C1 Green Chemicals AG: Methanol 2.0 am Standort Leuna. Wie wir mit grünem Methanol Industriegeschichte schreiben

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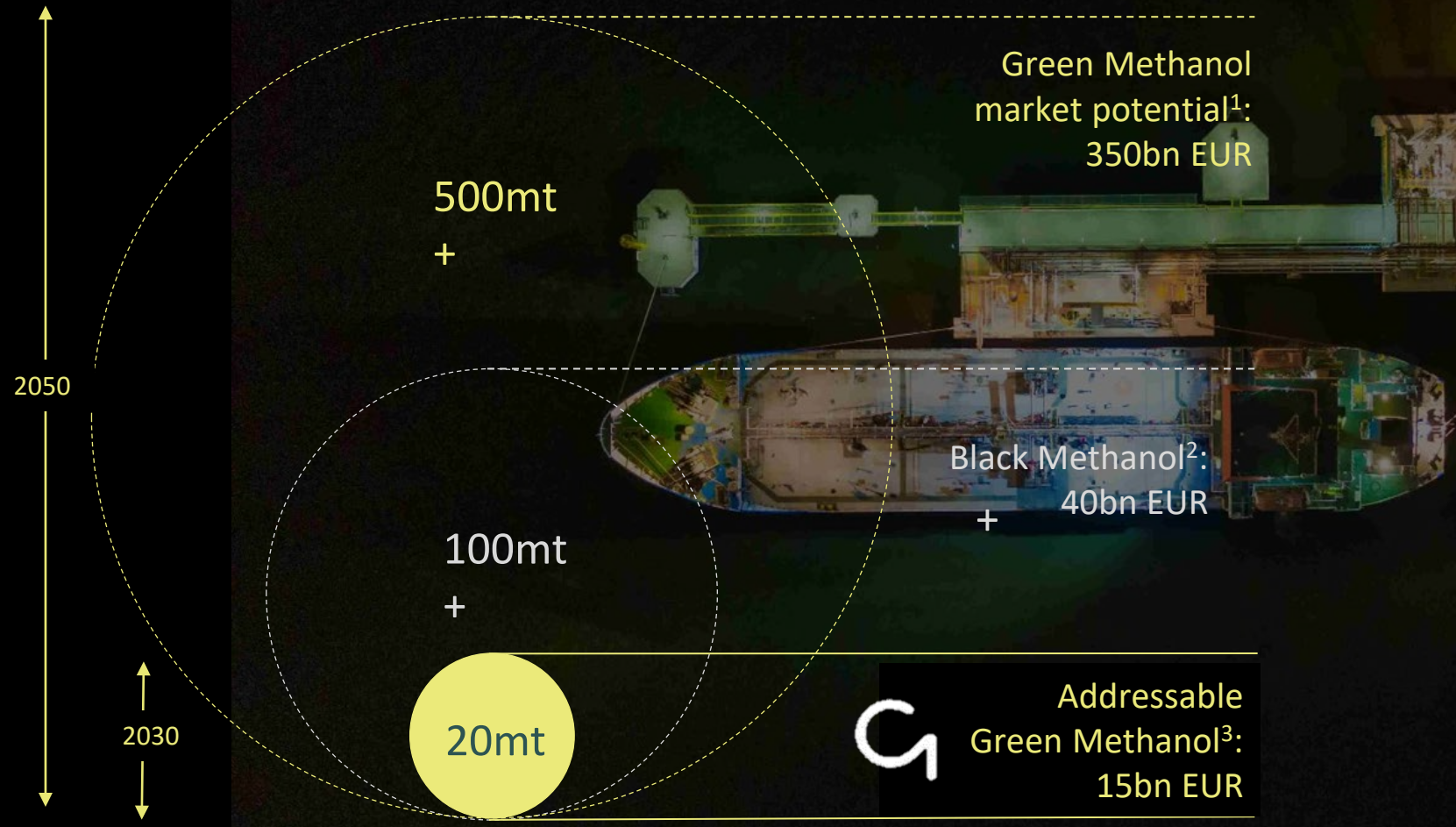
METHANOL MARKET

