

bioliq® - BtL pilot plant

Thomas Kolb

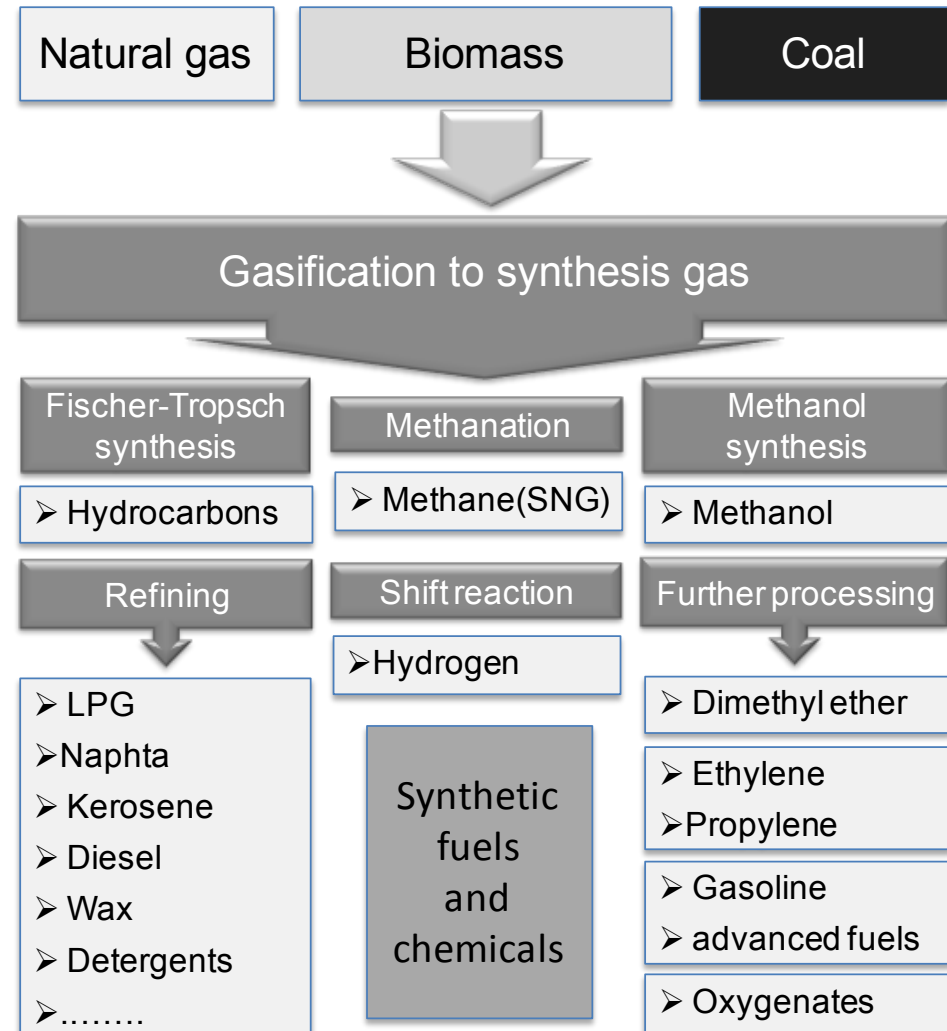
Aviation Biofuels through Biomass Gasification,
IEA Task 33 | Trondheim | May 25, 2016

Engler-Bunte-Institut, Chemische Energieträger – Brennstofftechnologie, EBI ceb
Institut für Technische Chemie, Vergasungstechnologie, ITC vgt



Motivation

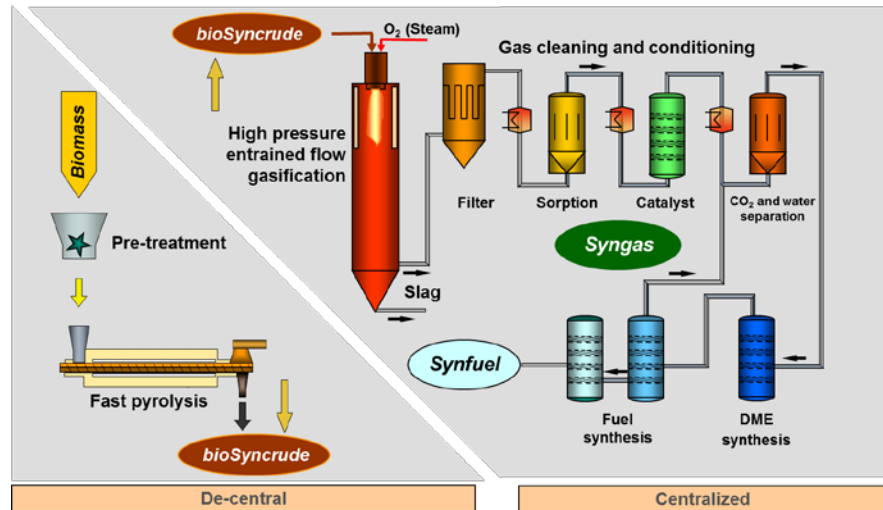
- Biomass is the **only renewable carbon carrier** and on long term to be used for carbon containing products prior to heat power
- **Synthesis gas is a versatile platform** for fuels and chemicals productions as well as between biomass and fossil feedstocks
- Thermo-chemical biorefineries are **feedstock flexible** and combine the production **of fuels, chemicals, heat and power**
- **High feedstock potential** by using sustainable biomass resources, i.e. **biogenic residues**



