Coordinated by: NOW-GMBH.DE | Project management agency: VDI|VDE|IT, FNR

FUNDING PROGRAMME RENEWABLE FUELS

PILOT SBG

DBFZ

Pilot-scale one-step methanation

Catalyst screening and process optimization

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On behalf of: Federal Ministry of Transport

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DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH (DBFZ)

In a nutshell

Applied R&D for biomass conversion

Non-profit company

Shareholder Federal Republic of Germany

272

Employees

in 2025

26.5 million EUR turnover (2025)

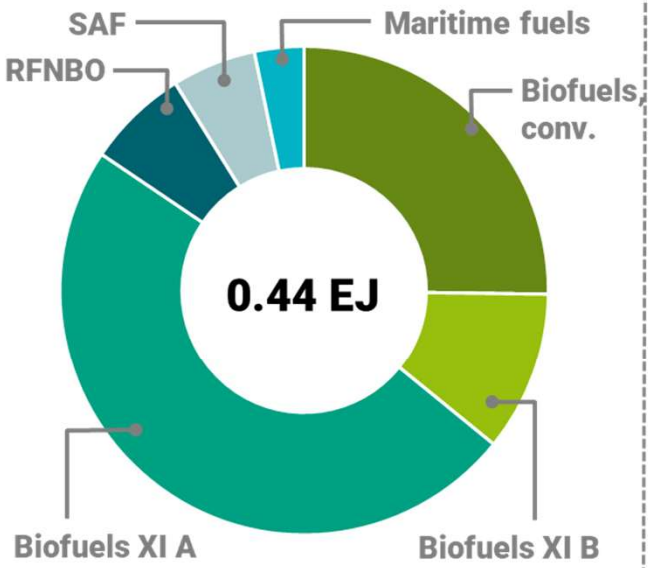
800 m² Technical center

800 m² Pilot plant

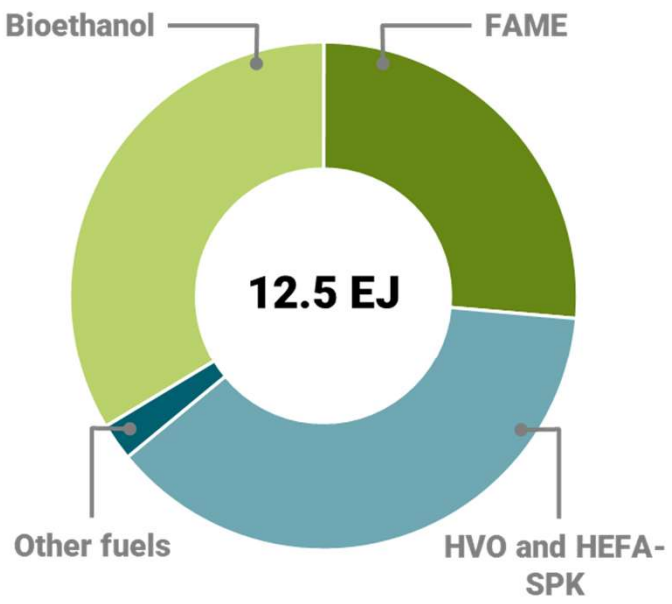
250 m² laboratories

Fuel demand in transport, capacities and bioenergy potential

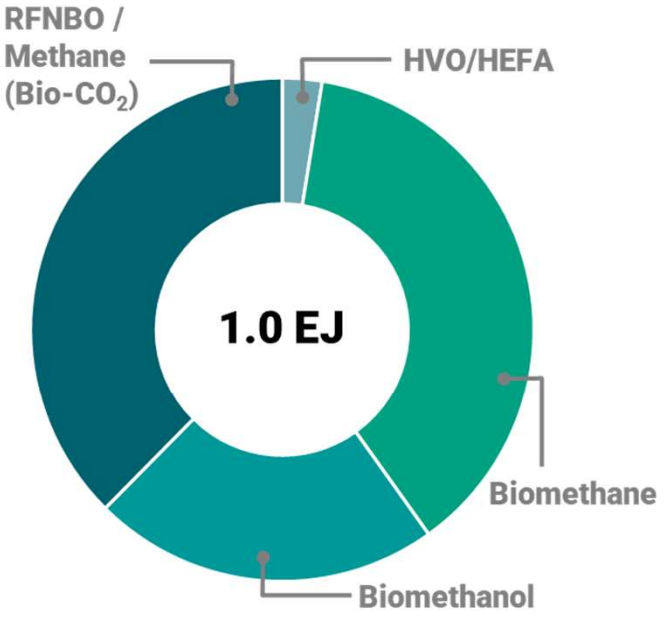
German fuel demand
(acc. to GHG quota, RFEUA, FEUM)



World fuel capacity
(in operation and projected)