There is a strong demand for green methanol coupled with a lack of supply



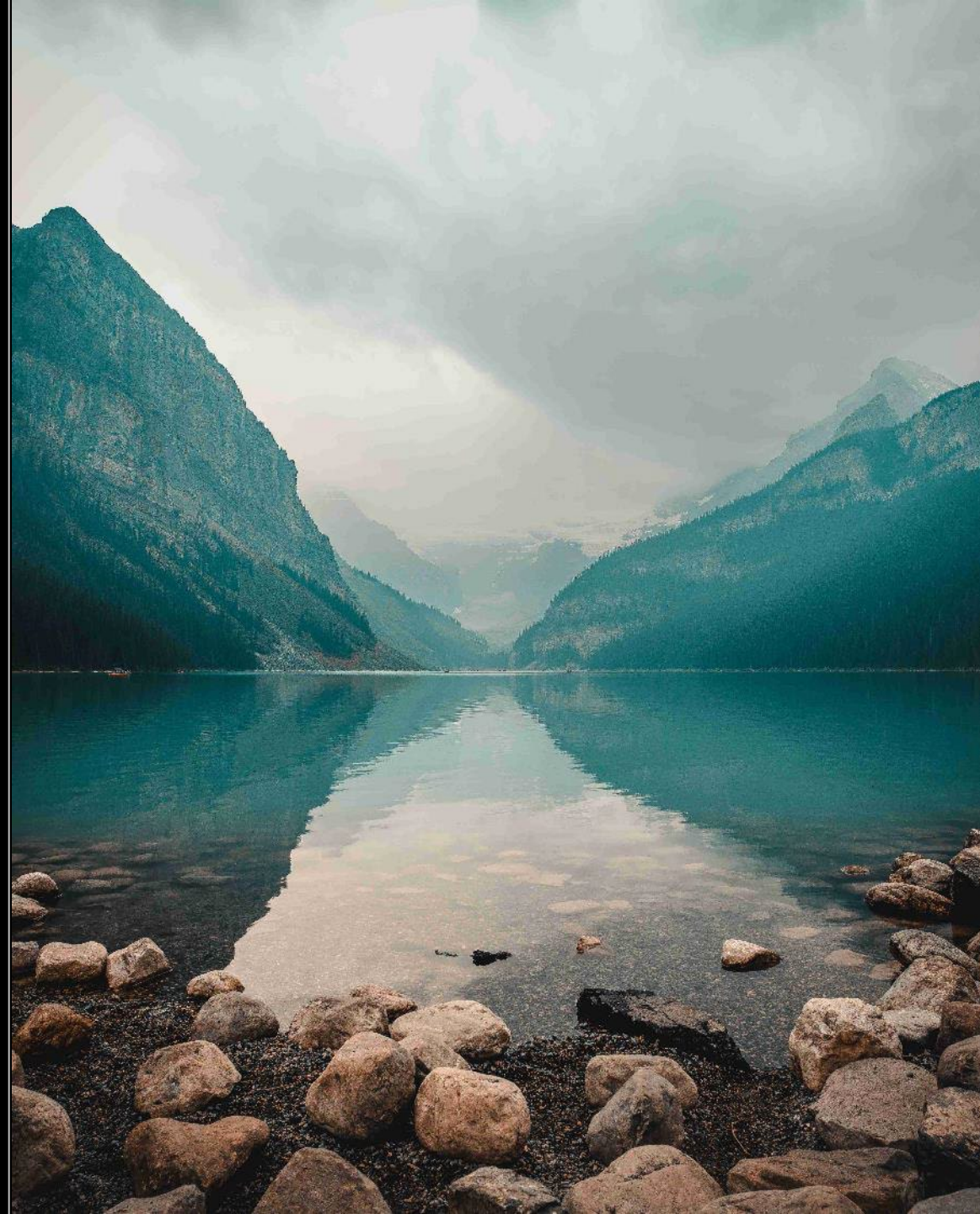
[1]https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jan/IRENA_Innovation_Renewable_Methanol_2021.pdf
[2]Current black methanol market: ~100mt could be converted to green methanol in the long run
[3]Methanol Institute: 19.5m ton (2028) at 700 EUR/ ton assumed market price for green methanol in shipping (long-term agreements), spot market currently at >1000 EUR/ ton green methanol