the bioliq[®] BtL Process

BtL residual biomass to gasoline

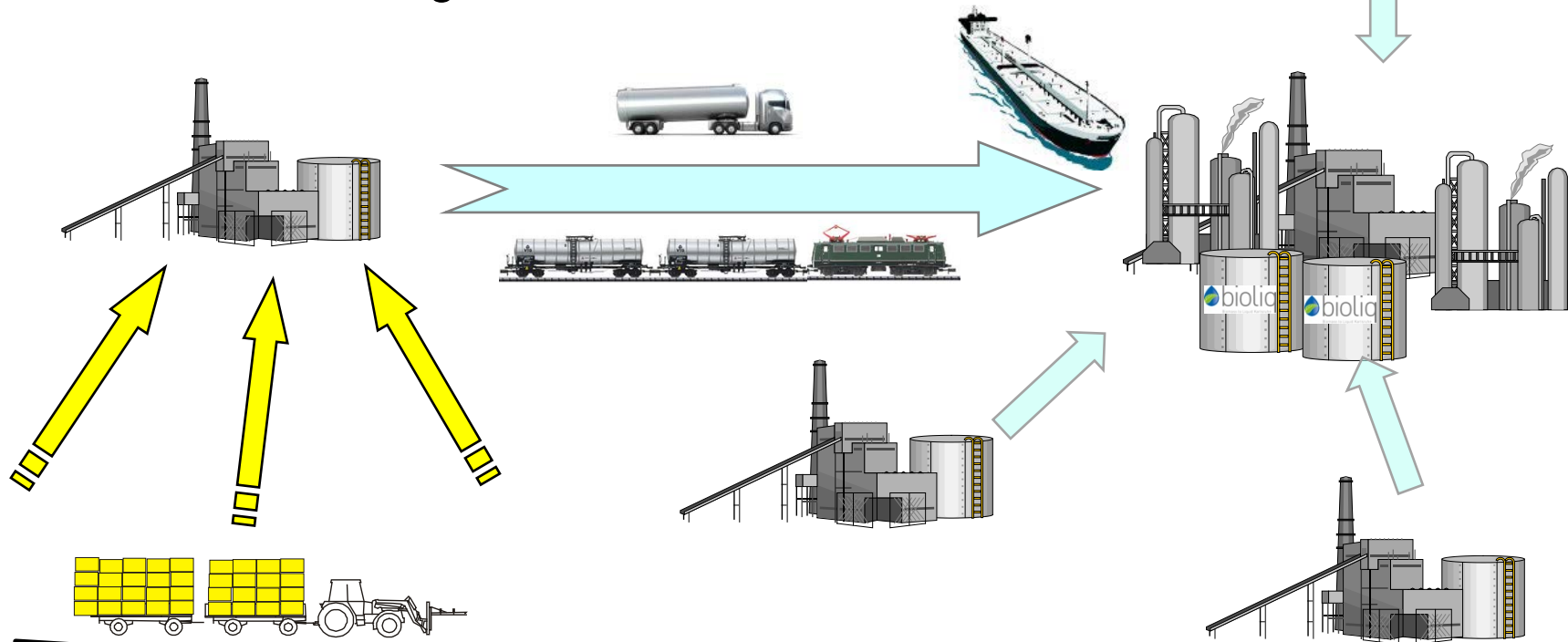
- de-central feedstock pretreatment
- central gasification / synthesis
- pilot plant with 500 kg/h straw pyrolysis, 5 MW gasification



- fast pyrolysis for slurry production from straw
- entrained flow gasification
- high temperature gas upgrading
- direct DME gasoline synthesis

De-centralized / central concept

- Energy densification of biomass in regional distributed plants by bioliqSyncrude production
- Economic conversion in large scale to syngas and further refining into fuels & chemicals

