DecarGas. Low-carbon clean fossils for the next generation

DecarGas enables the utilization of fossil resources without CO2 emissions in the energy and chemical industry into a H2 driven economy

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Technological Offers type

Technological solutions

Research and innovation areas

- Climate, Energy and Mobility
- Industry, Materials and Circular Economy

ODS

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Where?

"Guillermo Velarde" Nuclear Fusion Institute Thermal Energy for Sustainability

Keywords: | emissions | fossil resources

Brief description of the technology solution and the added value it provides

Decarbonization of fossil resources, as natural gas, produces clean hydrogen and pure carbon particles. DecarGas achieves the development of an industrial scalable reactor for decarbonization that enables the utilization of fossil raw materials for hydrogen and pure carbon production in the energy and chemical sector . It will constitutes a real tool to avoid greenhouse gases emissions, producing competitive marketable products, reducing drastically their environmental production impact and combined cost.

Description of the technological base

In fossil decarbonization, hydrocarbons are thermally splitted into pure solid carbon and hydrogen. The process is an effective carbon capture technique with two worthy products:

- Graphitic carbon showing potential applications as structural, light and high conductivity material.
- Pure hydrogen produced from fossil without carbon dioxide generation or CO traces.

Methane decomposition was proposed in the past but its implementation was not proven to be technically and economically viable at industrial scale.

We have verified the concept of an innovative methane decomposition reactor based on methane injection into liquid metal that may be scalable to industrial scale and economically competitive, providing an alternative pathway to use natural gas while safeguarding the climate and facilitating the integration of a clean energy carrier like hydrogen in the energy sector.

"A simple bubbling of natural gas into a liquid metal bath allows the large scale implementation of fossil decarbonization producing pure hydrogen and capturing solid carbon"

– Suitable glass reactor material and bubbling device have been identified for the operation with liquid tin at 1200 ºC achieved, producing 100 W of hydrogen power with 78% yield for several days.
– Life cycle assessment (LCA) shows lower environmental impact than steam reformer and similar to electrolysis driven by wind.

Market demands

Energy

- Fossil resources supply 80% of the energy demand worlwide. A technology to avoid CO2 emissions from these sources is a must until a sustainable system based on renewables might supply energy needs.
- Chemical industry, as refineries and ammonia production requires process H2. A low-Carbon source of hydrogen will limit enormously their emissions.

Environment

- Reduction of greenhouses emissions is a must to stop keep average atmospheric temperature under control, achieving 2ºC target claimed in COP21 conference in Paris
- Environmental regulations may penalty CO2 emission technologies, and short term transitional solutions are needed.
- Availability of low-carbon technologies using fossil resources are required to avoid the collapse of sectors as energy and chemical industry.

Materials

- New technologies based on carbon-based materials as carbon fibres and graphene may be boost their development with the availability of cheap, CO2-free pure carbon.

"Low carbon solutions for industrial and energy processes is a must to control greenhouse gases emissions from fossil natural resources"

Competitive advantages

- Hydrogen costs are estimated between 1.5 and 3 €/kg, depending on the cost of natural gas. Additional profit may be obtained from carbon selling.
- Assuming a 50% penetration on the Ammonia production sector, the CO2 saving can be in the order of 0.15 Gton/y (0.5% of total anthropogenic emissions).
- Environmental Life Cycle impact similar to wind and electrolysis (4 kgCO2/kgH2)
- Available technologies in the market are based on the used of catalysts, with low H2 production rates, unable to feed massive chemical processes.
- Carbon capture and sequestration (CCS) as low-Carbon alternative poses risks of CO2 leakage and environmental impact.

Previous references

- The technology has been tested in a framework of a collaboration with two German centers (KIT and IASS) with the technical coordination of UPM and the supervision of the Novel Laureate for Physics Prof. Rubbia.
- It was deserved the front page to be mention as a feature technology for the future by the journal "New Scientist" issue 8th October 2016.
- The results of the proof of concepts has been described and validated by peers with almost 10 publications in ranked scientific journals.

Development stage

- Concept
- Research
- **Lab prototype**
- Industrial prototype
- Production

Contact

Contacto solución tecnológica

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