CIRCULAR CARBON CHEMISTRY

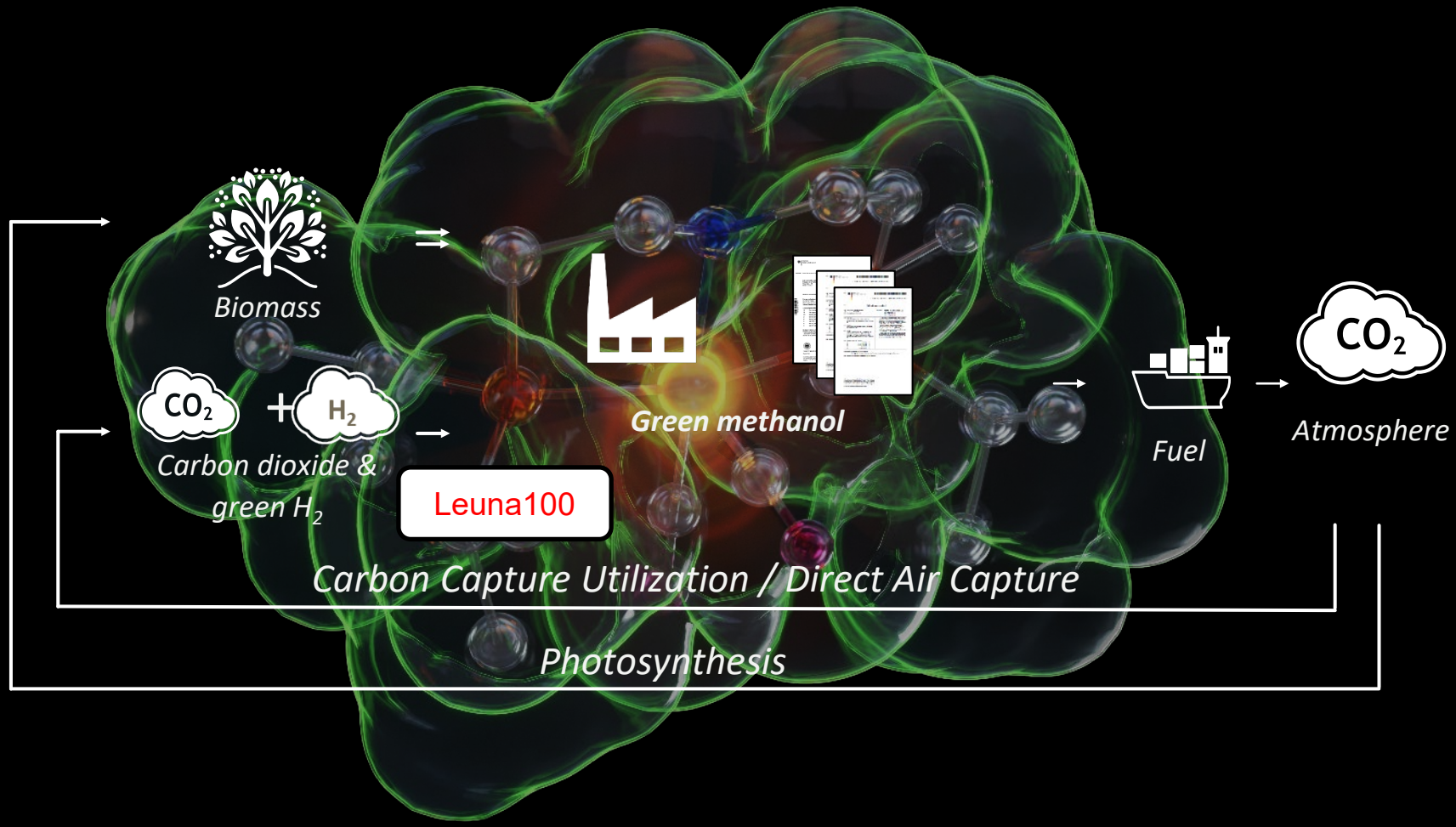
SIGNIFICANT MARKET: Green methanol as both alternative fuel and chemical feedstock

OVERDEMAND: Green Methanol shortage in emerging market (shipping and other sectors)

TECHNOLOGY: Strong limitations of conventional technology to utilize green feedstocks at competitive pricing



SOLUTION



Ultra-efficient and proprietary homogeneous catalysis technology to produce green methanol

CIRCULAR CARBON CHEMISTRY

TECHNOLOGY SCALING ROADMAP

2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028

Lab batch experiments
in Berlin

TRL 3,4 (achieved)

proof of concept

Mini plant in Berlin
Fully operational

TRL 5 (achieved)

