



**IEA Bioenergy**  
Technology Collaboration Programme



# Country Report Germany

## Task 33 Thermal Gasification of Biomass

### Update

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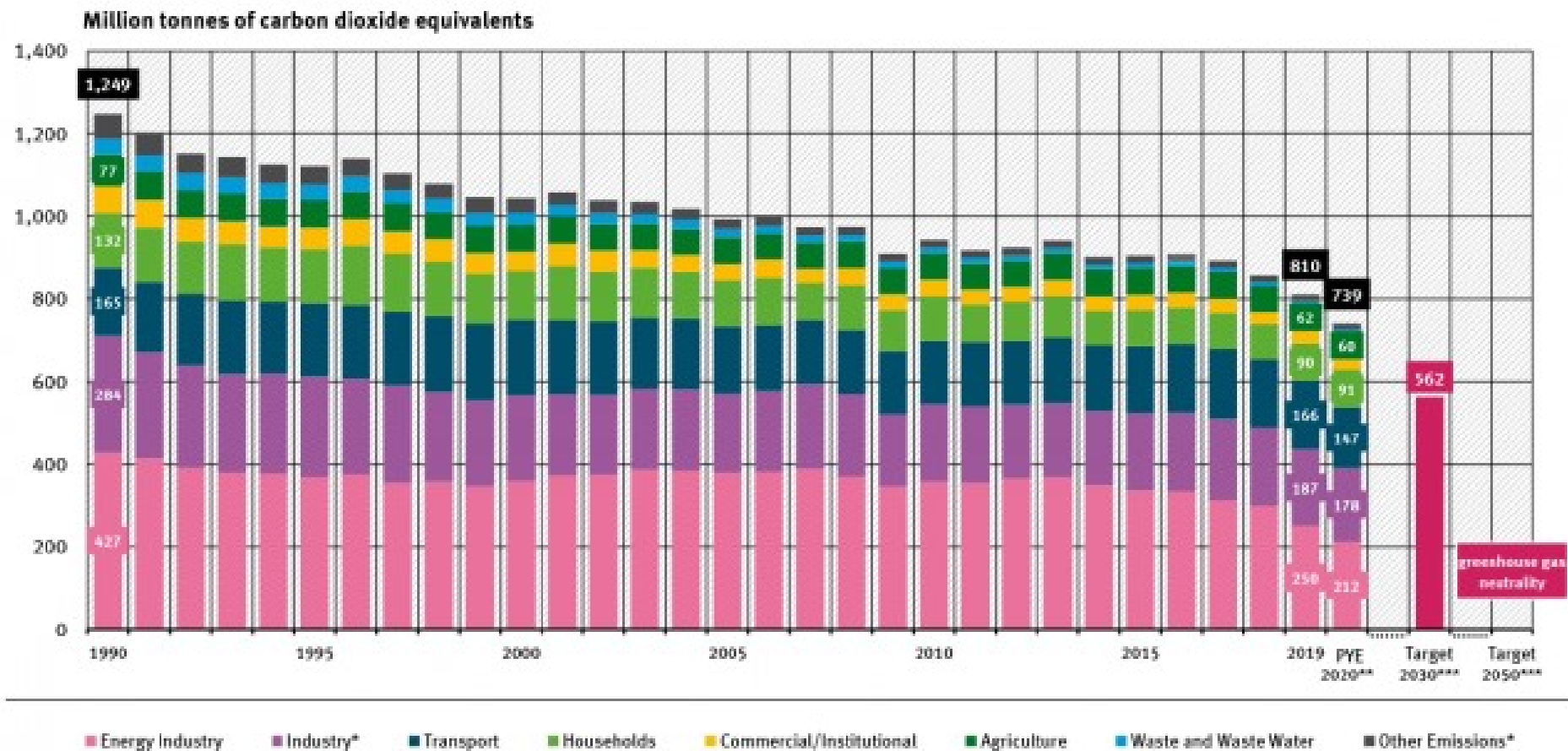
Onlineworkshop, 03.06.2021

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**Technology Collaboration Programme**

by **iea**

## Emission of greenhouse gases covered by the UN Framework Convention on Climate



Emissions by UN reporting category, without land use, land use change and forestry

\* Industry: Energy and process-related emissions from industry (1.A.2 & 3)

Other Emissions: Other combustion (rest of CRF 1.A.4, 1.A.5 military) & fugitive emissions from fuels (1.B)

\*\* PYE: Previous-Year-Estimate for 2020

\*\*\* Targets 2030 and 2050: Federal Climate Protection Act (KSG), Bundesgesetzblatt 2019 Part 1, No. 48 of 17.12.2019

Source: German Environment Agency, National Inventory Reports for the German Greenhouse Gas Inventory 1990 to 2019 (as of 12/2020) and Previous-Year-Estimate (PYE) for 2020 (Press-Info 07/2021 from 15.03.2021)

# Politics

- German Constitutional Court: “Climate protection act from 2019 in part unconstitutional”

→ New Climate protection act in 2021

- What does the new climate protection law provide for?

In short:

- significantly stricter climate protection targets.
- 65 percent fewer greenhouse gases by 2030 than it did in 1990, compared with only 55 percent previously.
- CO<sub>2</sub> emissions are to fall by as much as 88 percent by 2040.