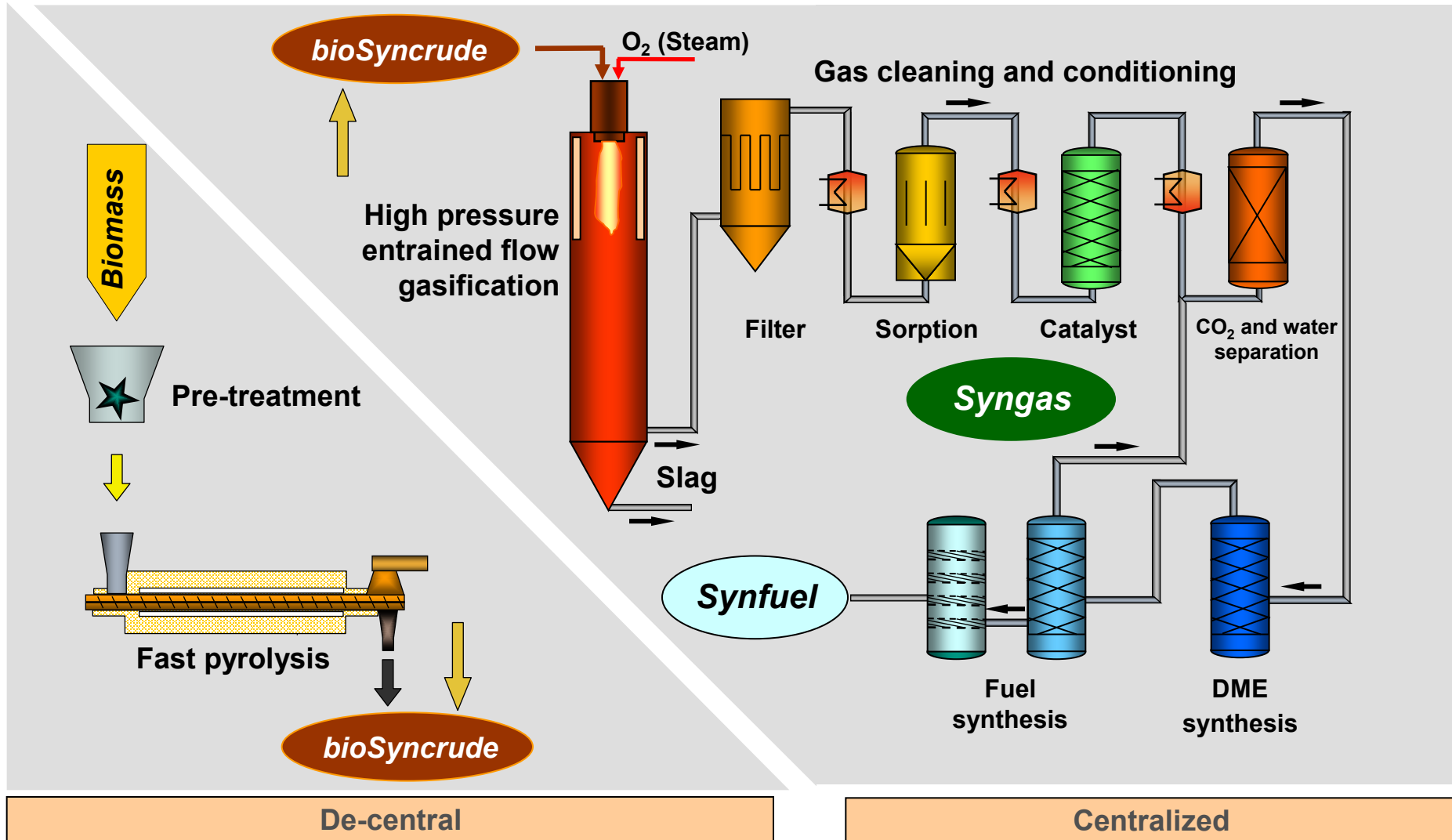


Energy density: 2 GJ/m³

25 GJ/m³

36 GJ/m³

Process chart



Status of the bioliq[®] project

	Stage I	Stage II	Stage III	Stage IV
Process	Fast pyrolysis	High pressure entrained flow gasification	Gas cleaning and Synthesis I	Synthesis II
Product	BioSyncrude	Synthesis gas	Dimethyl ether	Gasoline
Capacity	2 MW (500 kg/h)	5 MW (1 t/h)	150 kg/h	< 100 l/h
Realization	2005 - 2008	2008 - 2013	2009 - 2011	
State	In operation	In operation	In operation	

Partners:

TCI: 64 Mio.EUR



bioliq[®] pilot plant

Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages



Entrained Flow
Gasification
(5 MW, 1 t/h)
2008-2013



Fast pyrolysis
(2 MW, 500 kg/h)
2005-2008



Gasoline synthesis
(2 MW, 50 kg/h)
2009-2011



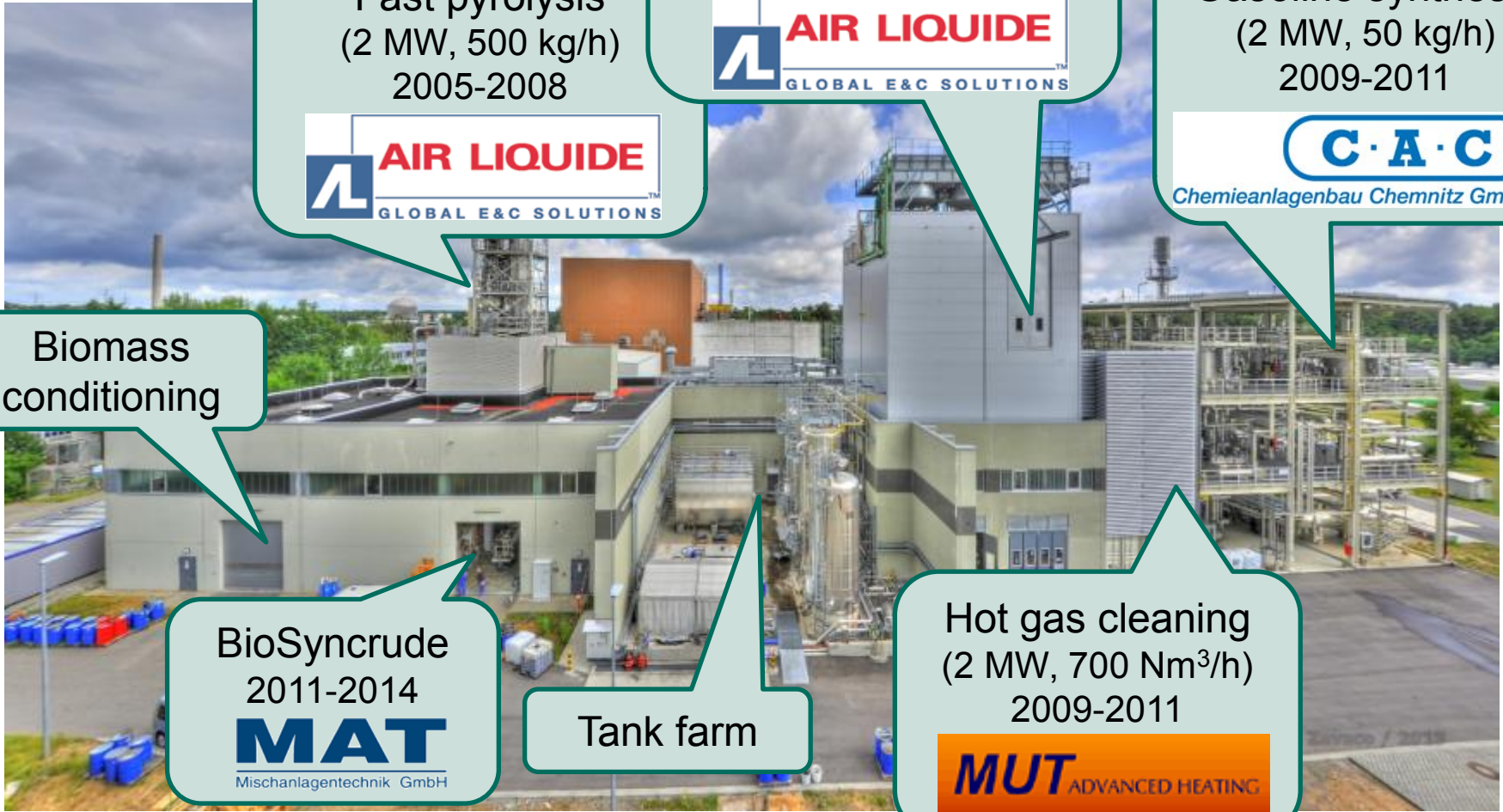
Biomass
conditioning

BioSyncrude
2011-2014

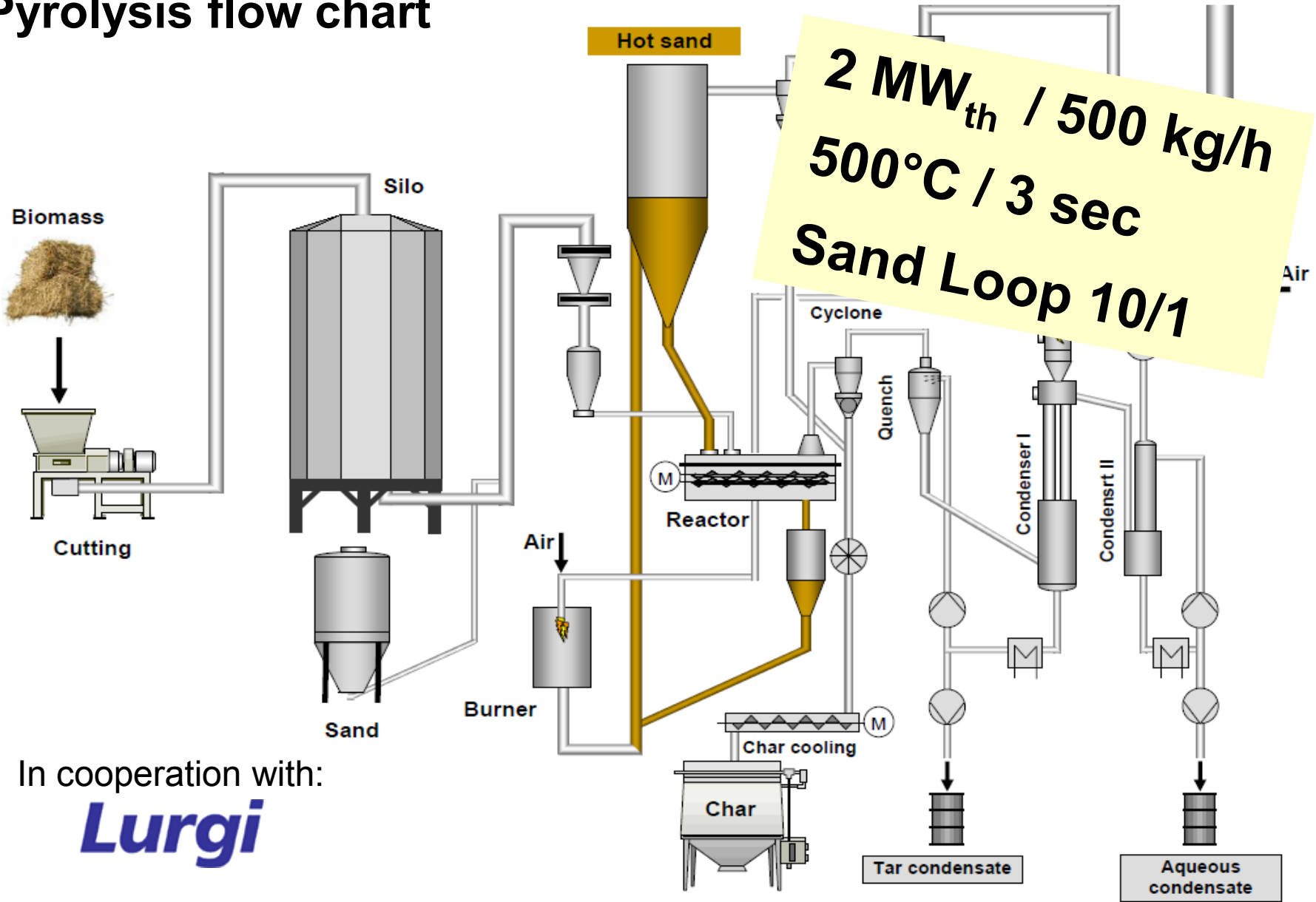


Tank farm

Hot gas cleaning
(2 MW, 700 Nm³/h)
2009-2011



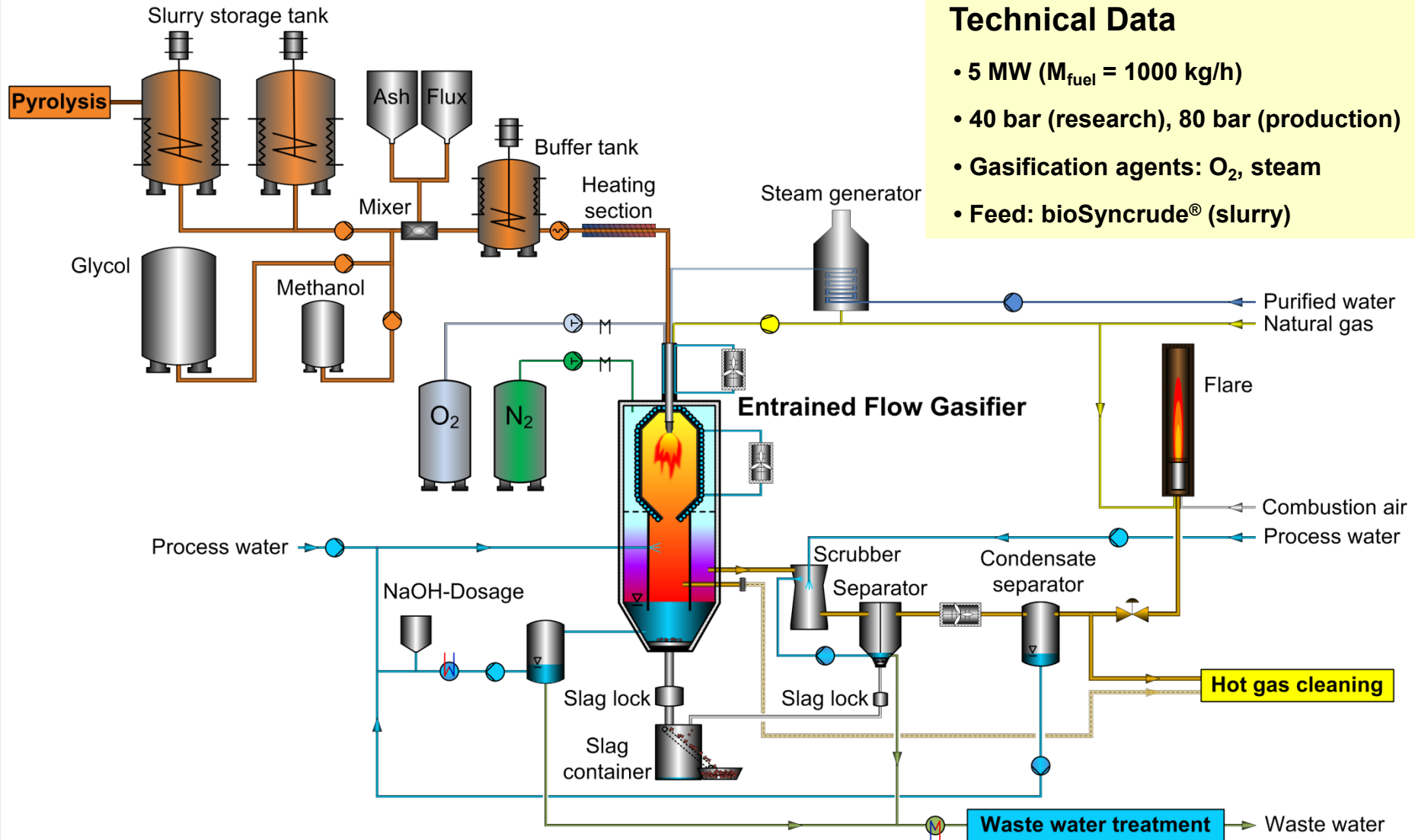
Pyrolysis flow chart



In cooperation with:

Lurgi

High pressure entrained flow gasification

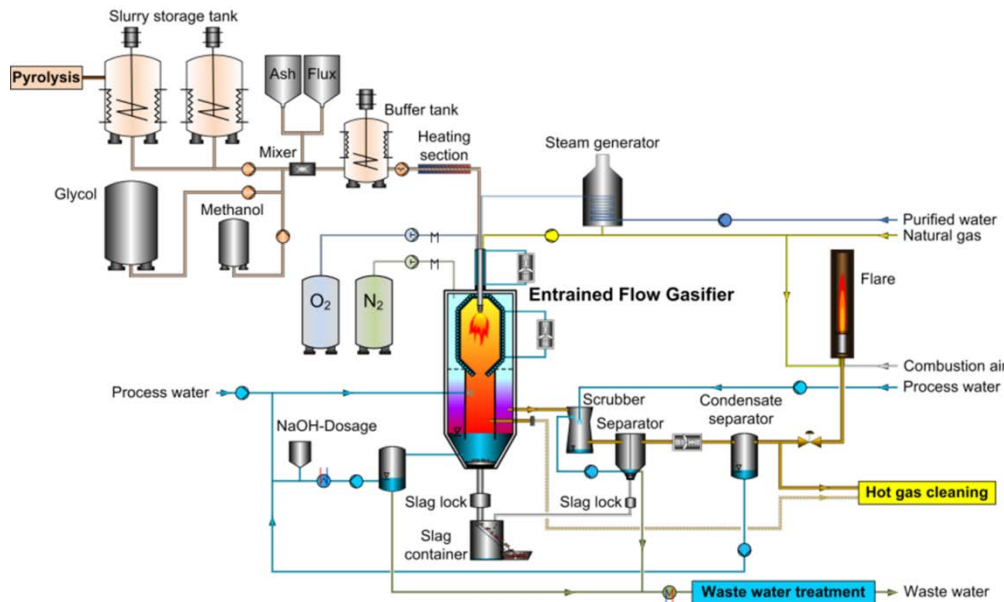
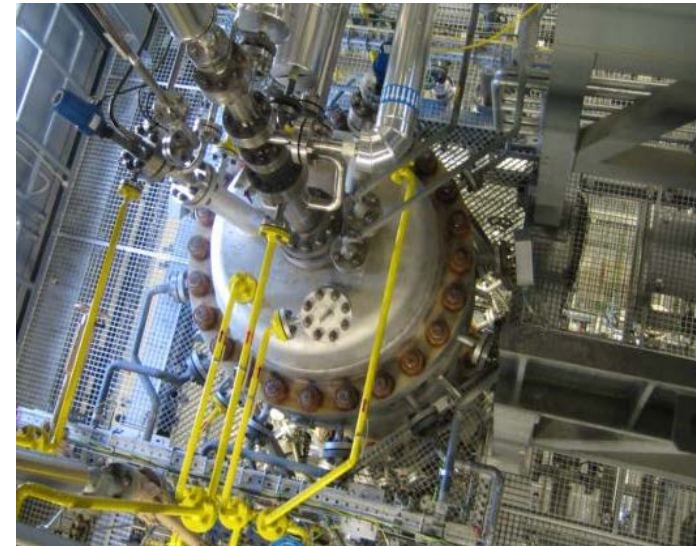


bioliq[®] Entrained Flow Gasifier

research focus



- atomization of high viscous fuel
- fuel conversion / slagging
- radiation / analytics
- numerical simulation



technical data

- membrane wall EFG
- 40 and 80 bar configuration
- 1 t/h slurry / 1 MW
- oxygen / steam blown

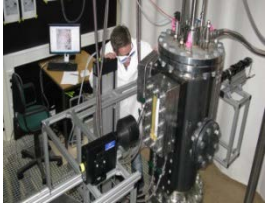
Helmholtz Virtual Institute for Gasification Technology – HVIGasTech