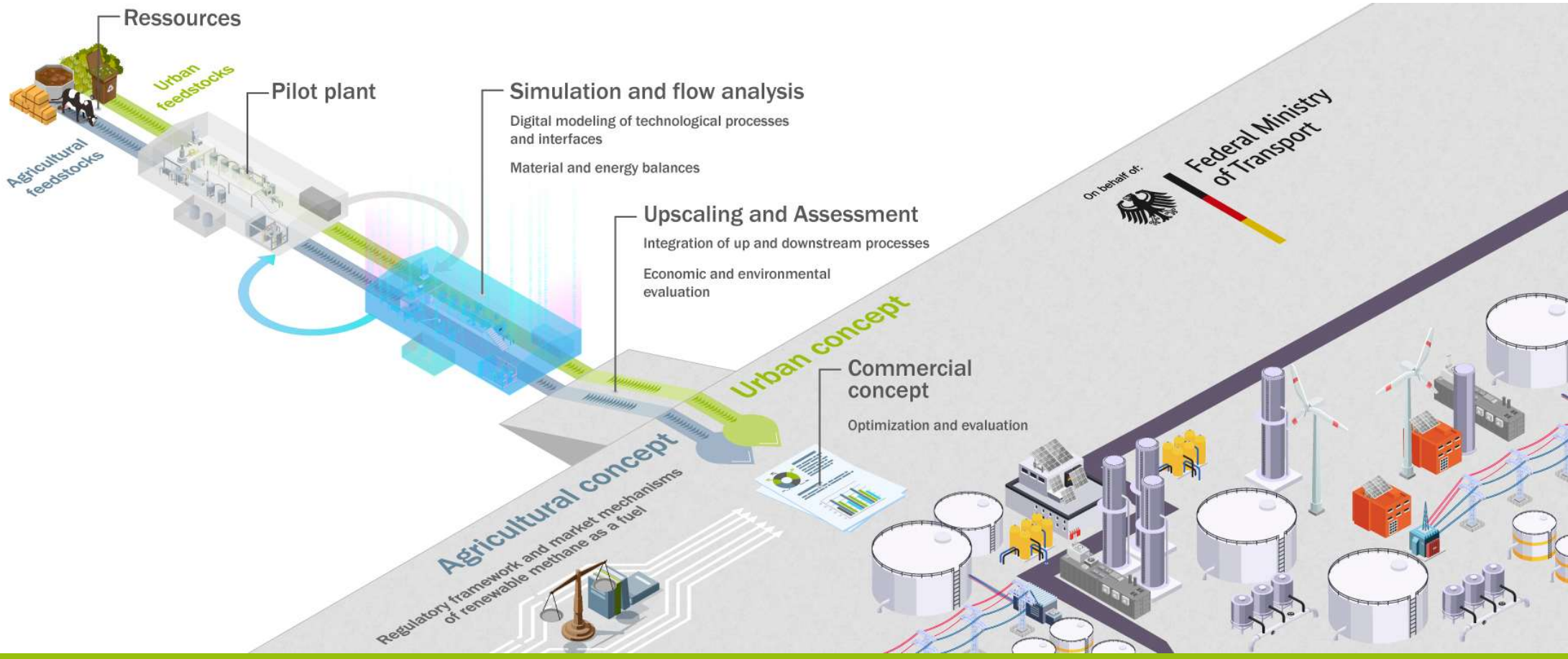
European bioenergy potential
(non food, balanced in fuel output)



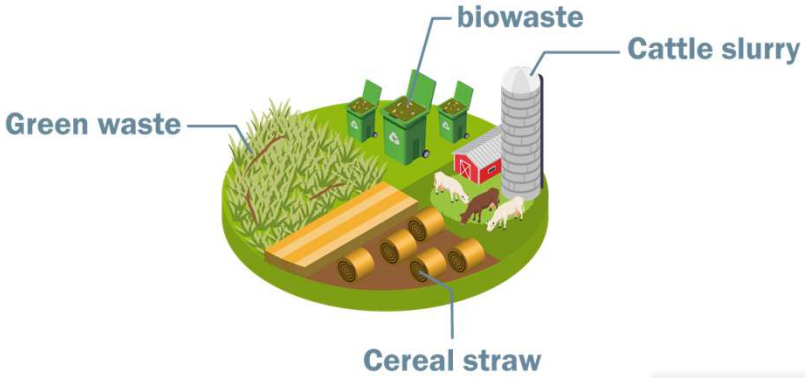
Mueller-Langer et al. FOTF 2026
Sources: adapted from Naumann, et al. (07/2025): Hintergrundpapier | Szenarien zur THG-Quote im Kontext des Referentenentwurfs 2025 und des Klimaschutzgesetzes bis 2045., online available: https://www.dbfz.de/fileadmin/user_upload/Referenzen/Statements/DBFZ_HP_Szenarien_THG_Quote.pdf; Schröder et al. (2025): Marktkennzahlen. In: Schröder, J.; Görsch, K. (Hrsg.) (2025). Erneuerbare Energien im Verkehr: Monitoringbericht. Leipzig: DBFZ. and Naumann et al. (10/2024): Hintergrundpapier. Bio2x. Online available https://www.dbfz.de/fileadmin/user_upload/Referenzen/Statements/Hintergrundpapier_Bio2x_Okt_2024.pdf