Source: <https://www.tagesschau.de/inland/innenpolitik/klimaschutz-gesetz-101.html>

- R&D
- Industry small scale
- Industry large scale

LiPRO Energie GmbH&Co.KG

CUTEC TU Clausthal-Zellerfeld

thyssenkrupp Industrial Solutions AG

Fraunhofer-Institut UMSICHT

RWE

RWTH Aachen TEER

Biotech Energietechnik GmbH

Air Liquide E&C

TU Darmstadt, Energiesysteme und -technik

Karlsruhe Institute of Technology

Uni Stuttgart IFK

KOPF SynGas

Fraunhofer-Institut IFF

Deutsches Biomasseforschungszentrum DBFZ

TU Freiberg

TU Dresden

Hochschule Zittau/Görlitz

OTH Amberg-Weiden

Burkhardt GmbH

REGAWATT GmbH

Spanner Re<sup>2</sup> GmbH

Holzenergie Wegscheid GmbH

Technical University of Munich

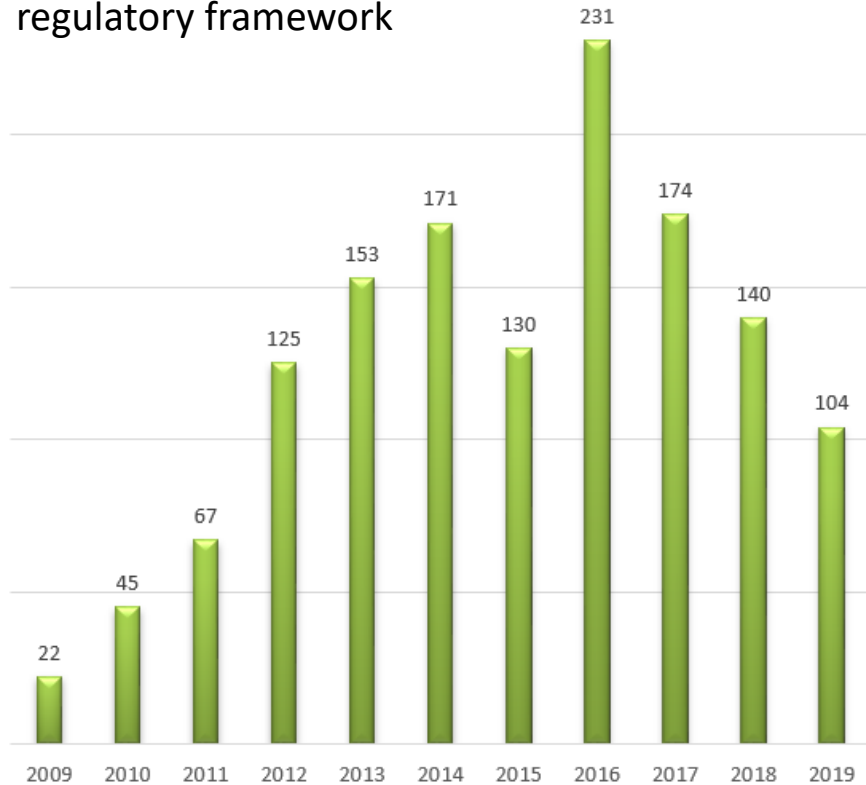
Stadtwerke Rosenheim GmbH

FAU Chair of Energy Process Engineering

# Biomass gasification plants - small scale

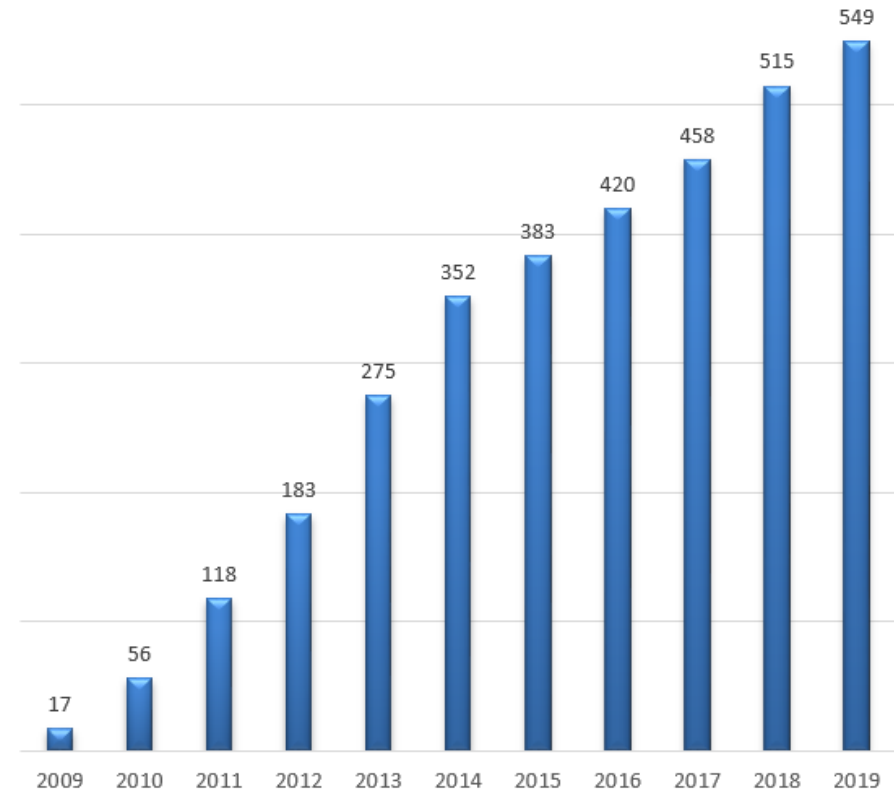
Amount of biomass-CHP-Plants installed from German companies

- Market continues to cool down
- As the number of equipment manufacturers remains constant, a turnaround can be achieved in the short term by improving the regulatory framework



Cumulated amount of installed plant in Germany

- The market has stabilized at a low growth level.
- Growth spurt is not foreseeable.



