

BRISK Transnational Access



**Testing and validation of an online tar monitoring device at
a 3 MW_{th} demo gasifier at CIUDEN**

Andreas Gredinger

Institute of Combustion and Power Plant Technology

at the BRISK Open Workshop / TOTeM 40 - 22.04.2015, Delft

Process technologies:

- ✓ (Dual) Fluidized bed systems at different scales
- ✓ Entrained flow reactors

Fuels:

- ✓ Solid fossil
- ✓ Solid and liquid biogenic
- ✓ Residuals, Sludge, etc.

Processes:

- ✓ CFB solid fuel combustion
- ✓ Flameless combustion
- ✓ Gasification
- ✓ CCS

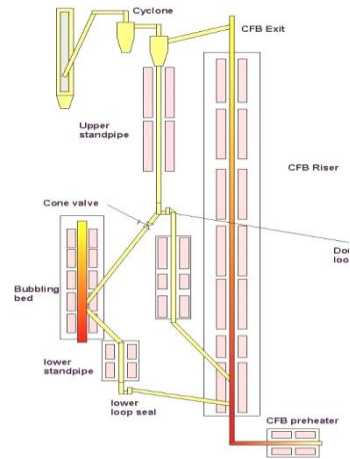
Process Modelling:

- ✓ In-house developed 1D-models
- ✓ Aspen+

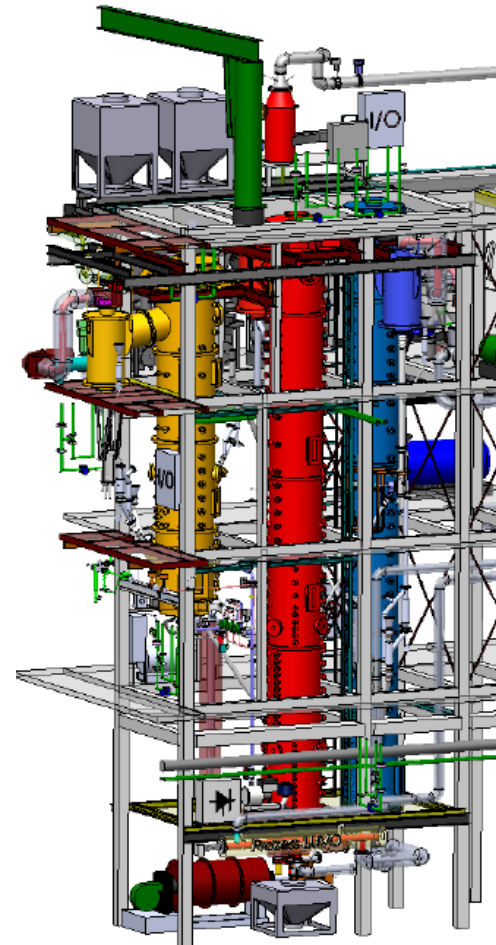
Measurement technologies:

- ✓ Standard flue gas components
- ✓ Tar (online and conventional)
- ✓ Sulphur, Chlorine, Alkalis

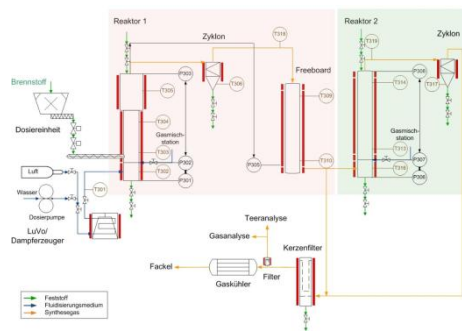
20 kW_{th} electrically heated DFB Gasifier



