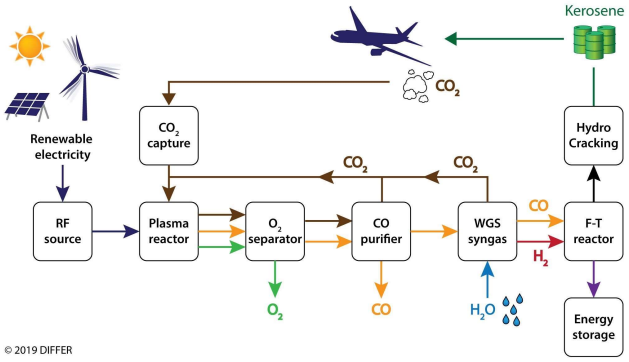
KEROGREEN project proof-of-concept: Production of jet fuel via CO_2 plasmolysis and Fischer-Tropsch synthesis

Carbon neutral fuel

- CO_2 is a valuable commodity which can be recycled and put to good use.
- Renewable electricity derived from sun and wind has made big strides over the past decade. However, overcoming the mismatch between renewable electricity supply and demand is the challenge that still lies ahead.
- Carbon neutral fuel serves a dual purpose: it provides long term, large scale energy storage to match intermittent renewable energy supply and it provides high energy density fuel to enable long range transport and mobility with no increase in atmospheric CO_2 concentration.

Project target



The KEROGREEN project aims for the demonstration of the full chain having as starting point captured CO_2, water and electricity and obtaining as final product kerosene. The demonstration plant will be located at the Karlsruhe Institute of Technology (Germany) with a capacity of 3 liters of kerosene per day.

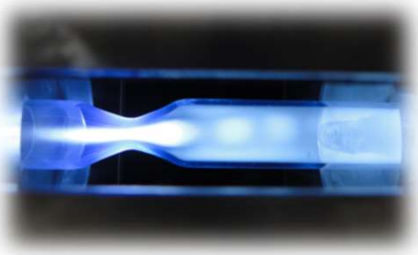
- Technology Readiness Level is raised from TRL 3 to 4.
- Projected costs at this stage are estimated at +50% of fossil kerosene. Process simulation will be used to test different process configurations to lower the production cost.
- The intermediate CO product is a valuable gas by itself. Combination of CO_2 plasmolysis with the different gas separation techniques will be applied to reach high CO purity.
- Project duration: 4 years (2018-2022).

Technology

INERATEC / In-house kerosene plant

KEROGREEN offers an innovative conversion route. The conversion is based on plasma driven dissociation of air captured CO_2, solid oxide membrane separation of oxygen and Fischer-Tropsch (F-T) synthesis of kerosene. Synergy between plasma activated species and novel perovskite electrodes of the oxygen separator raise CO productivity and energy efficiency. The different technologies applied within the KEROGREEN process are:

- CO_2 plasmolysis (DIFFER),
- Oxygen permeable membranes (VITO and Cerpotech),
- CO purification (HyGear),
- Integrated Water-gas shift and CO_2 removal (KIT),
- Fischer-Tropsch synthesis (INERATEC),
- Heavy hydrocarbons hydrocracking (KIT).



DIFFER / CO_2 plasmolysis reactor

Challenges

- Combination of CO_2 plasmolysis with oxygen permeable membranes.
- Maximization of the overall energy and carbon efficiencies of the process full-chain.
- System integration of the different technologies into one compact assembly by a multi-disciplinary team.
- Reduction of the production cost of kerosene produced as a carbon neutral fuel.

Project partners

DIFFER Dutch Institute for Fundamental Energy Research · KIT Karlsruhe Institute of Technology · vito · Cerpotech · HYGEAR · INERATEC

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