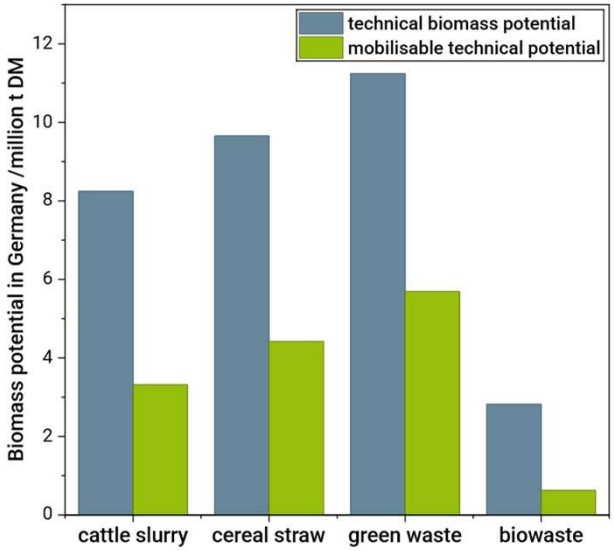
Project presentation

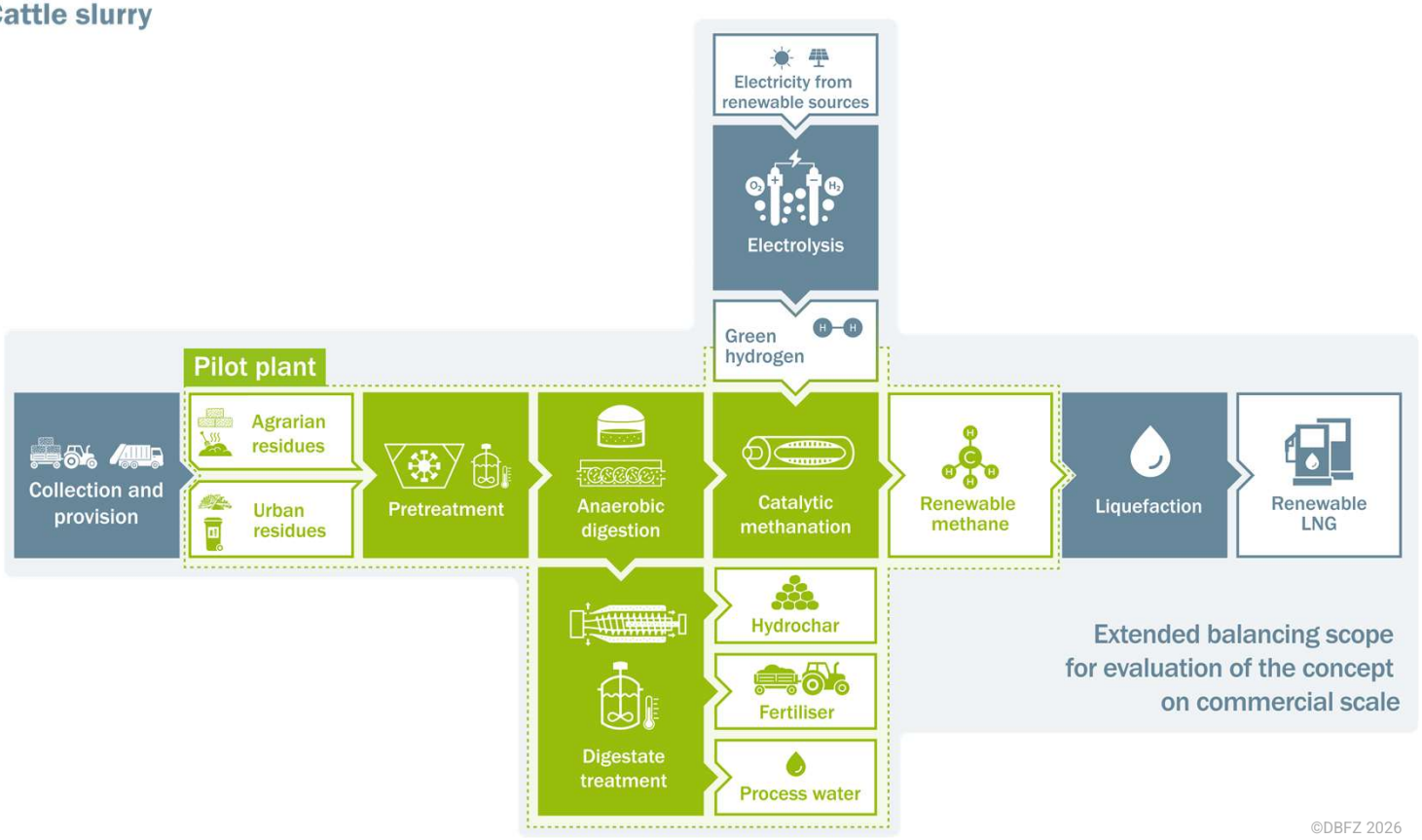
Overview Pilot-SBG



Overview of the process



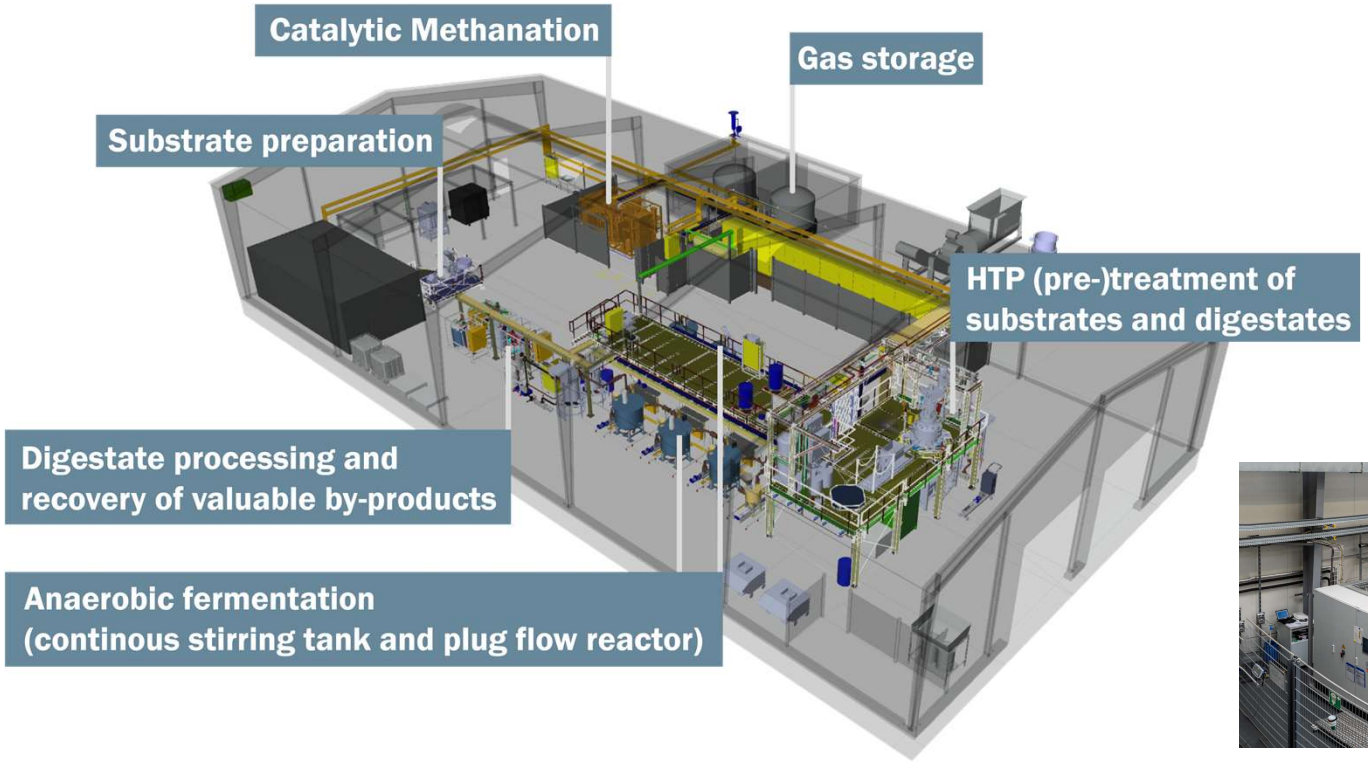




Source: Naegeli de Torres, F., Brödner, R., Cyffka, K.-F., Fais, A., Kalcher, J., Kazmin, S., Meyer, R., Radtke, K. S., Richter, F., Selig, M., Wilske, B., & Thrän, D. (2024). DBFZ Resource Database: DE-Biomass Monitor. Biomass Potentials and Utilization of Biogenic Wastes and Residues in Germany 2010-2020 [Data set]. Zenodo DOI: 10.5281/zenodo.14273285

Project presentation