## Prozessdetails

### Fließbild zweistufige Gaserzeugung

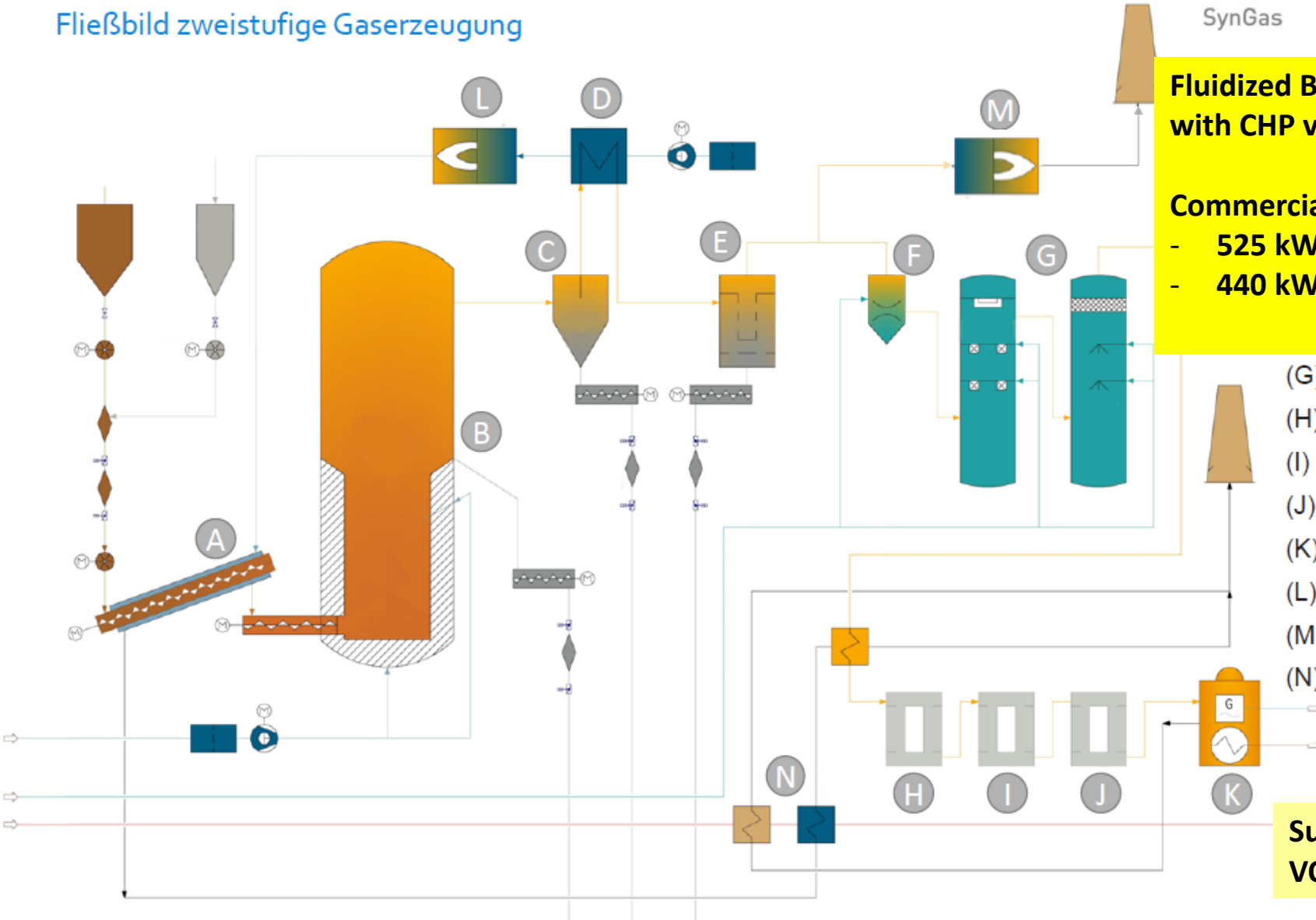
**Fluidized Bed Gasifier for Sewage Sludge  
with CHP via Gas Engine**