200 kW_{th} DFB Pilot Gasifier



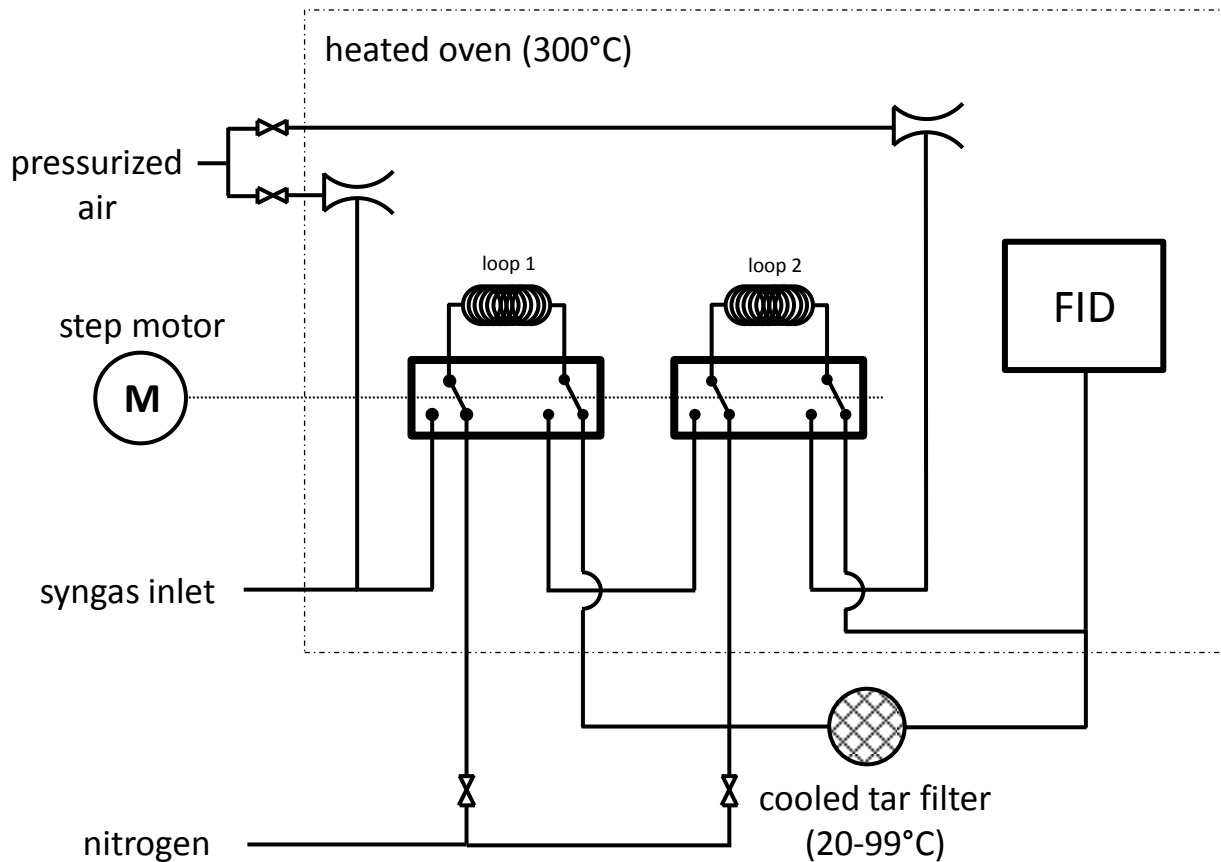
5 kW_{th} electrically heated FB batch Gasifier