0,0024 ton per day

proof of continuous production

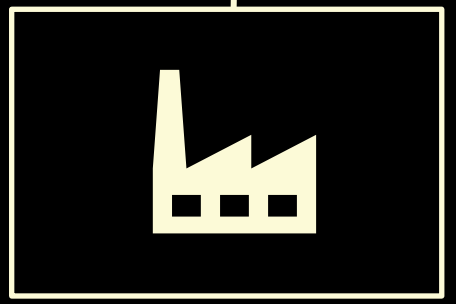
Pilot plant in Leuna
Commissioning: Q2 2024

TRL 6 (Q2 2024)

0,1 ton per day

proof of continuous production

with industrial off-the-shelf components under real feedstock conditions



Demo plant, in planning
Commissioning: Q3 2026

TRL 7/8 (Q3 2026)

10+ ton per day

proof of continuous production

with industrial off-the-shelf components with **existing syngas source (CO+H2) & mass-balancing Biomethane**

at industrial scale under commercial terms (product off-take etc)

Partner gesucht!

PILOT PLANT OPENING

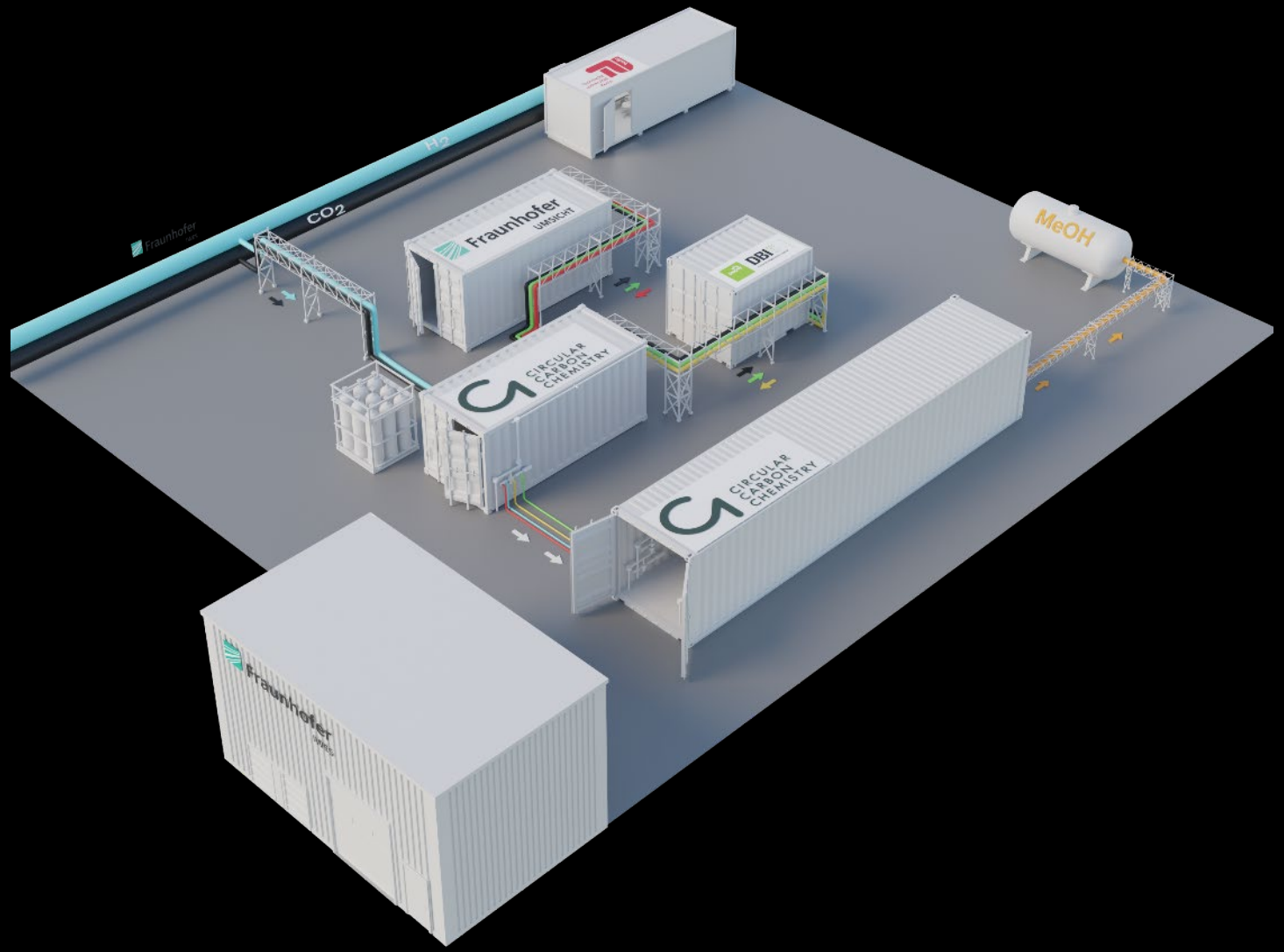
Project: Leuna100
Chemical park Leuna, Germany