**Commercial plant for Sewage Sludge in Koblenz**

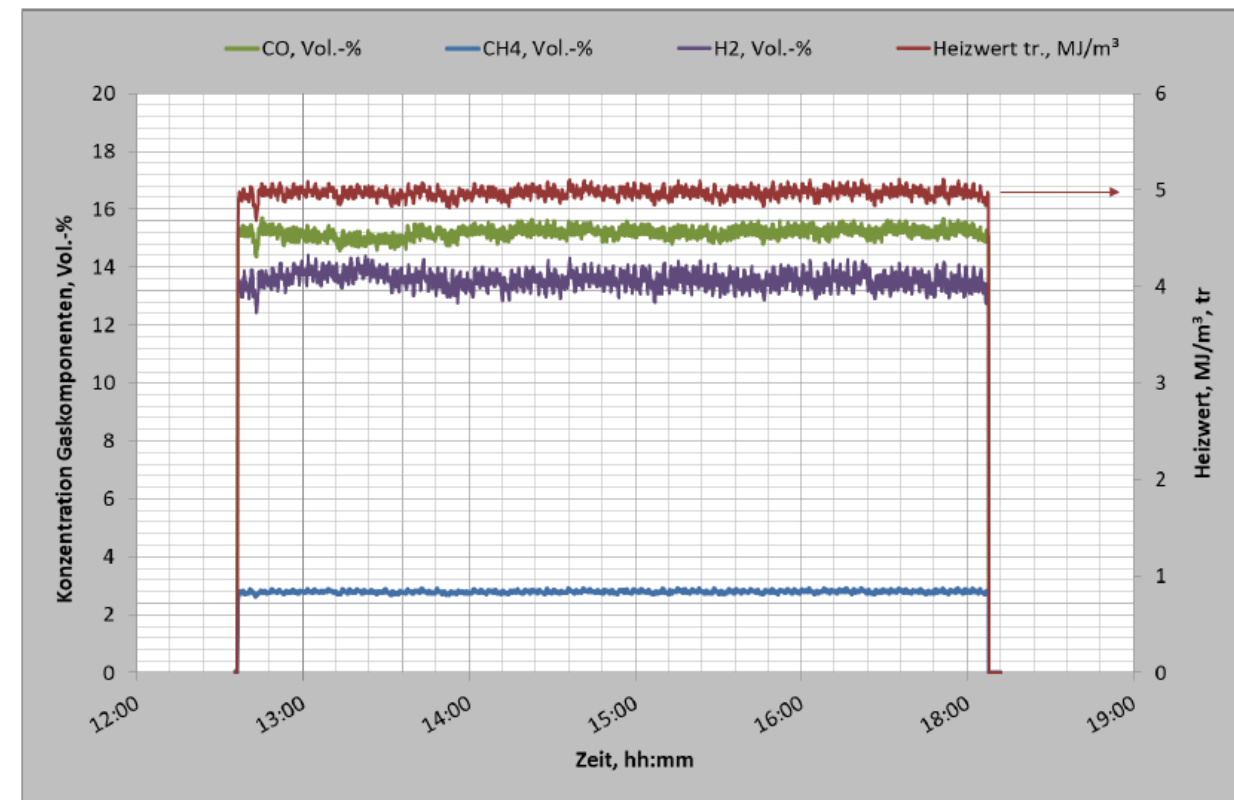
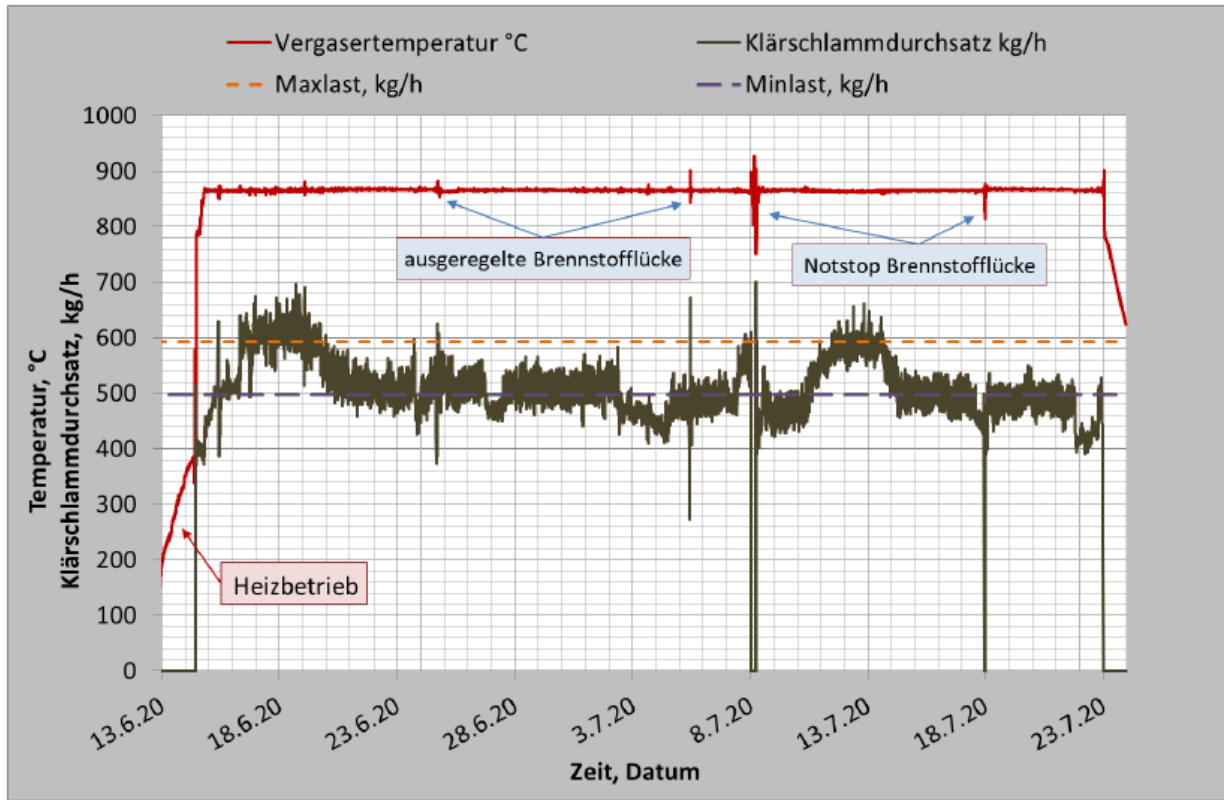
- 525 kW heat
- 440 kW power