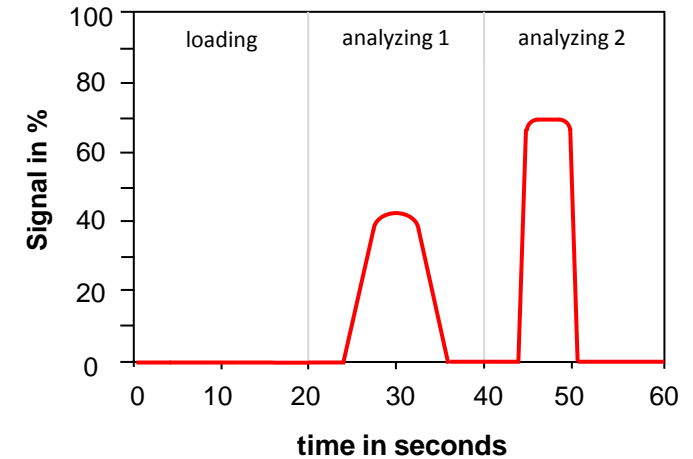
Prototype of new online tar analyzer



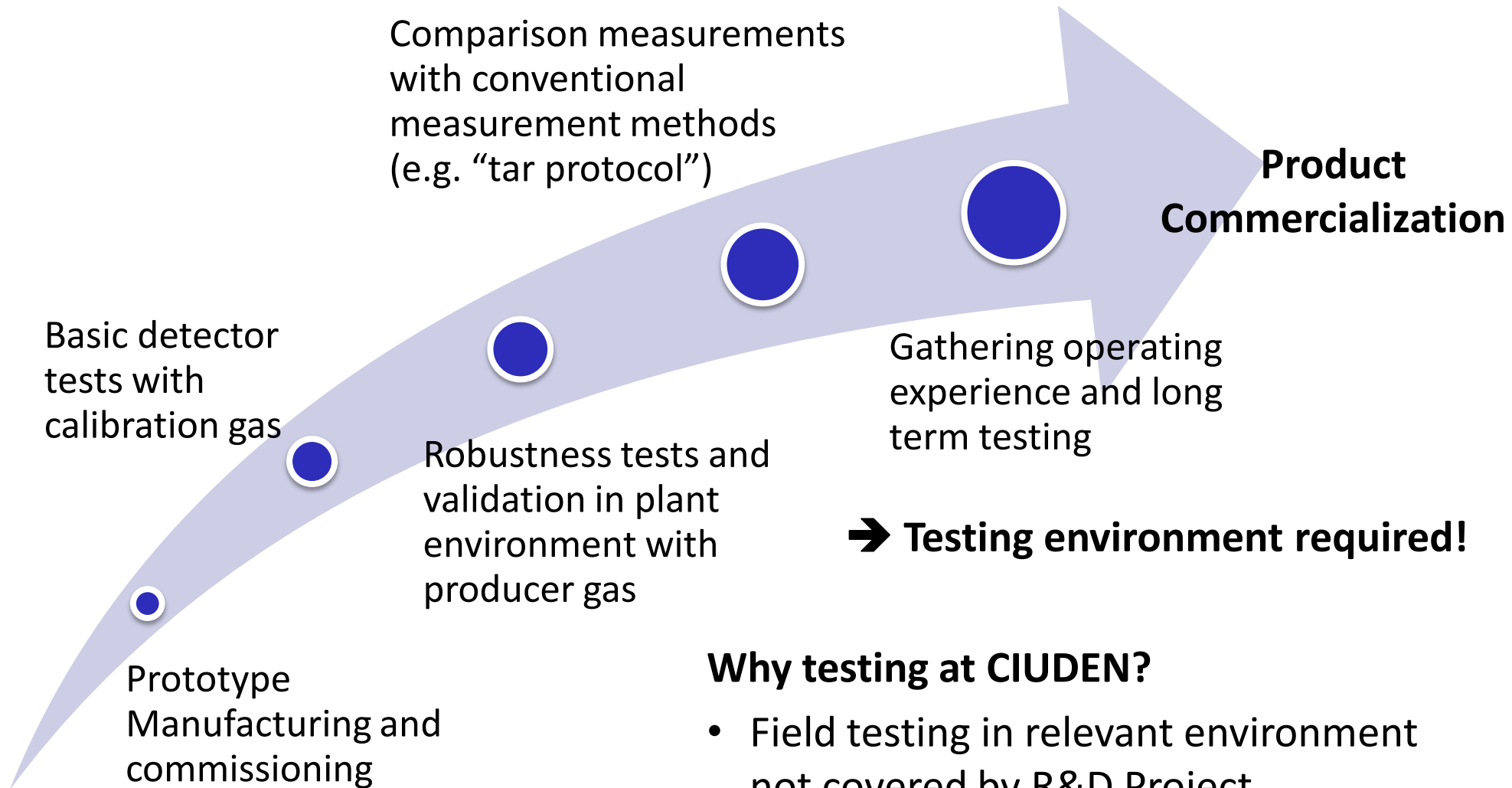
Measurement principle of the online tar analyzer