Overview of the pilot plant



Location: DBFZ, Leipzig, Germany
Full operation since: 01/2025

Methanation

Gas storage & flare

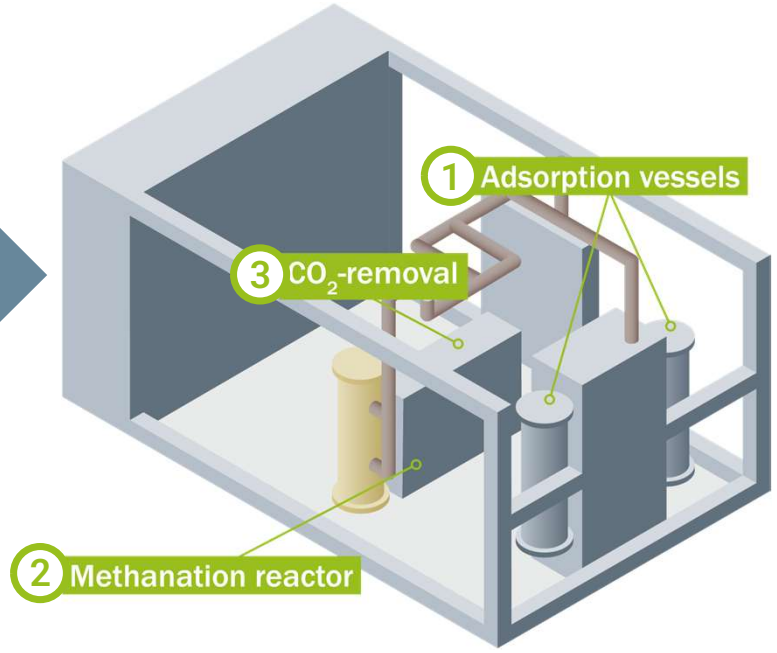
PILOT SBG

DBFZ

Methanation

Overview of the methanation in the pilot plant

Biogas

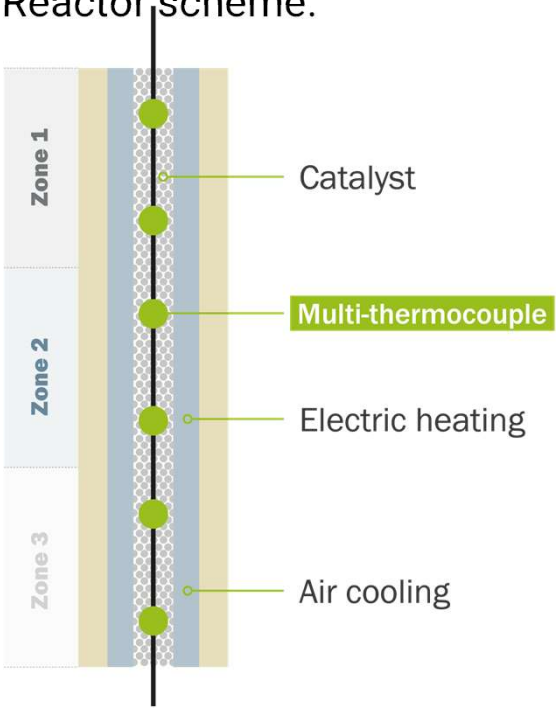


1. **Biogas purification**
   H_2S-adsorption on iron oxides
2. **Catalytic methanation**
   $CO_2 + 4\ H_2 \leftrightarrow CH_4 + 2\ H_2O$
3. **CO_2 separation**
   Absorption in NaOH solution

Renewable methane

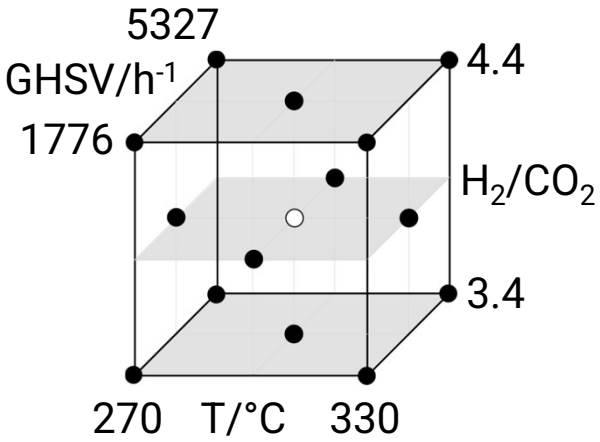
Catalyst screening

Reactor scheme:

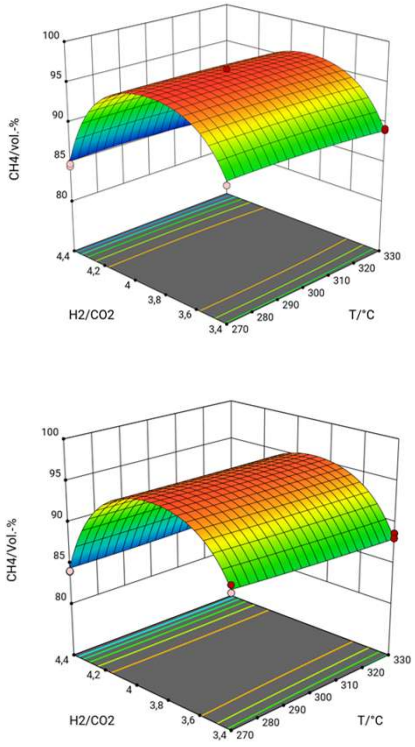


Catalysts: Ni(20m%)/Al_2O_3 and Ni(20m%)/CeO_2

→ determining the optimum operating point



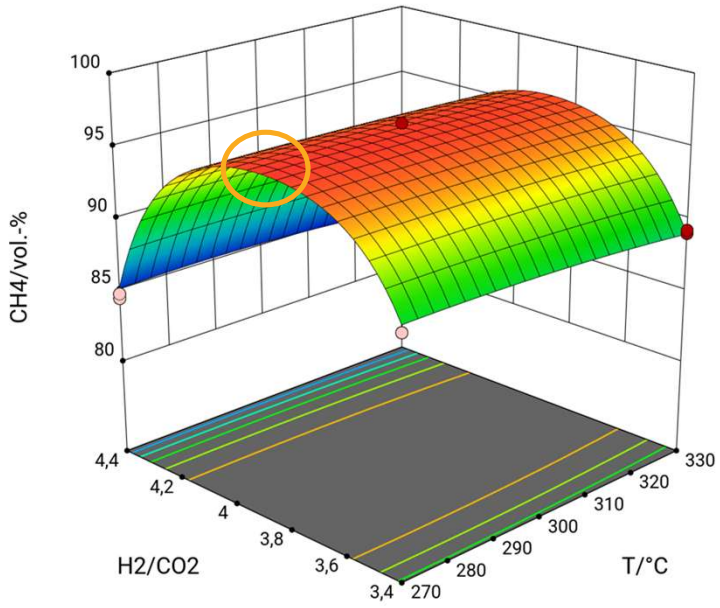
Result



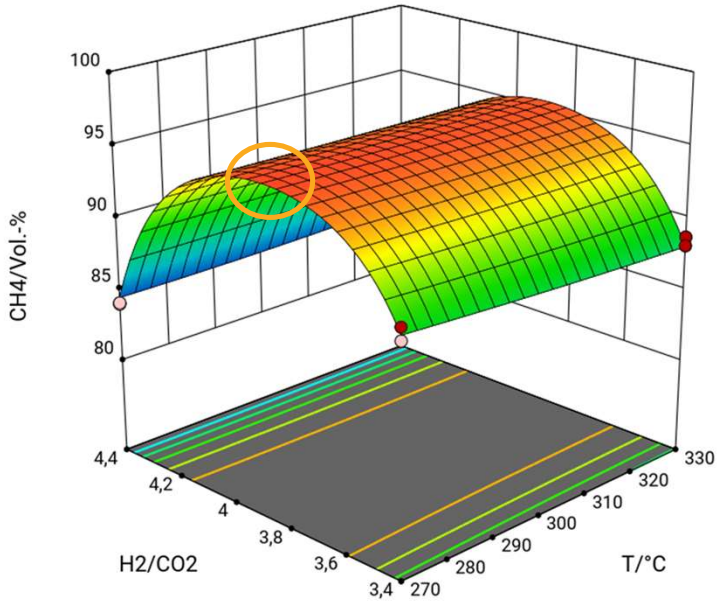
Test conditions: biogas (CH_4 = 53 vol%, CO_2 = 47 vol%); theoretical recirculation of product gas = 4; p = 18 bar(g)

Catalyst screening

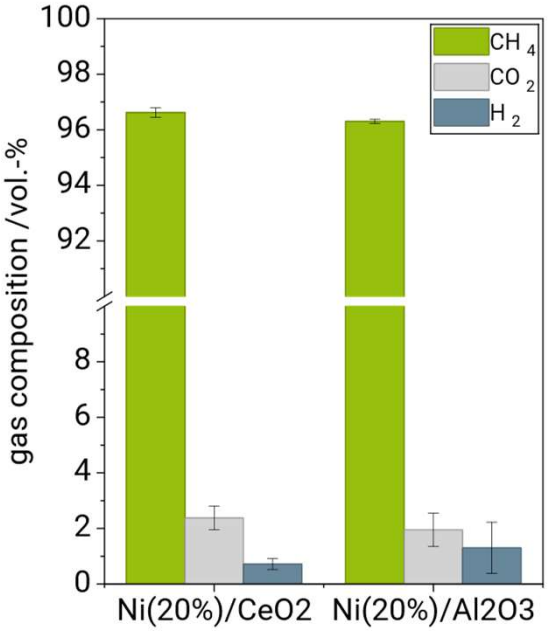
Ni(20%)/CeO_2, GHSV = 1776 h^{-1}



Ni(20%)/Al_2O_3, GHSV = 1776 h^{-1}



T = 270 °C, GHSV = 3552 h^{-1}, H_2/CO_2 = 3.9



Optimum according to model:

T = 270 °C, GHSV = 1776 h^{-1}, H_2/CO_2 = 3.87

Validation (vol.-%):

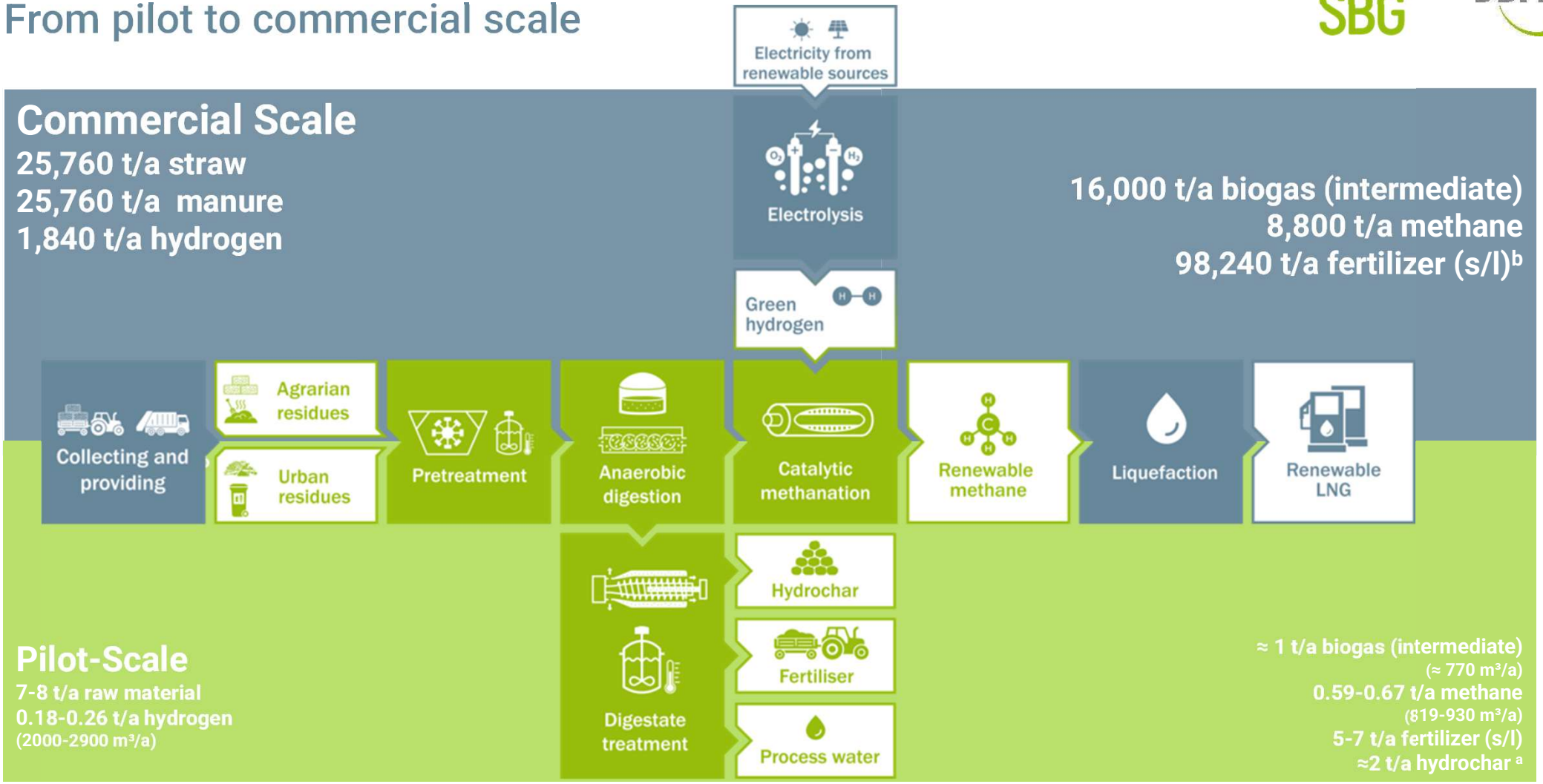
CH_4 = 96.27 %, CO_2 = 2,92 %, H_2 = 0,53 %