- (G) Wäschergruppe
- (H) Hg-Filter
- (I) H<sub>2</sub>S Filter
- (J) Polzeifilter
- (K) BHKW
- (L) Faulgasbrenner
- (M) Not TNV
- (N) Wärmeauskopplung

**Successful acceptance run  
VOB acceptance on hold because of COVID**



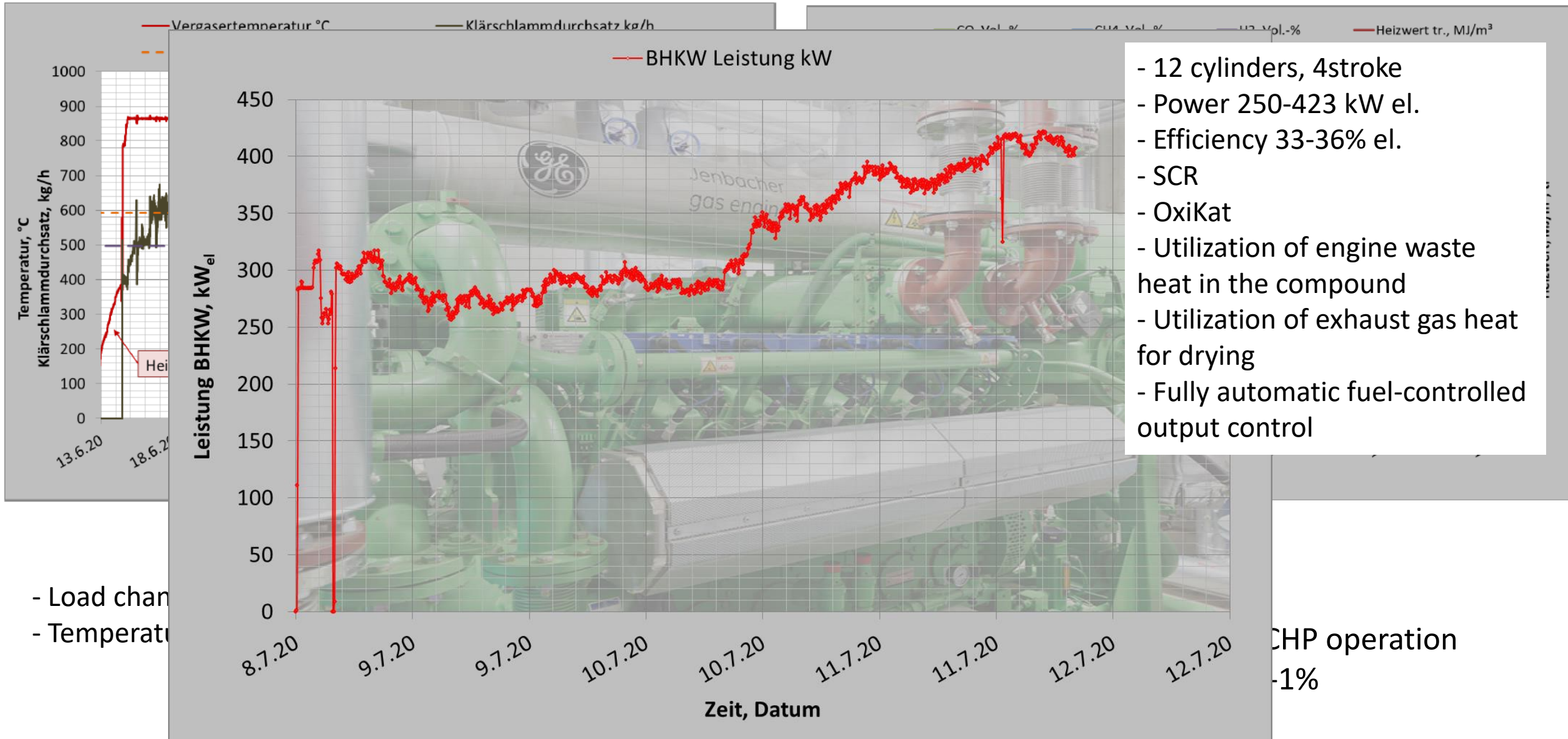
## Performance data test run



- Load change between 500 and 600 kg/h OS
- Temperature variation +/- 5K

- stable gas quality
- high calorific value and stable CHP operation
- C2,C3 components approx. 0.6-1%

