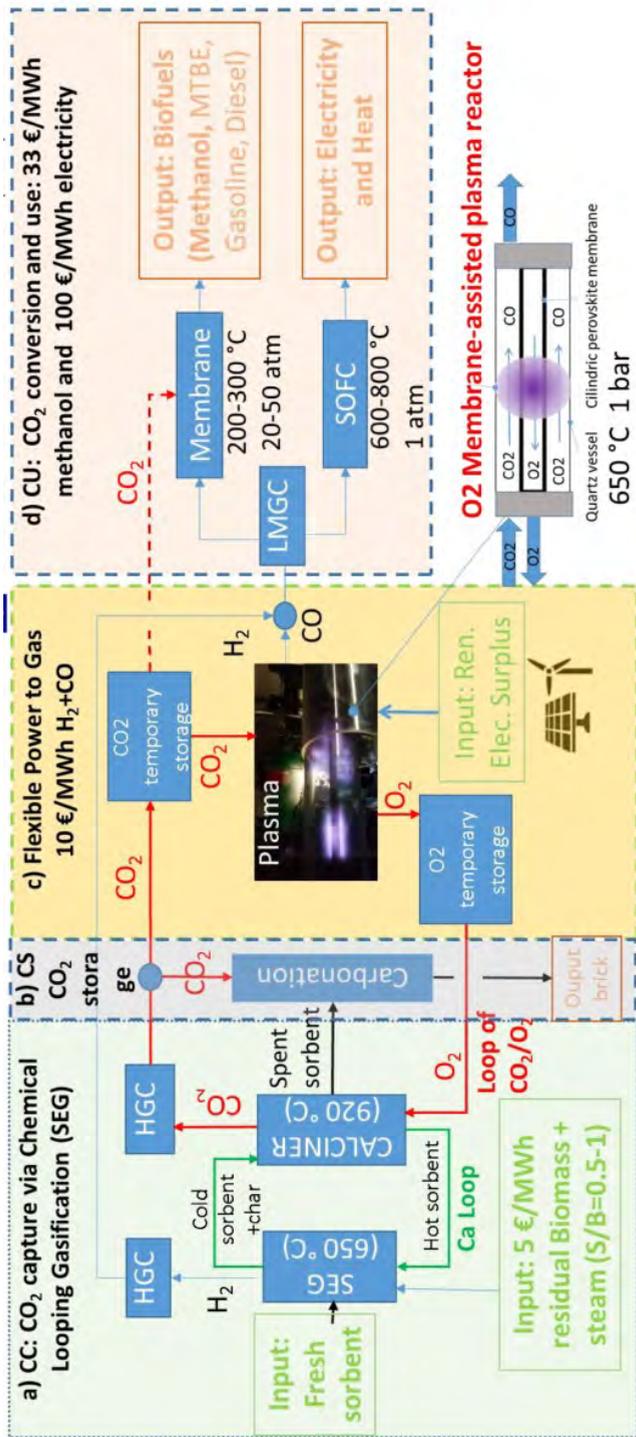


The Process



Partnership

Coordinated by



Project data

Period: 01.12.2020 – 30.11.2024

Funded under: H2020-EU.3.3. - SOCIETAL CHALLENGES - Secure, clean and efficient energy

Topic: LC-SC3-RES-1-2019-2020 - Developing the next generation of renewable energy technologies

Call for proposal: H2020-LC-SC3-2018-2019-2020

Funding Scheme: RIA - Research and Innovation action

Total cost € 3 928 257,50

EU contribution € 3 928 257,50

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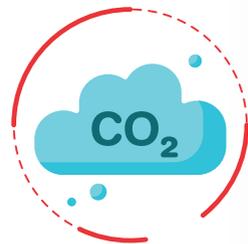
Gasification Integrated with CO₂ capture and conversion

Grant agreement ID: 101006656



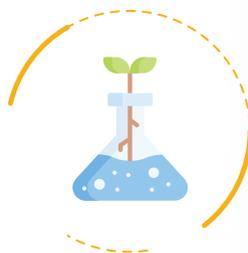
GICO Project

GICO aims to develop renewable energy technologies that will form the backbone of the EU energy system by 2030 and 2050. GICO seeks to develop an advanced (in terms of applicability, reliability, efficiency, cost and impacts), smart and flexible (encompassing almost all biomass residues and highly discontinuous electricity) approach to convert bioenergy and RES electricity excess into biofuel and on-demand power production, so producing fuel for the transport sector meanwhile balancing the grid stability. To achieve such goals, a solution based on the integration of advanced SEG, CCSU and P2G technologies is proposed.



CO2 capture and conversion

- SEG - Sorption Enhanced Gasification: H2 production via steam gasification intensified with CO2 capture process by CaO sorbent;
- Syngas with hydrogen content more than double of the standard gasification and flue gas with 90% CO2 developing;
- CO2 dissociation via O2 membrane-assisted plasma reactor powered by renewable electricity surplus;
- Low CAPEX and OPEX owing to the higher efficiency and use of low-cost grid excess electricity.



Biofuel and energy production

- Methanol synthesis membrane reactor with double the yield per pass
- Electricity production: electricity production via SOFC using Syngas;
- Increase technology performances of biofuel and bioelectricity energy efficiency increase of more than 35% (90% versus 65% for fuel and 40% versus 25% for electricity);
- Cost reduction of more than 50% (33 €/MWh vs 75 €/MWh for fuel and 100 €/MWh vs 220 €/MWh for electricity).



New materials and technologies

- HTC - HydroThermal Carbonization pre-treatment for high temperature removal of S and Cl components
- Hot Gas Conditioning: Filter candles with integrated sorbents and catalyst for the reduction of inorganic species and H2 together with
- Plasma-Enhanced Catalytic Oxidation treatment (PECO); Reforming catalyst materials for high H2 production
- Novel perovskite membranes with plasma technologies for CO2 separation

ACTIVITIES

Biomass, HTC, SEG and HGC

The proof of- concept of an advanced sorption enhanced gasification (SEG) process for high efficiency high purity H2 stream production along with a high concentrated CO2 stream from residual biomass will be demonstrated through material and process development.

Co2 Conversion and O2 Separation

A series of plasma assisted catalysis technologies will be developed and tested in order to compare the result and define the most convenient technology for the final application. Oxygen separation membranes with high CO2 tolerance and resistant to plasma will be developed and characterized. Furthermore plasma-assisted membrane reactor for CO2 to CO conversion, and O2 separation will be laboratory integrated and tested.

Integrated Lab Scale Tests and Industrial Plant Design

Different reactors will be tested and the proper plant design for future applications will be evaluated. The development of the correct auxiliary and their integration into the respective test bench is part of the activity. Development of membrane reactors for methanol production and methanol synthesis test will be carried out. Moreover, SOFC button cells tests with cleaned syngas to perform studies on the effect of organic and inorganic contaminants will be carried out. Forced trip events (fuel shortage, load cycling) will be performed: the results will be used as input for the system industrial scale plant design and modelling activities.

Modelling & Validation

Entire process of fully system simulation (at large scale) for performance analysis and system optimization. Data on sustainability aspects related to the novel innovative concept will be gathered. The environmental, economic and social aspects that are more relevant in the novel concept will be identified. The results from LCA, LCC and S-LCA will be integrated to provide a holistic point of view of the sustainability of the novel concept.

Dissemination Communication and Exploitation

A detailed market assessment and efficient business strategies for the successful implementation and replication of the GICO model will be carried out, as well as a plan to promote knowledge-sharing among the most relevant stakeholders, media and citizens.