10,4m EUR public funding
by German Federal Ministry
for Transport

Video

CIRCULAR CARBON CHEMISTRY

FUNDING PROGRAMME RENEWABLE FUELS
Funded by: Federal Ministry for Digital and Transport
Coordinated by: NOW GMBH.DE
Project management agency: VDI|VDE|IT FNR
on the basis of a decision by the German Bundestag



LEUNA 100

100 years after the first commercial methanol production started we reinvent the process completely

Where do you find us in Leuna?

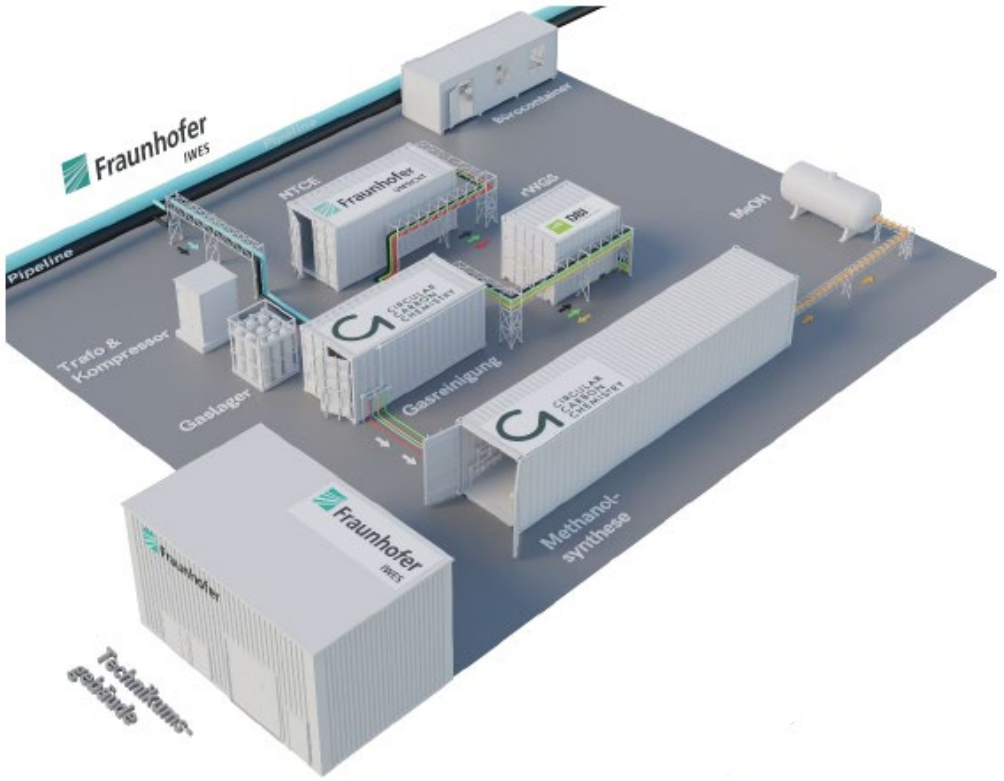
Pilot plant at the Fraunhofer IWES area

Office

Infraleuna
Building /
Eingang 5
Raum 1.106

Projekt Leuna100 am Hydrogen Lab Leuna

Arbeitspakete des Fraunhofer IWES



Erschließung der neuen Testfläche

Medienversorgung

Integration der Einzelanlagen in eine übergeordnete Prozessleittechnik und das Sicherheitssystem des Standortes

Gemeinsames Erarbeiten eines übergeordneten Sicherheits- und Regelkonzeptes für den Betrieb der gekoppelten Anlagen