## Performance data test run



- 12 cylinders, 4stroke
- Power 250-423 kW el.
- Efficiency 33-36% el.
- SCR
- OxiKat
- Utilization of engine waste heat in the compound
- Utilization of exhaust gas heat for drying
- Fully automatic fuel-controlled output control

- Load change  
- Temperature

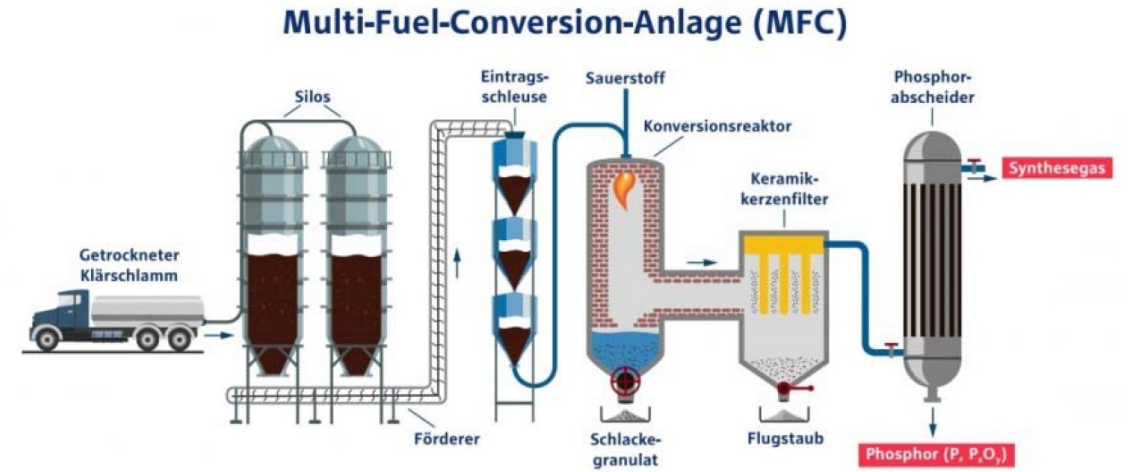
CHP operation  
-1%



# RWE Phosphorus from Sewage Sludge

MFC (Multi Fuel Conversion) within ITZ-CC (Virtuelles Innovations- und Technologiezentrum Carbon Conversion)

- Pilot plant in Niederaußem
- Atmospheric entrained flow gasifier
- Three-component fuel mixing, refractory lining, dip quench, liquid ash discharge
- Fuels: Sewage Sludge, Sewage Sludge Ash, Lignite (ca. 130 kg/h, max 800 kW<sub>th</sub>)
- Temperature ~1,500°C
- Objective: Prove recovery of phosphorus from sewage sludge / sewage sludge ash
- Erection in 2020, Start-Up June 2021
- Funding provided by State of North Rhine Westphalia (Ministry of Economics);  
Total project budget (incl. cost for plant operation): 6.7 Mio. €
- Partners: Fraunhofer UMSICHT, Ruhr Universität Bochum
- Perspective: Waste gasification



Source: RWE; <https://www.group.rwe/presse/rwe-power/2019-08-01-neue-versuchsanlage-gewinnt-lebenswichtigen-rohstoff-phosphor-aus-klaerschlamm-zuruck>

# Industry Activities

## Blue Energy CHP

Up date 2021

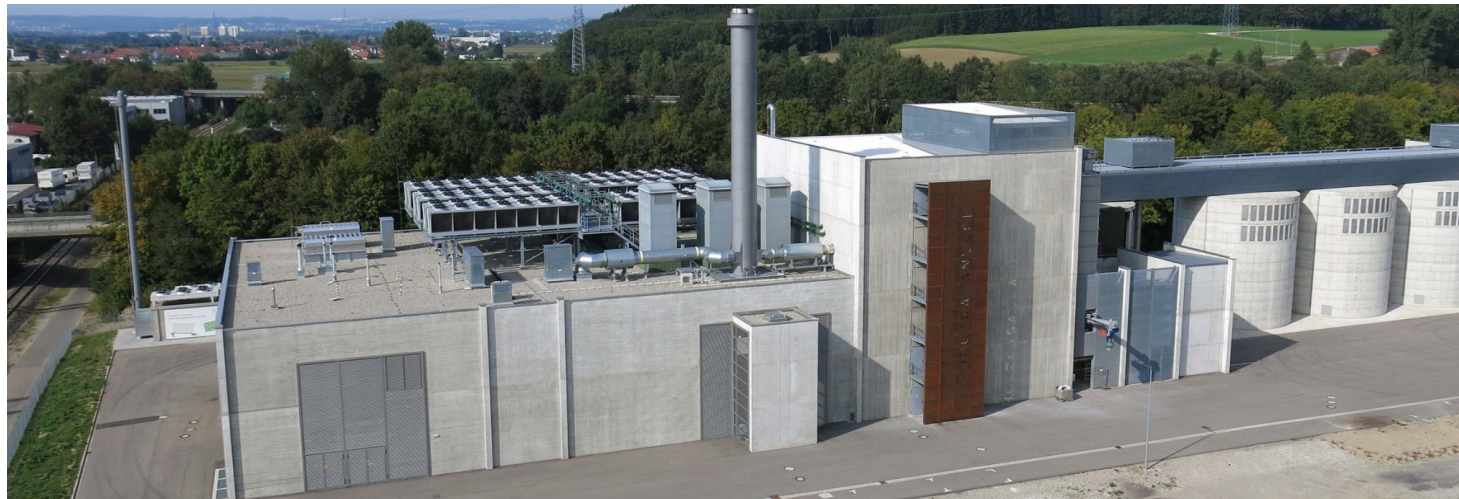
### Blue Energy Europe Holzgas-Heizkraftwerk Senden

