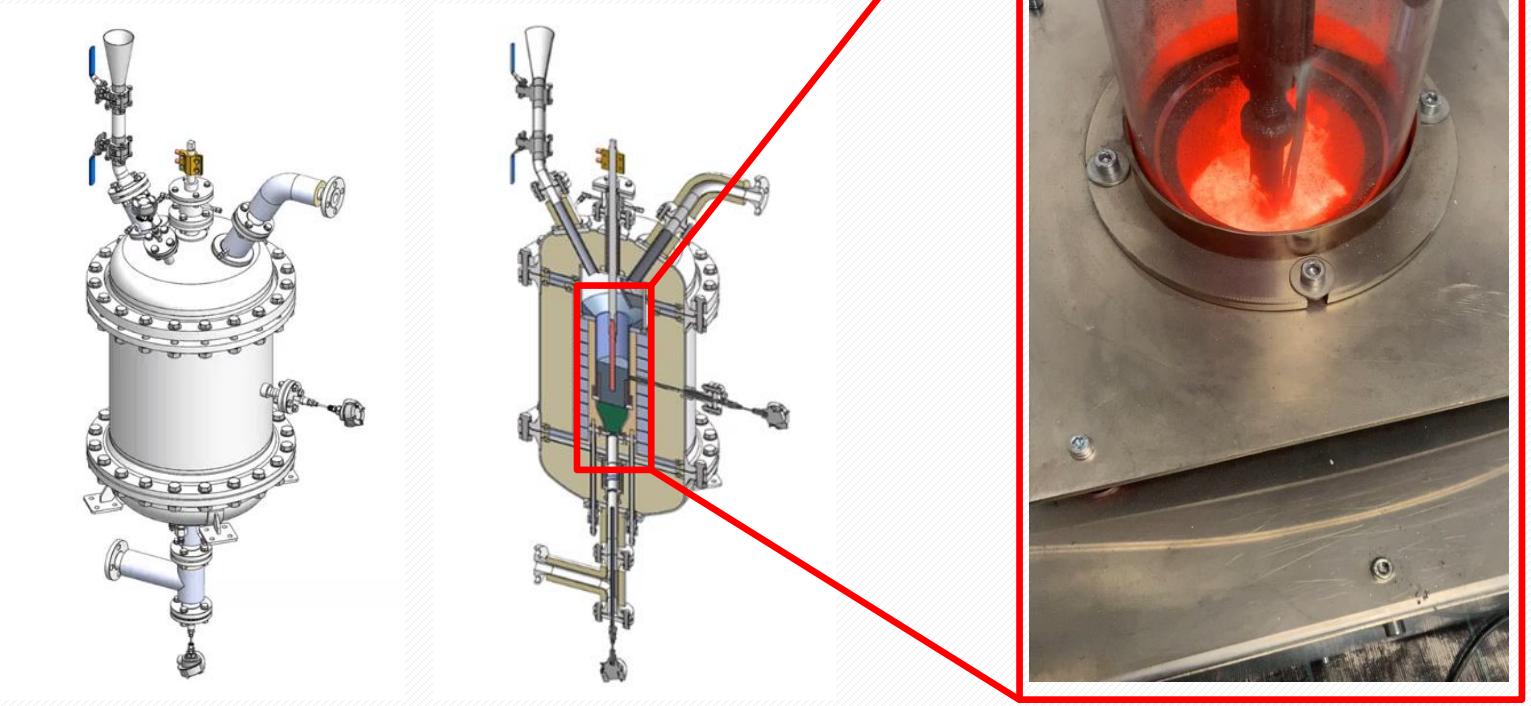
(3) $CO + 2\,H_2 = CH_3OH$

Core of the technology: electrified process for conversion of acid gas into CO, S and water

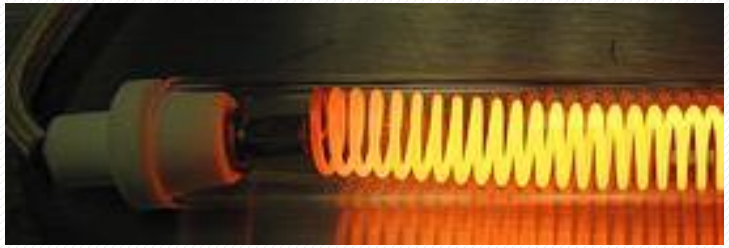
CO valorization showcase: the step to prove purity of CO stream