Research Field Energy

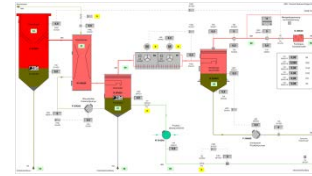


Integrated Research on Gasification

High Pressure Atomization



KIT
PAT

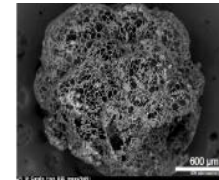


Process Control

KIT

fuel →
← O₂ / Steam

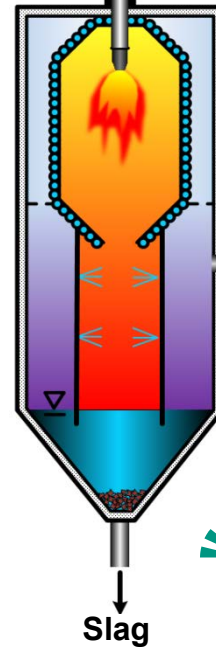
Fuel Conversion



KIT
RWTH AACHEN
UNIVERSITY

Entrained Flow Gasification

KIT
REGA

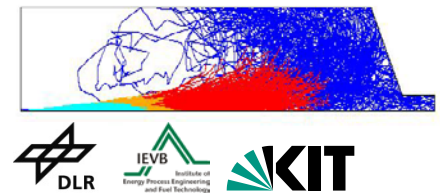


→ Raw Syngas

Process Efficiency

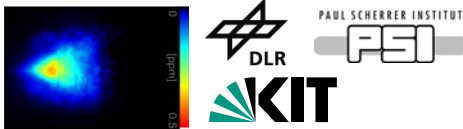
Materials
KIT

Numerical Simulation



DLR **IEVB** **KIT**
Institute of Energy Process Engineering and Heat Technology

Measuring Techniques

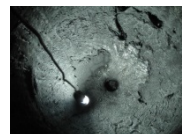


DLR **PSI**
KIT

Helmholtz Virtual Institute
for Gasification Technology

HVI **GAS** **TECH**
Helmholtz Virtual Institute for Gasification Technology

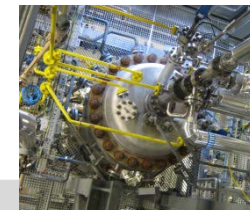
↓ Slag



Slag Control

KIT

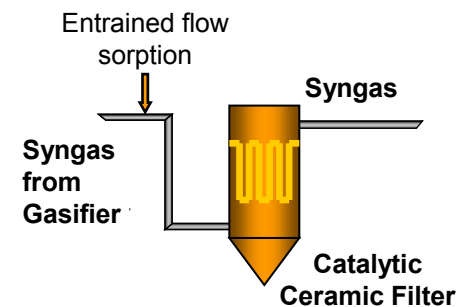
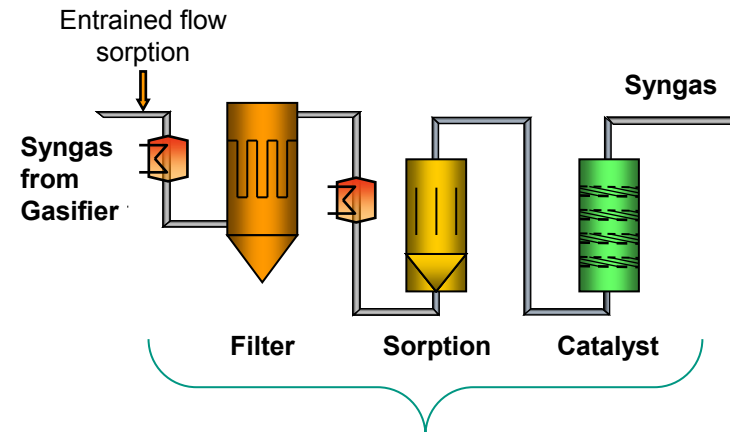
bioliq® EFG
KIT 5MW
80 bar



Thomas Kolb

High Temperature-High Pressure Gas Cleaning

- HTHP dry sorption of sour gas compounds and alkali
- Catalytic conversion of hydrocarbons and N-species
- CO₂ separation (optional)
- 700 m³/h STP synthesis gas (40 m³/h at 80 bar, 800 °C)



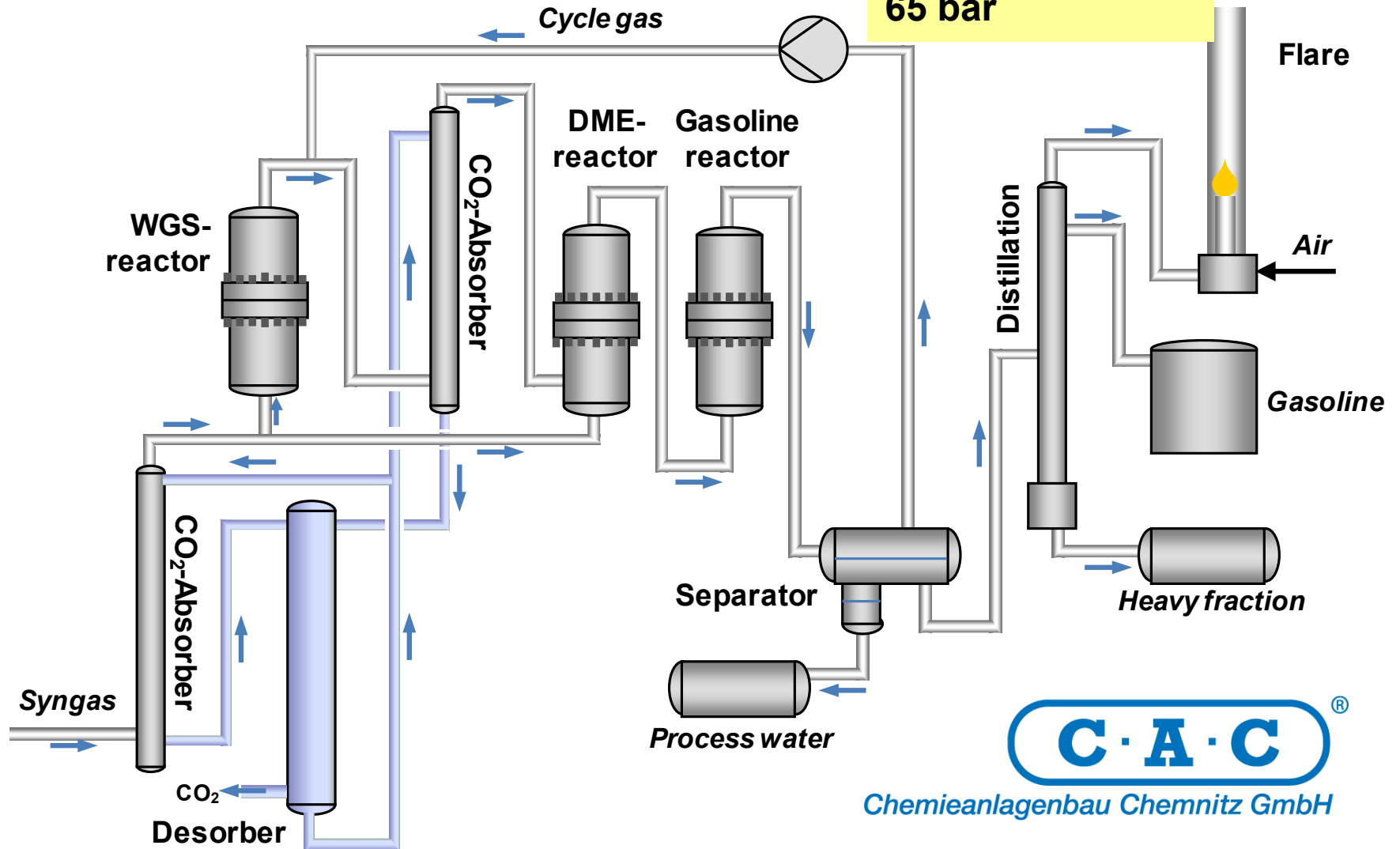
- ⇒ Energy savings ca. 10% compared to state-of-the-art gas cleaning
- ⇒ Process integration