Wood gas cogeneration plant to be converted into an advanced bio-energy park

Future Products:

- Heat and Power
- Bio-oil
- Hydrogen

- Plant stands due to lack of approval from licensing authority
- Wood oil was initially classified by the authorities as waste and wanted to approve the plant only according to waste law
- **Currently: Submission of new permit application**
- **hope for start up again in the middle of 2022**



Industry activities:

# BioTfuel-Projekt



**VENETTE UNIT** From biomass to energy carrier



**DUNKIRK UNIT** From energy carrier to synthetic fuels

Industry activities:

# BioTfuel-Projekt



**Update May 2021:**

**Bionext and its partners have reached a major milestone in the development of low-carbon BioJet Fuels with the production of Fischer-Tropsch-synthesis products from wood waste biomass.**

Stable and continuous gasification of various woody biomasses pre-treated by torrefaction were achieved over several weeks on the pre-industrial units allowing bio-based Synthesis gas (syngas) to be converted into Fischer-Tropsch products.

**VENET  
energy**

Press Release Thyssen Krupp Industrial Solutions 12.04.2021

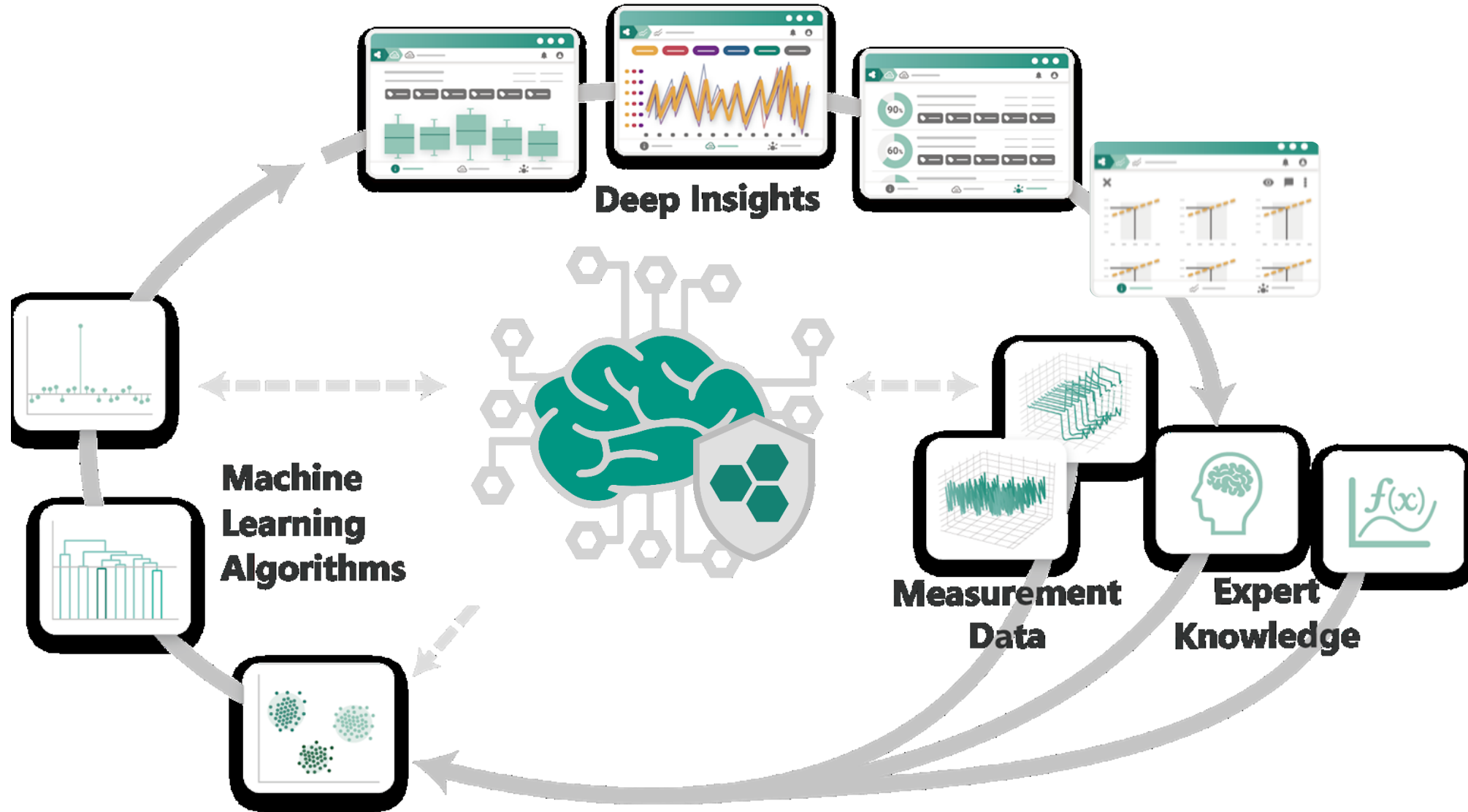
## Technical details campaign March 2019