T = 270 °C, GHSV = 1776 h^{-1}, H_2/CO_2 = 3.81

CH_4 = 95.47 %, CO_2 = 3.69 %, H_2 = 0,61 %

Scale Up

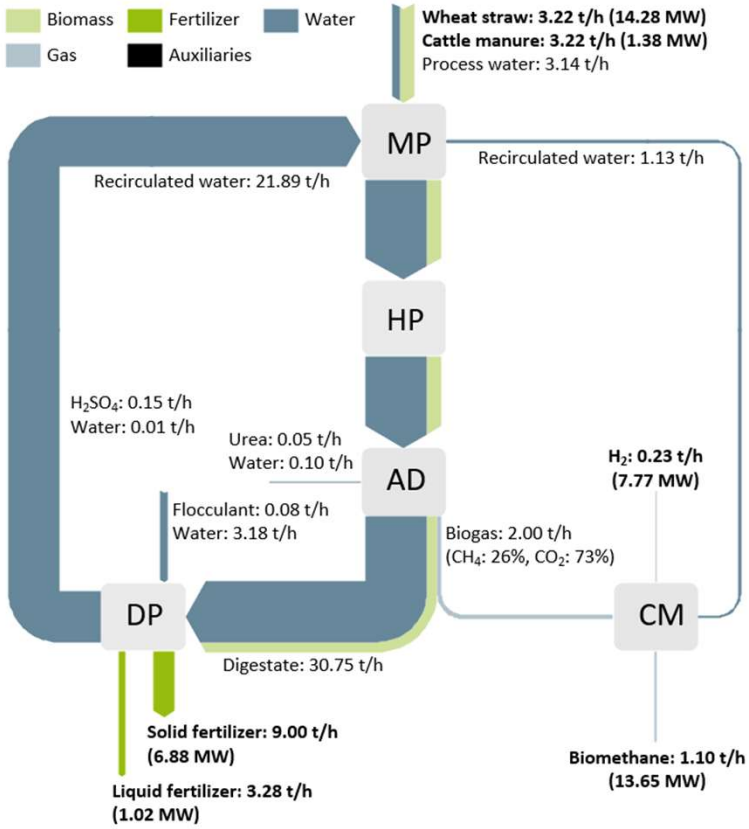
From pilot to commercial scale



m³ - standard cubic metre; [a] Rough approximation from the mass balance of the engineering phase of the pilot plant. Biogas, fertiliser and hydrochar amount and composition depend on the raw material origin and quality; [b] for the first commercial size plant concept results from lab scale preliminary tests were used since the pilot plant was still in commissioning.

Scale Up

Mass and energy balance | commercial scale



Results

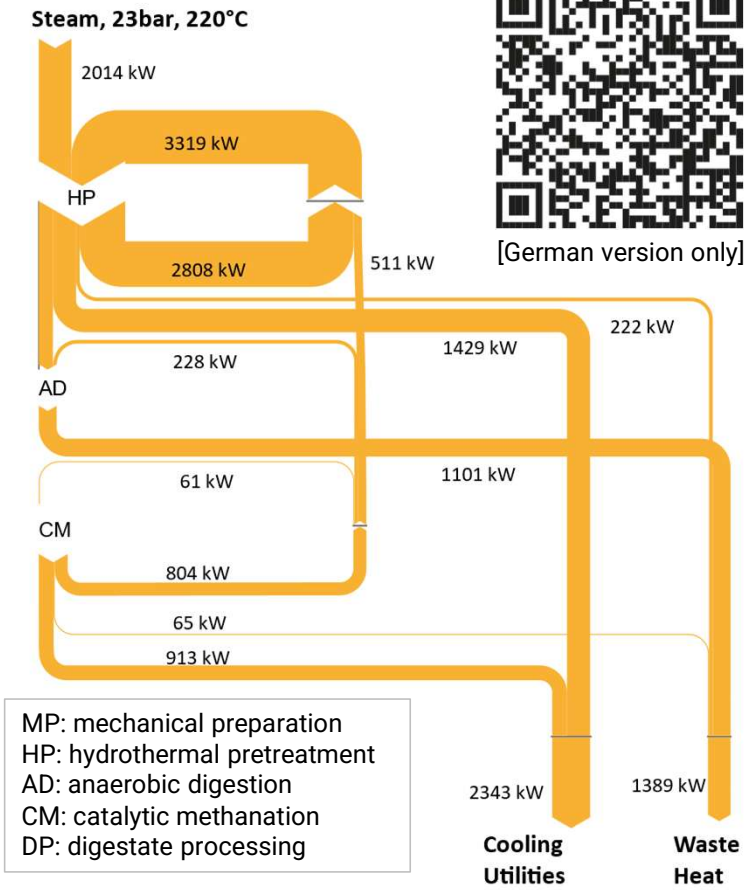
BUEM = 18.3 %; 45.4 %
(N/P/K fertilizer; considering all anorganic content)

BUEE = 16.9 %
(only fuel)

ECE = 33.4 %; 52.8 %
(only fuel; fuel + fertilizer)

BUEE, BUEM = Energetic and Material based biomass utilization efficiency

ECE = Energy conversion efficiency

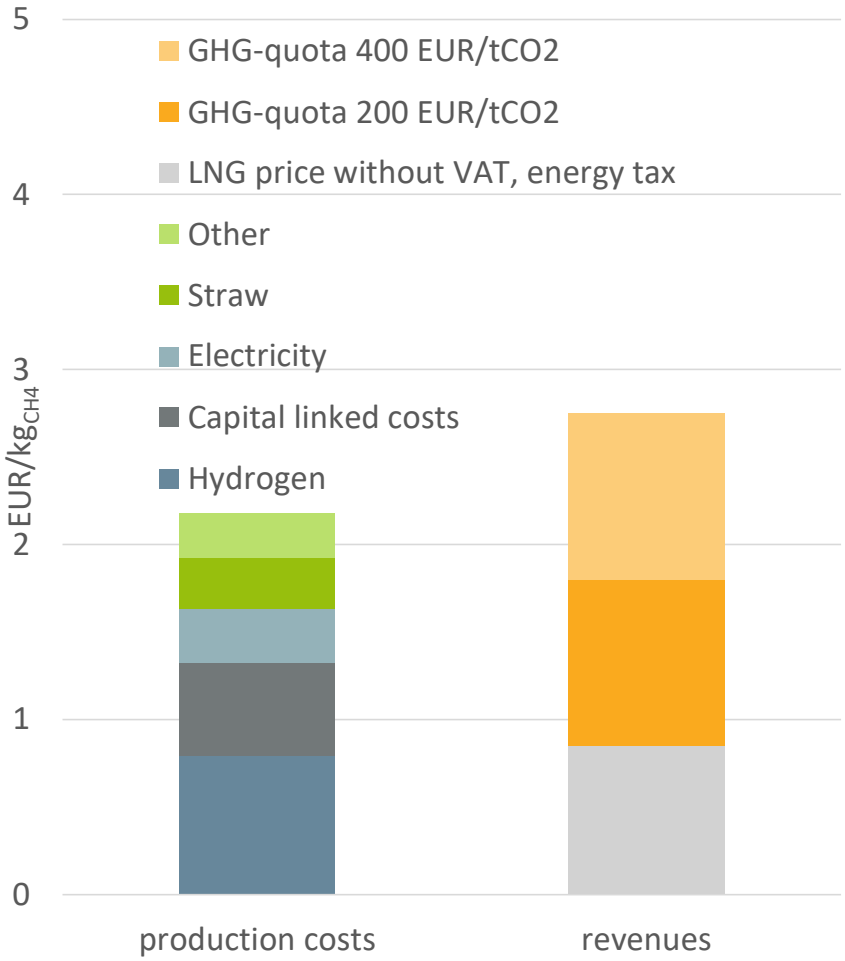


[German version only]