Enabling reactor technology

Electrothermal fluidised bed reactor



- Heat is generated inside the reactor due to Joule effect (same as, for instance, heating elements);



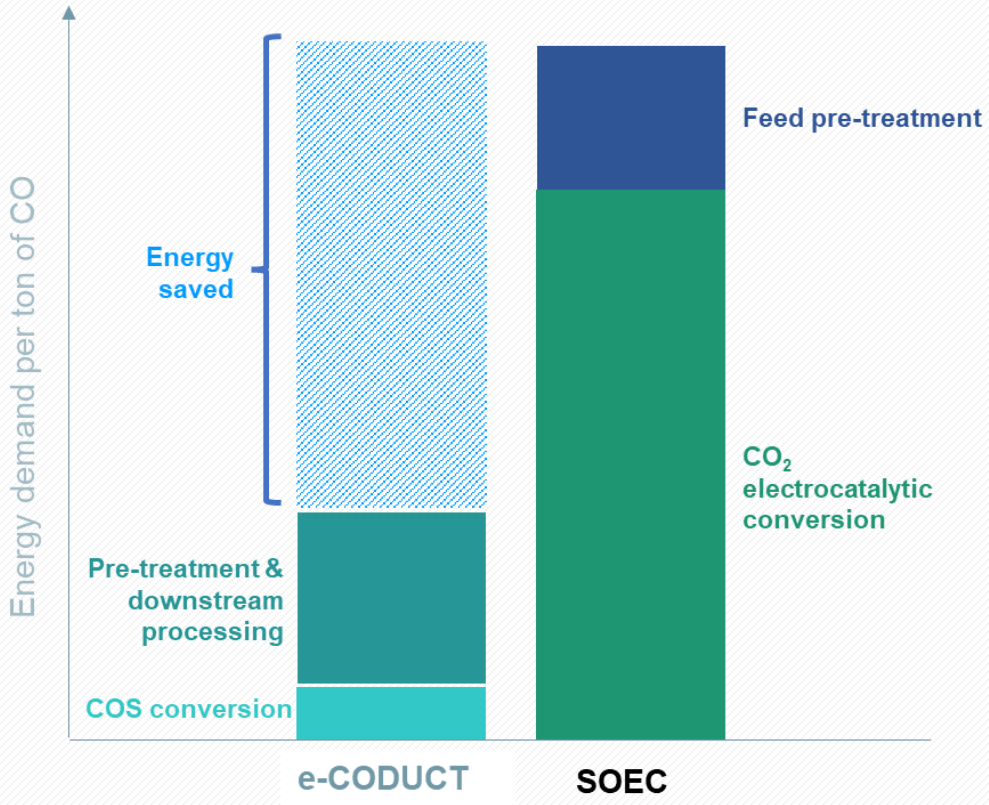
$$Q = I^2Rt$$

- The heating element is solid, fluidized phase of bed, which could be formulated with a catalyst;
- Feedstock passes upwards at high speed, mixing the solid particles ➔ short residence times of reactants, homogeneous heat distribution;

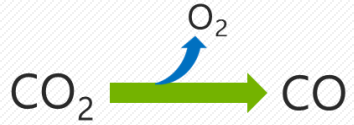
e-CODUCT technology benchmark & advantages

e-CODUCT value proposition

- Treats mixed streams, non-sensitive to pollutants;
- Co-produces sulfur and water, which could be used in a in proximity or marketed;
- COS is "pre-activated" molecule, which is easy to convert;