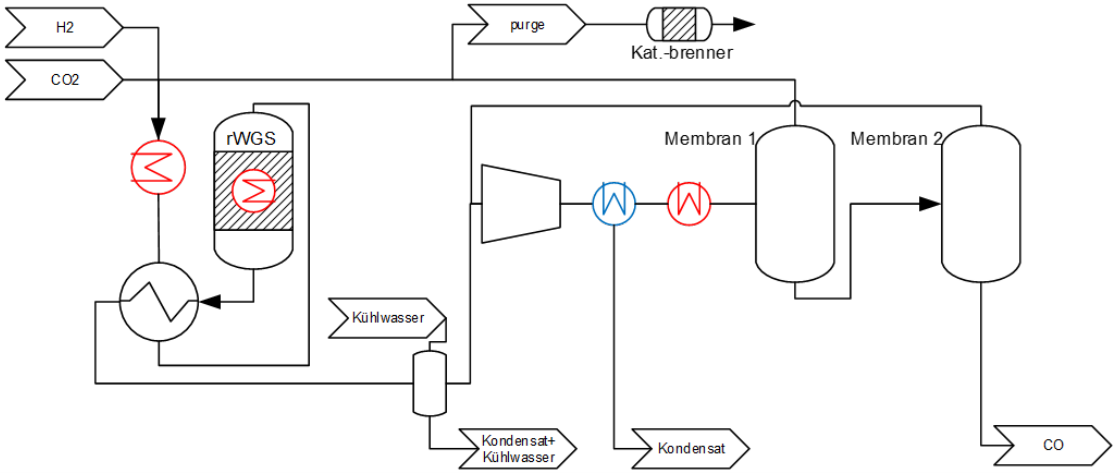
Erstellung und Durchführung eines Versuchsplanes für einen lastflexiblen Betrieb unter Betrachtung der Einzelanlagen und der Produktqualität

Fraunhofer IWES

Leuna100 / reverse Wasser-Gas-Shift / **rWGS**

- Reverse Wasser-Gas-Shift-Reaktion

$$CO_2 + H_2 \leftrightarrow CO + H_2O \quad \Delta_R H^0 = +41{,}2\ kJ/mol$$



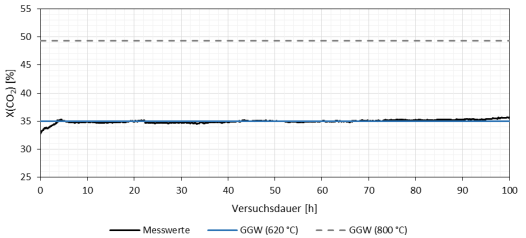


Abb.: Langzeitversuch rWGS, 100 h bei 800 °C –stabil!

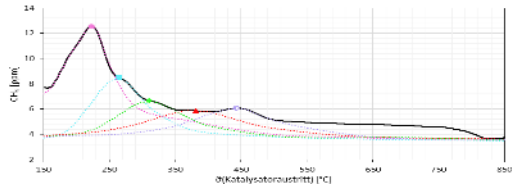


Abb.: Nachweis rWGS ohne C-haltige Ablagerungen

Entwicklung DBI-Gruppe

- Katalysatortests
- Simulation
- Basic- Detailengineering
- Aufbau und Inbetriebnahme

