

PARTNERS



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KEROGREEN
MAKING GREEN KEROSENE
OUT OF CO₂, WATER, AND
RENEWABLE ELECTRICITY



We **integrated** the individual, separate processes...

... and installed it into a shipping **container!**

Now, will you **fly with us...**

... to the **next level** of technology readiness?

THE CIRCLE OF KEROGREEN

Step 1: The 12 steps to produce kerosene cost a lot of energy. To produce green kerosene, the energy source has to be renewable. Good sources are solar energy and wind energy.

Step 2: CO₂ feedstock is to be (re-)captured from ambient air for the fuel cycle to become CO₂ neutral

Step 3: The energy from step 1 drives a so called RF source, a kind of microwave-oven.

Step 4: A plasma reactor uses the microwave radiation and splits CO₂ in CO and O₂. This so called plasmolysis has been proven at small scale by DIFFER.

Step 5: To remove the oxygen [O₂] VITO and Cerpotech produced oxygen permeable membranes. DIFFER demonstrated that oxygen is removed from the mixture. CO and CO₂ go to the next step.

Step 6: In the CO purifier, made by HyGear, undesired gases are removed to supply clean CO for the next step.

Step 7: The integrated water-gas shift and CO₂-removal is built by KIT. CO and H₂ go to step 8.

Step 8: The Fischer-Tropsch synthesis by INERATEC is a collection of chemical reactions that converts a mixture of carbon monoxide and hydrogen into liquid hydrocarbons, mainly alkanes, a source for e.g. clean diesel fuel, Kerosene and wax.

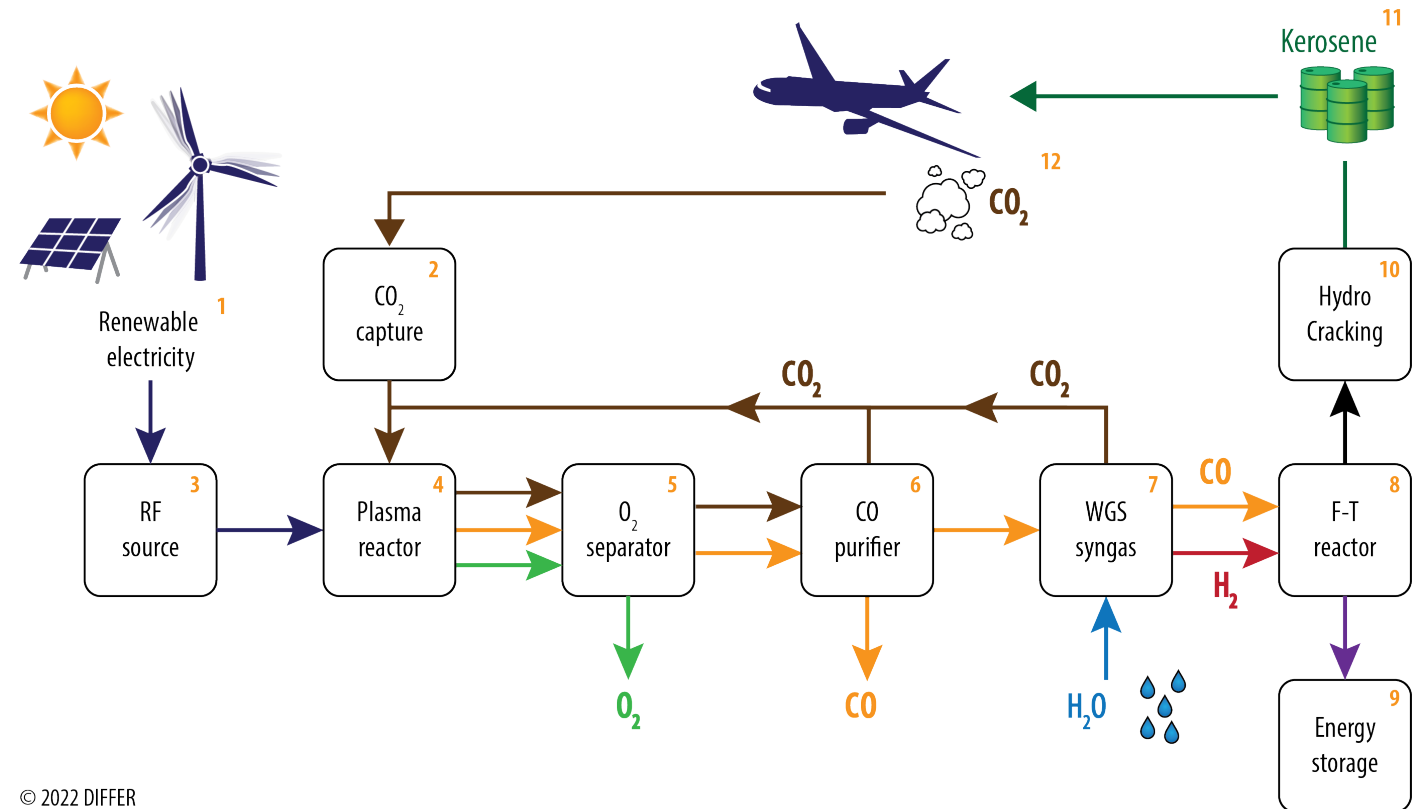
Step 9: An excess fraction e.g., molecules that do not fit to the Kerosene specification could be stored for later use (or as CO₂ storage).

Step 10: The molecules which have passed the hydrocracking step (by KIT) and fit to the Kerosene blend, a mixture of carbonmolecules with 8 to 14 carbonatoms, are sent to final upgrading for aviation.

Step 11: Kerosene can be stored in barrels and tanks.

Step 12: The kerosene is used by a plane. The plane produces CO₂ and H₂O. The CO₂ can be captured and used again. And the circle is closed.

FROM CO₂, WATER, AND RENEWABLE ELECTRICITY TO GREEN KEROSENE IN 12 STEPS



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Main achievements

- Individual elements have been demonstrated at lab-scale
- The elements have been integrated in a container sized system

Key figures

Plasma Reactor (step 4)

- Up to 0.7 kg CO/h production rate
- Typical energy cost: 0.12 kWh/kg CO

CO purification (step 6)

- Up to 98% purity (on single step)
- Up to 95% CO yield

Fischer-Tropsch & Hydrocracking modules (steps 8 + 10)

- In-line recycling (and cleaning) of residual wax
- Wax conversion > 50%
- Required isomer content of > 30% for kerosene obtained

Challenges

- To scale up the oxygen separator (step 5) to system level
- To produce 0.1 kg/h kerosene with a fully integrated system

What's next?

- We would love to get into contact with investors, policymakers, companies and airports
- Do you take green kerosene with us to the next level?