In analyzing phase



- Loop volume gets flushed to FID.
- Tars of loop 1 are cooled and separated on a cooled filter.
- Components measured:
 - Total hydrocarbon
 - Non-condensable HC
 - Tars (condensable HC)



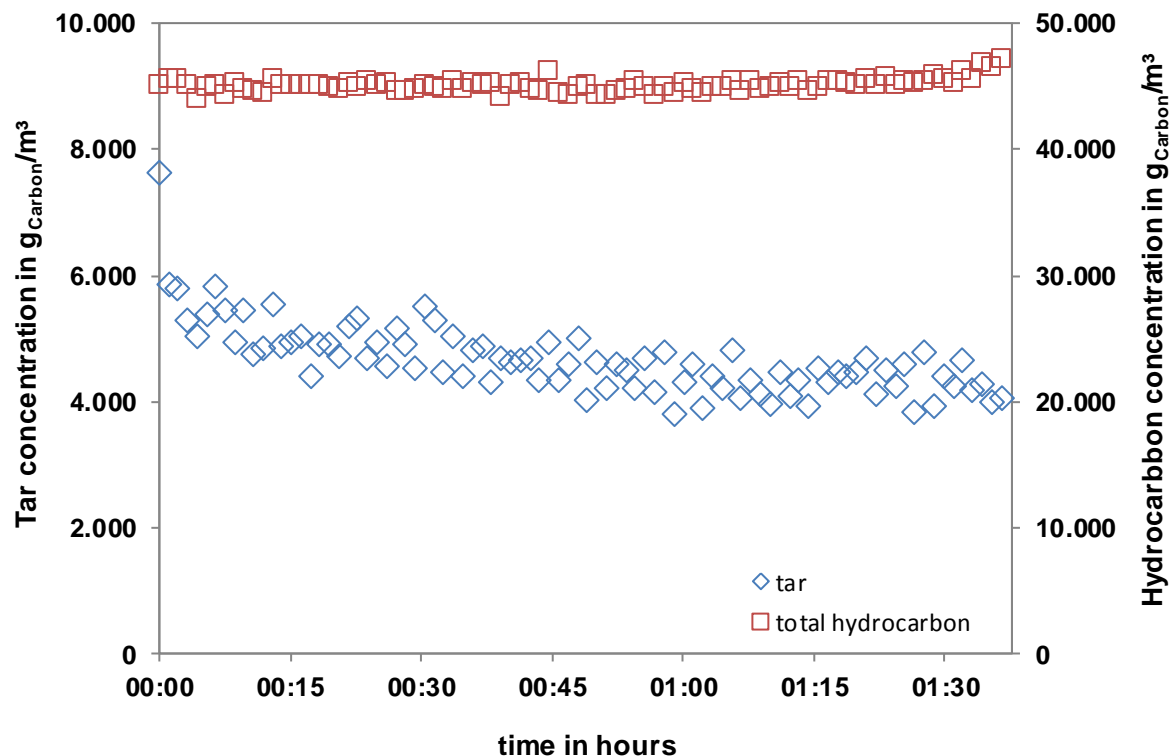
➔ **Testing environment required!**

Why testing at CIUDEN?

- Field testing in relevant environment not covered by R&D Project
- Full focus on prototype validation

Results of TA visit at 3 MW_{th} gasifier at CIUDEN

- Total 10 days of continuous gasifier and analyzer operation
- 15 long term test runs of analyzer (up to 8 hours)