CO_2 electroreduction

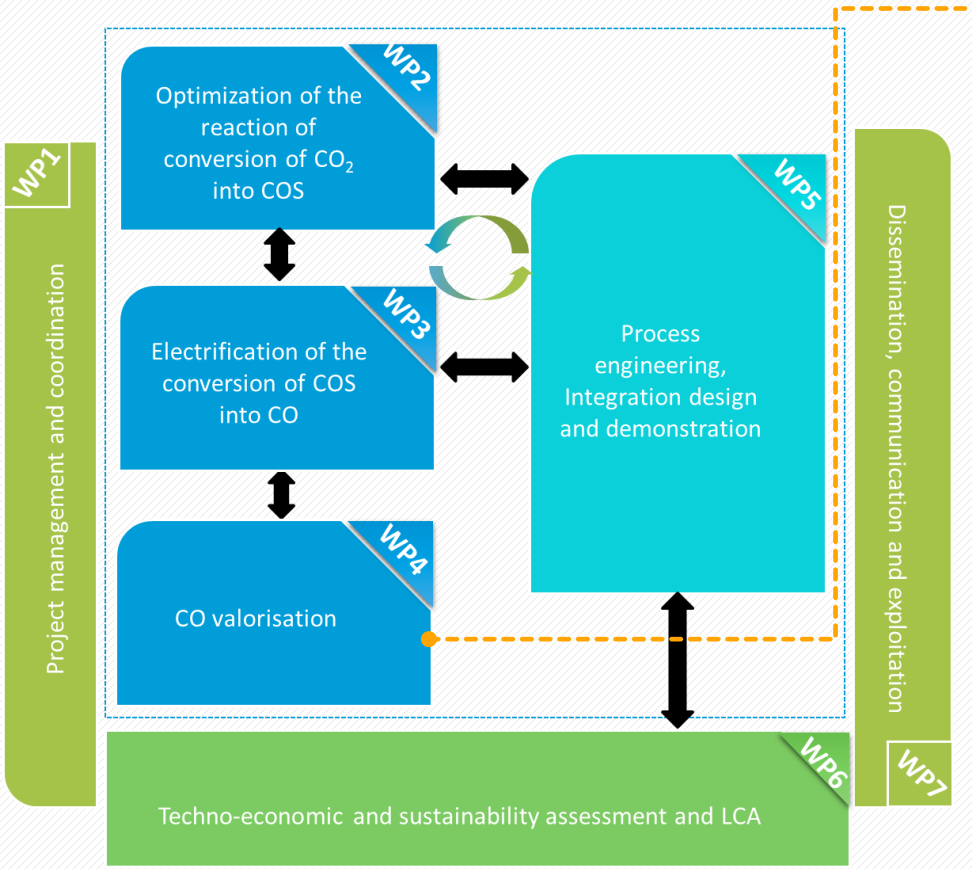


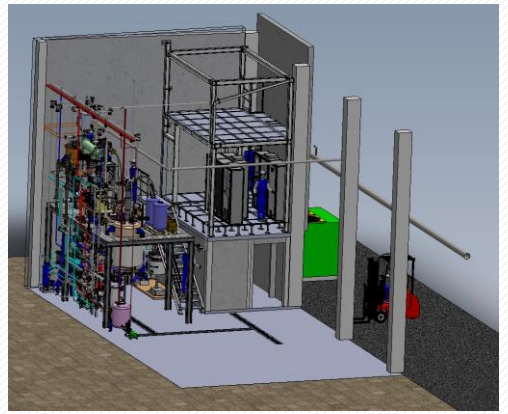
- Demands high purity streams, extremely sensitive to pollutants (SOEC is the major CAPEX contributor);
- Co-produces oxygen as dilute stream (enriched air), which is vented with losses of product and fatal heat;

Consortium

- The consortium is formed of 9 partners from 5 countries (Belgium, Netherlands, France, Slovenia, Germany);
- 4 partners are industrial including 2 multinationals (Saint-Gobain, TotalEnergies), and 2 SMEs (PDC, Benkei);
- 4 partners are research and technology organisations (CNRS, DECHEMA, CO NOT and NIC);
- 1 university (UGent).

Project planning & pilot location





- Work is split in 7 + 1 (ethics) work packages distributed over 36 month of project;
- Unit location: pilot demonstration industrial hall in Slovenia and will be powered with 100% green energy produced from sawdust residues;

Exhaustive approach: from R&D to development of a business case