Source: Röder, L. S.; Nitzsche, R.; Etzold, H.; Oehmichen, K. (2024). Beispielkonzept zur Bereitstellung von erneuerbarem LNG aus biogenen Rest- und Abfallstoffen und erneuerbarem Wasserstoff im kommerziellen Maßstab: Fokusheft im Projekt Pilot-SBG. Leipzig: DBFZ. 31 S. ISBN: 978-3-949807-06-0. DOI: 10.48480/jsct-z879

Scale Up

Market | Methane production costs and possible revenues

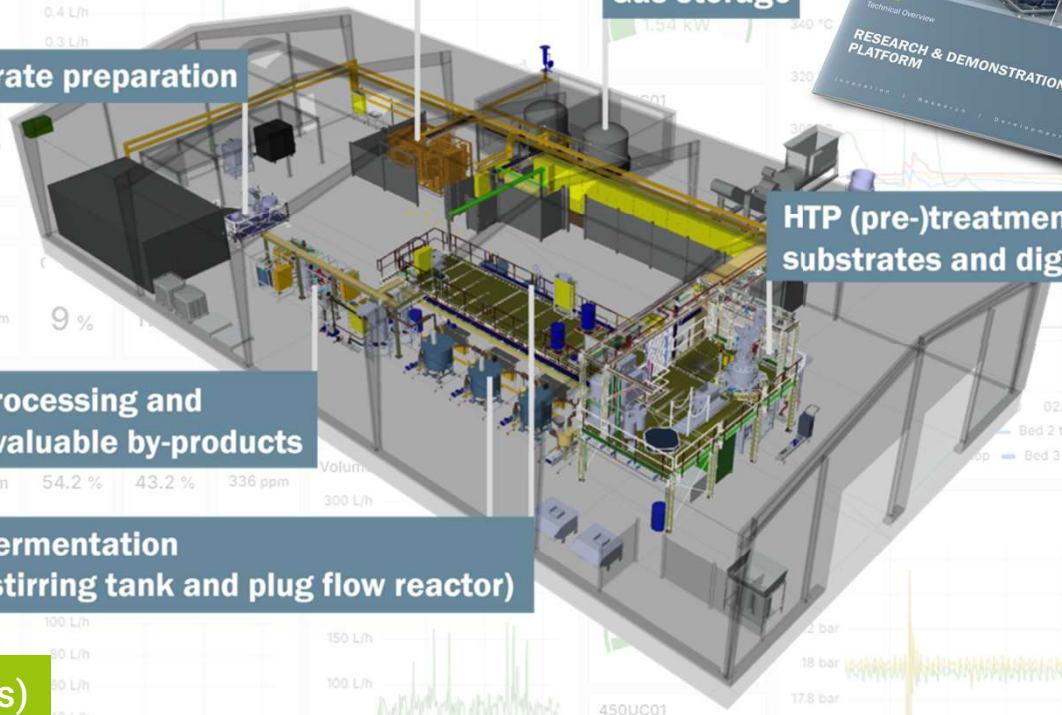


- GHG quota revenues could have a high positive impact on the business case
- Regulatory changes drive rising prices by end of 2025 (400 EUR/t_{CO2})
- From 2026 onward, double counting for advanced biofuels ends
- Market prices for 2026 are still under development

Source: Röder, L. S.; Nitzsche, R.; Etzold, H.; Oehmichen, K. (2024). Beispielkonzept zur Bereitstellung von erneuerbarem LNG aus biogenen Rest- und Abfallstoffen und erneuerbarem Wasserstoff im kommerziellen Maßstab: Fokusheft im Projekt Pilot-SBG. Leipzig: DBFZ. 31 S. ISBN: 978-3-949807-06-0. DOI: 10.48480/jsct-z879

Technology and fields of research

- Fully automated plant
- Intensive process monitoring
- Plug and play
- Waste/Biomass to X (W/BtX)
- Flexibility
- Biogenic CO_2
- RFNBO
- Advanced feedstock (wastes and residues)
- Modularity



Technical overview

Visit our website

Do you want to add your technology and test it in relevant environment?

Integrated biorefinery for renewable fuels, chemicals and by-products

Flexibility in feedstock and operation conditions with plug and play options

Do you need to scale up your lab scale fermentations?

5x 1m³ CSTR
1x 0.5m³ PFR

Platform chemicals through hydrothermal treatment or char for sequestration.

500-L-Reactor (240 °C / 40 bar);
with steam generator
and high pressure injection

E-fuels from captured CO_2, biogas, syngas; catalyst testing and more …

Adsorption unit
Fixed bed methanation reactor
Product gas cleaning

Screw press
Chamber filter press
Ultra-/Nano filtration
Reverse osmosis

Technical scale research biogas plant

Fully automated,
2x 180 m³ CSTR, 50 m³ PFR, post digester + digestate storage,
mechanical pretreatment …

You need down streaming for your fermentation broth?

Interested? Contact us!

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