- ❑ Test series: Lambda variation from maximum to minimum reactor temperature to determine scale-up factors.
  - glycol
  - glycol + wood coke
  - Wood pyrolysis oil

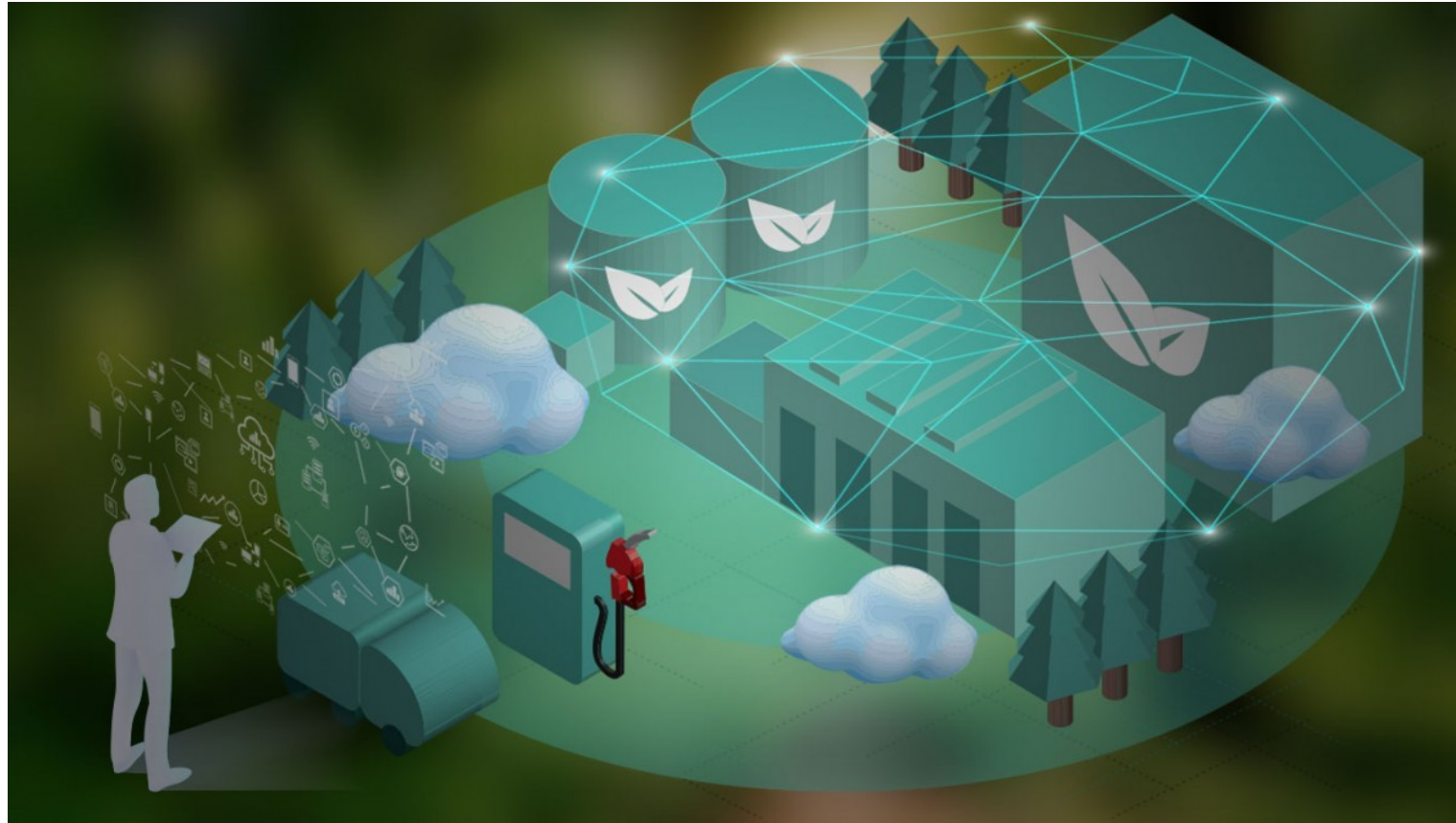
## Technical details campaign April/May 2021

- ❑ Test series: Lambda variation from maximum to minimum reactor temperature to determine scale-up factors.
  - Wood pyrolysis oil + wood coke
- ❑ Test series: measurements with high speed camera to detect the influence of operating conditions on flame structures and flame stability

# Solution approach: EDI *hive* Hybrid models: Data-driven approach combined with expert knowledge



## Use case: Predictive control of synthetic fuel production plants (bioliq®)



### Expected efficiency potential through AI:

Data-driven approach combined with expert knowledge  
Increase in fuel yield by 5-10 % for different feedstock compositions

# Consortium



*Technology and expertise for the formalization and objectification of expert knowledge, for predictive process optimization and control, and for the distribution of scalable digital services.*

# Companion Groupe

Wir sind für Sie nah.



...



*Data, user experience and customers regarding process plants*

*SMEs from the project committee with processes and plants and process engineering and chemical expertise*



Mark Eberhard



[www.ieabioenergy.com](http://www.ieabioenergy.com)