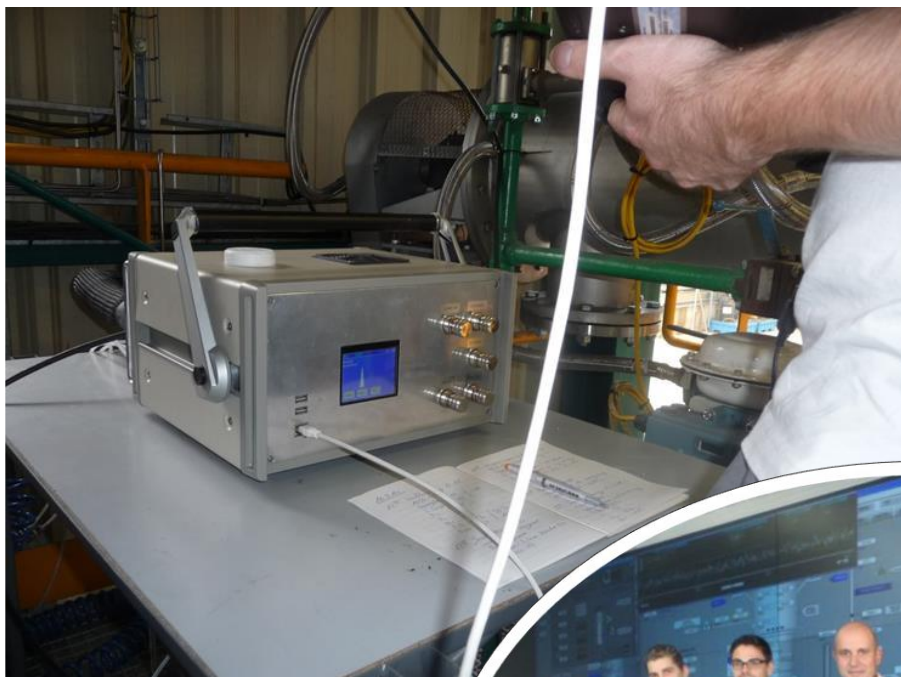


89 measurement cycles in 97 minutes (one each 65 seconds)

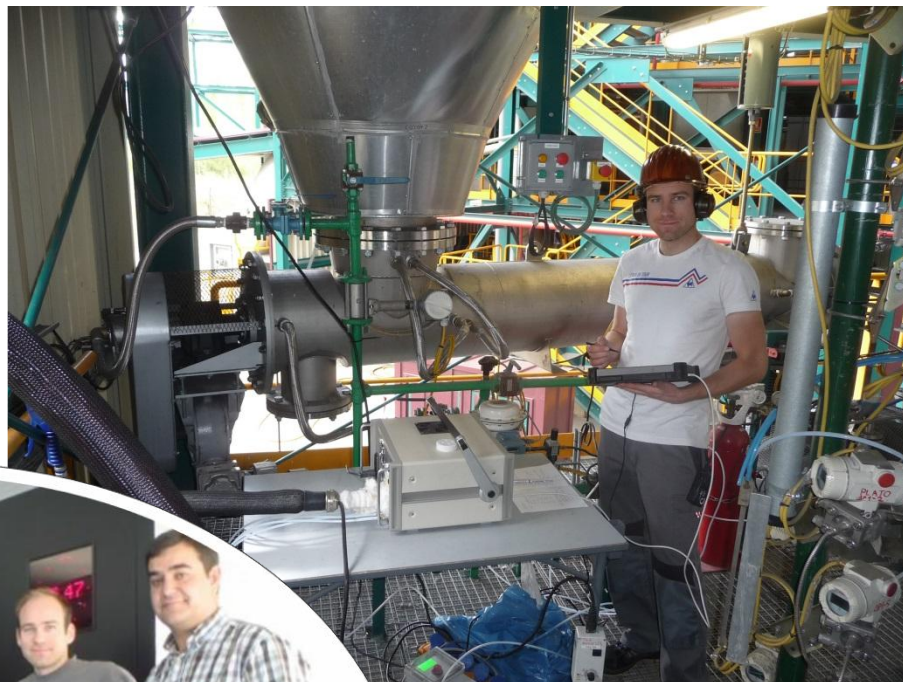
- Filter material: Sintered bronze
- Average gasification temperature: 877°C
- Average tar concentration: 4.666 g_{Carbon}/m³
- Average concentration of total HC: 45.115 g_{Carbon}/m³

➤ The small decrease in tar concentrations over the measuring time is because of the saturation of the used tar filter.