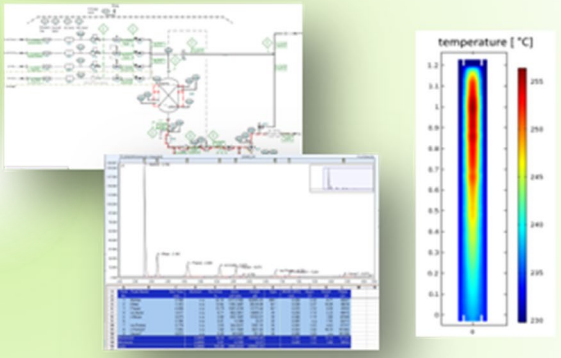
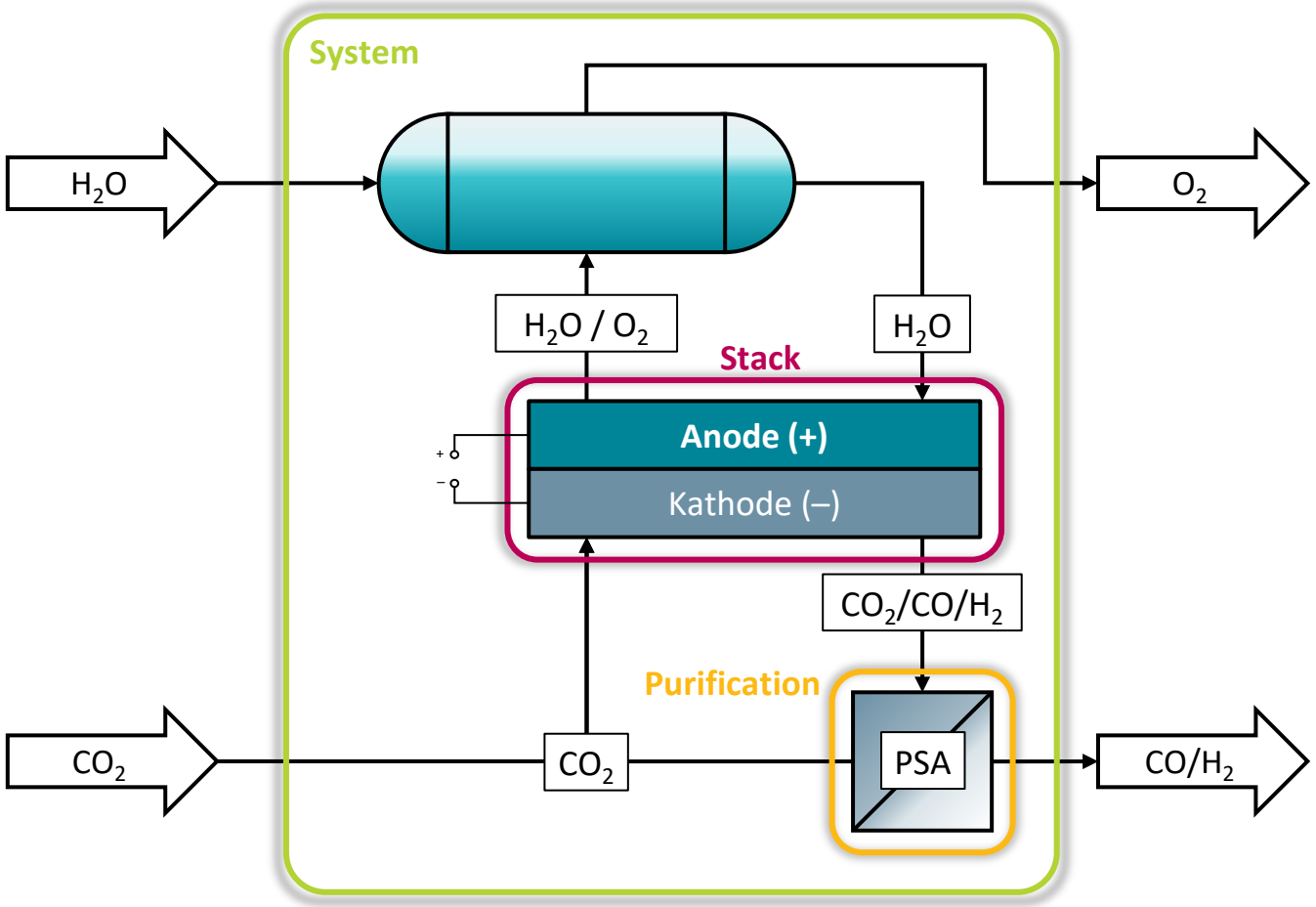


Abb.: rWGS-Anlage DBI für 1,0 m³/h (i.N.) CO

DBI Gruppe

Leuna100: Subproject UMSICHT

Syngas production via low-temperature-co-electrolysis (LTCE)



Fraunhofer UMSICHT

- Development of a modular LTCE process for syngas production from CO_2 and H_2O for load-flexible methanol synthesis

Electrolysis System

- Development of a modular balance of plant for automized operation of the electrolyzer