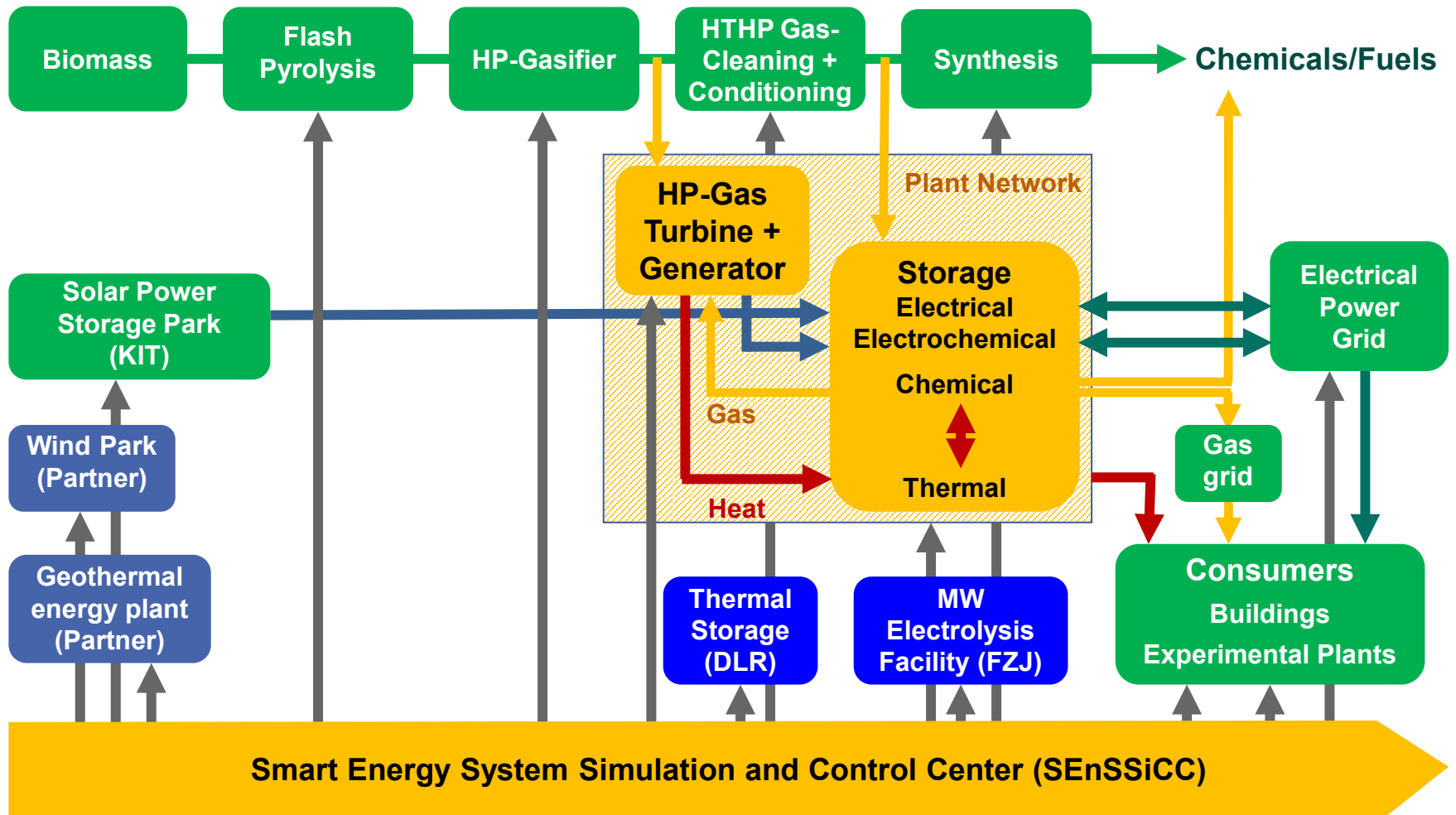
DI Leibold, Prof. Seifert / ITC

Synthesis plant scheme

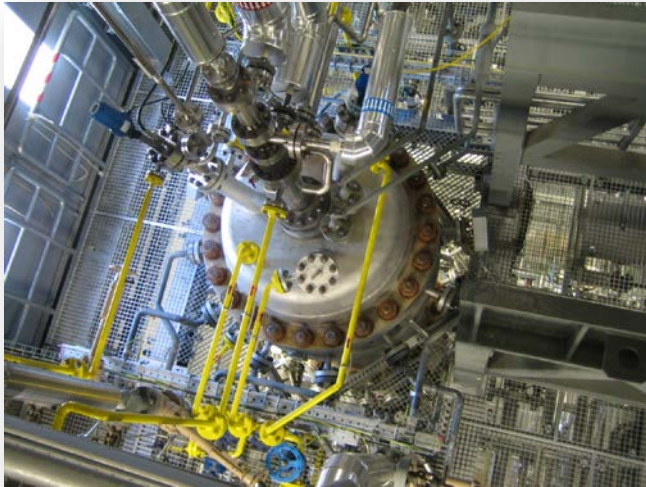
700 m_n³/h syngas
 40 kg/h gasoline
 65 bar



Chemieanlagenbau Chemnitz GmbH



bioliq® impressions



12 km pipelines, 50 km wiring,
250 motors, 1500 t steel,
40 pumps etc.

100.000 engineering hours,
64 Mio. EUR TCI,
1st full operation in 2014





Gefördert durch:



Bundesministerium
für Ernährung
und Landwirtschaft

aufgrund eines Beschlusses
des Deutschen Bundestages



Fachagentur Nachwachsende Rohstoffe e.V.



Investition in die Zukunft
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