Thanks to BRISK and the CIUDEN Team!



The tar analyzer prototype.

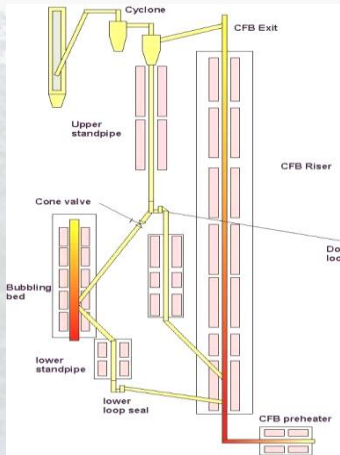


Measuring tars at CIUDEN.

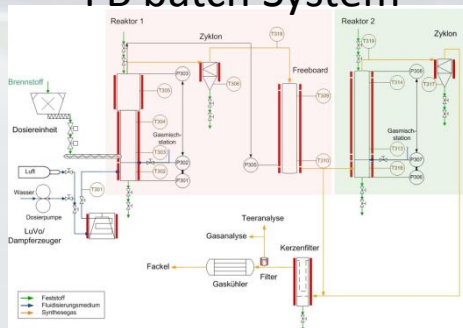


The day shift of the CIUDEN team.

20 kW_{th} electrically heated DFB System



5 kW_{th} electrically heated FB batch System



Fluidized Bed Gasification

- ✓ Air gasification
- ✓ Steam gasification
- ✓ Steam/Oxygen gasification
- ✓ Sorption enhanced reforming (SER)
- ✓ Two stage SER gasification

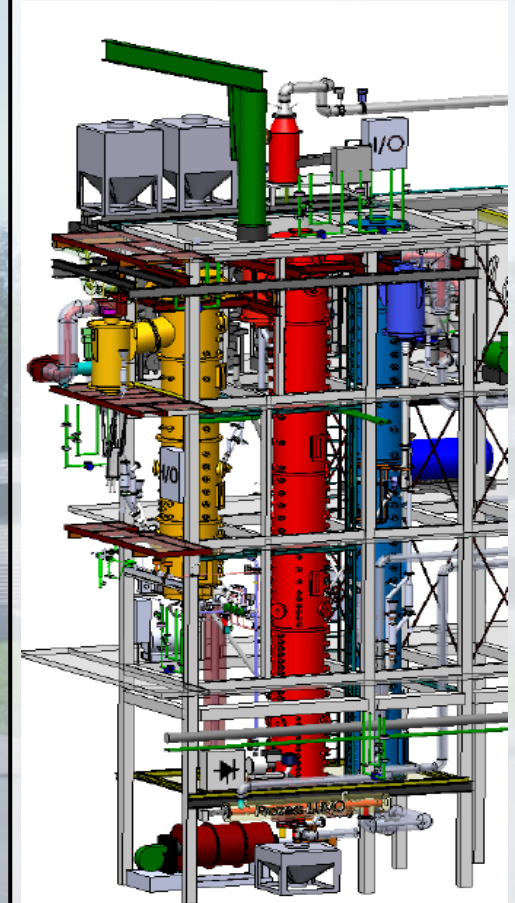
Fuels

- ✓ Biomass
- ✓ Waste
- ✓ Lignite

Measurement techniques

- ✓ Tar: wet chemical acc. tar protocol
- ✓ Non-condensable gases: online
- ✓ Non-condensable HC: GC
- ✓ H₂S, HCl: wet chemical
- ✓ Online Tar analysis

200 kW_{th} DFB Pilot Facility



Thank you for your attention !



Contact person: Andreas Gredinger

Institute of Combustion and Power Plant Technology - IFK
Department Decentralized Energy Conversion
Universität Stuttgart
Pfaffenwaldring 23
D-70569 Stuttgart

Tel.: +49 711 685 65585

Fax: +49 711 685 63491

Mail: andreas.gredinger@ifk.uni-stuttgart.de

<http://www.ifk.uni-stuttgart.de>

Analyzer manufacturer:
www.ratfisch.de