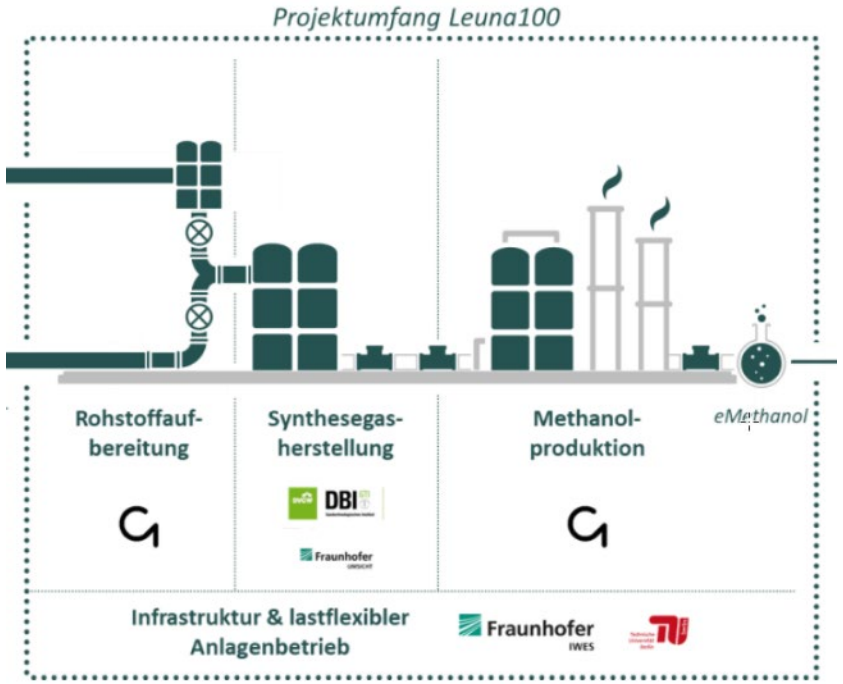
Electrolysis Stack

- Design, construction and assembly of a PEM electrolysis stack for co-electrolysis

Product Purification

- Development of a purification process (pressure swing adsorption) for syngas production via LTCE)

TU Berlin – Fachgebiet d|b|t|a



Anlage in Leuna

Liefern Informationen für

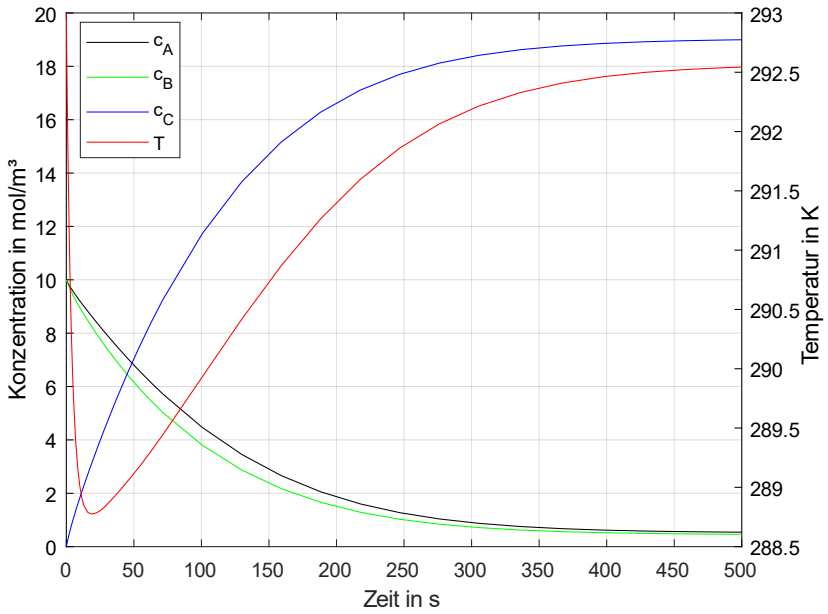
- Optimalen Anlagenbetrieb
- Lastflexible Betriebstrajektorien
- Auslegung
- Verschaltung einzelner Units

Liefert exp. Daten für

- Parameterschätzung
- Validierung

d|b|t|a

Dynamische Prozessmodelle



In–house Software MOSAICmodeling zur Dokumentation und Export zu Programmierungsumgebung

d|b|t|a

GESAMTKONZEPT
ERNEUERBARE KRAFTSTOFFE

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Bundesministerium für Digitales und Verkehr

Koordiniert durch:
NOW NOW-GMBH.DE

Projektträger:
VDI|VDE|IT
FNR

aufgrund eines Beschlusses des Deutschen Bundestages

TECHNISCHE UNIVERSITÄT BERLIN

Website

LinkedIn

30 years
d|b|t|a
research

WIR STELLEN EIN!

Erfahrenen Anlagenfahrer/
Betriebsingenieur in Leuna für
unsere Pilotanlage.

Sprich uns gerne an:
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ERDGESCHOSS
MATTHIAS-PIER-SAAL
UND GÄSTEZIMMER