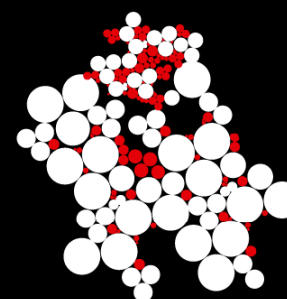




University of Twente
The Netherlands

Biomass Research

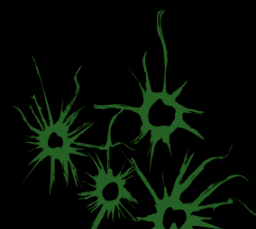
- from fuels to minerals -



Prof.dr.ir. Gerrit Brem

Energy Technology (UT)

BEON, 5 Nov 2015

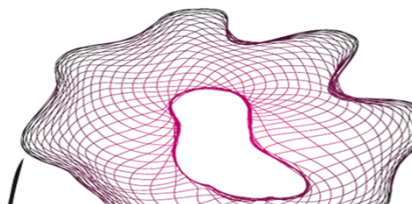


Biomass Research at University of Twente

Biomass is spearhead of UT!



- Faculty of Management and Governance
- Faculty of Science
- Faculty of Engineering Technology



Chair Energy Technology (Faculty of Engineering Technology)

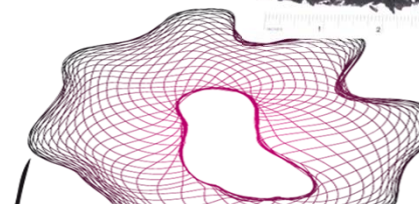
- **Combustion technology**

- > Biomass cofiring in coal fired power plants
- > Biomass waste combustion in grate furnaces
- > Combustion of biofuels in gas turbines



- **Production of fuels (liquid, gas, solid)**

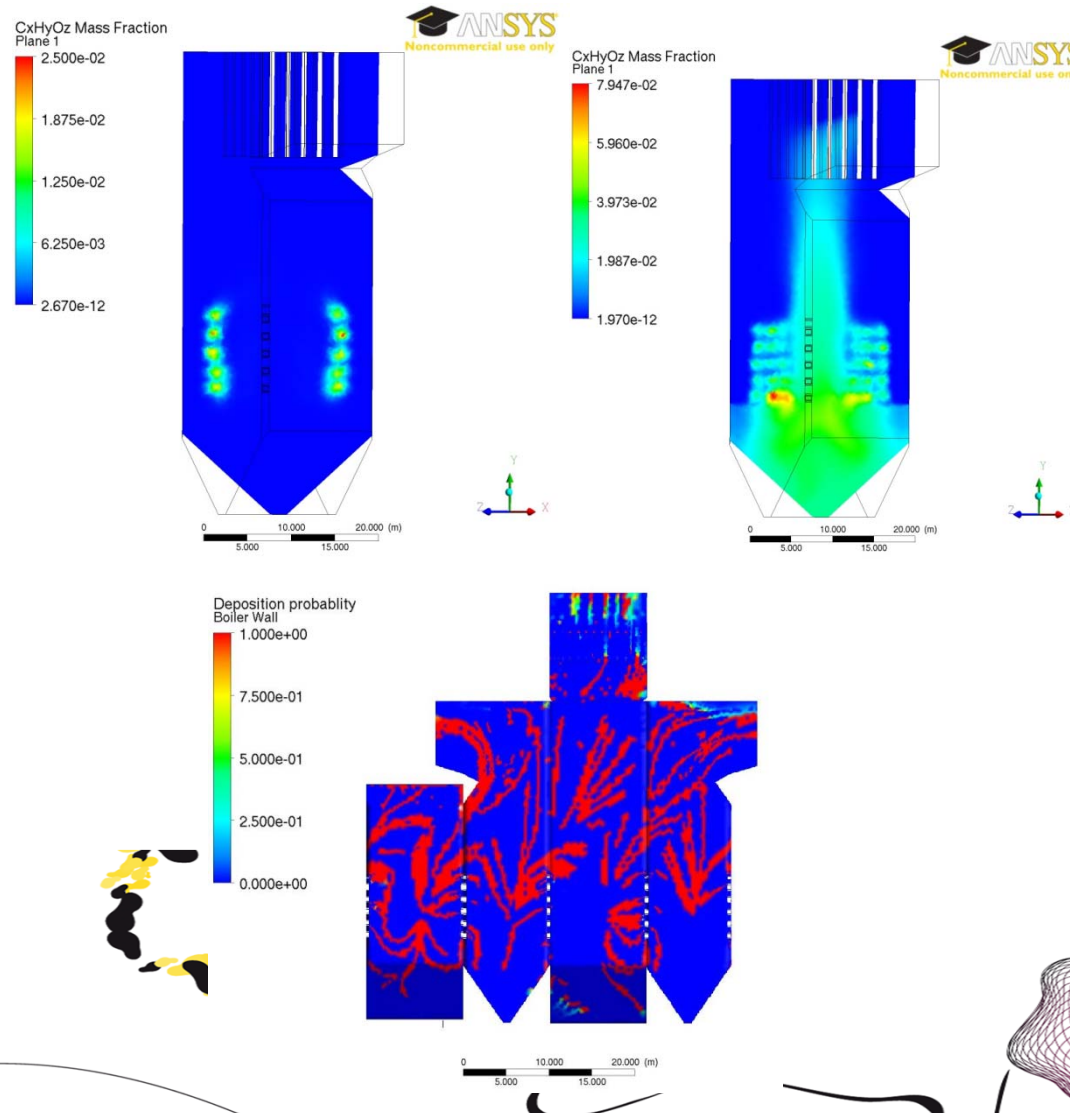
- > Pyrolysis
- > Gasification
- > Torrefaction
- > Solar fuels



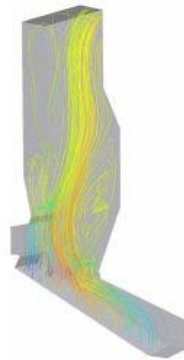
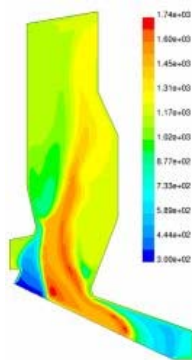
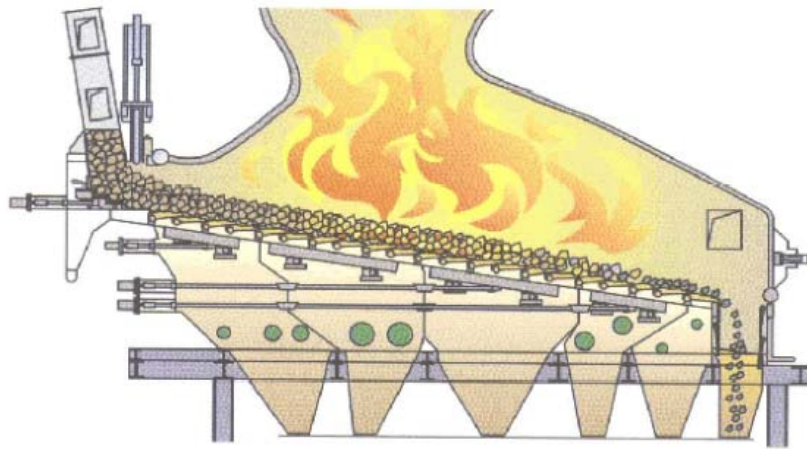
Laboratory of Energy Technology



Co-firing of biomass in power plants



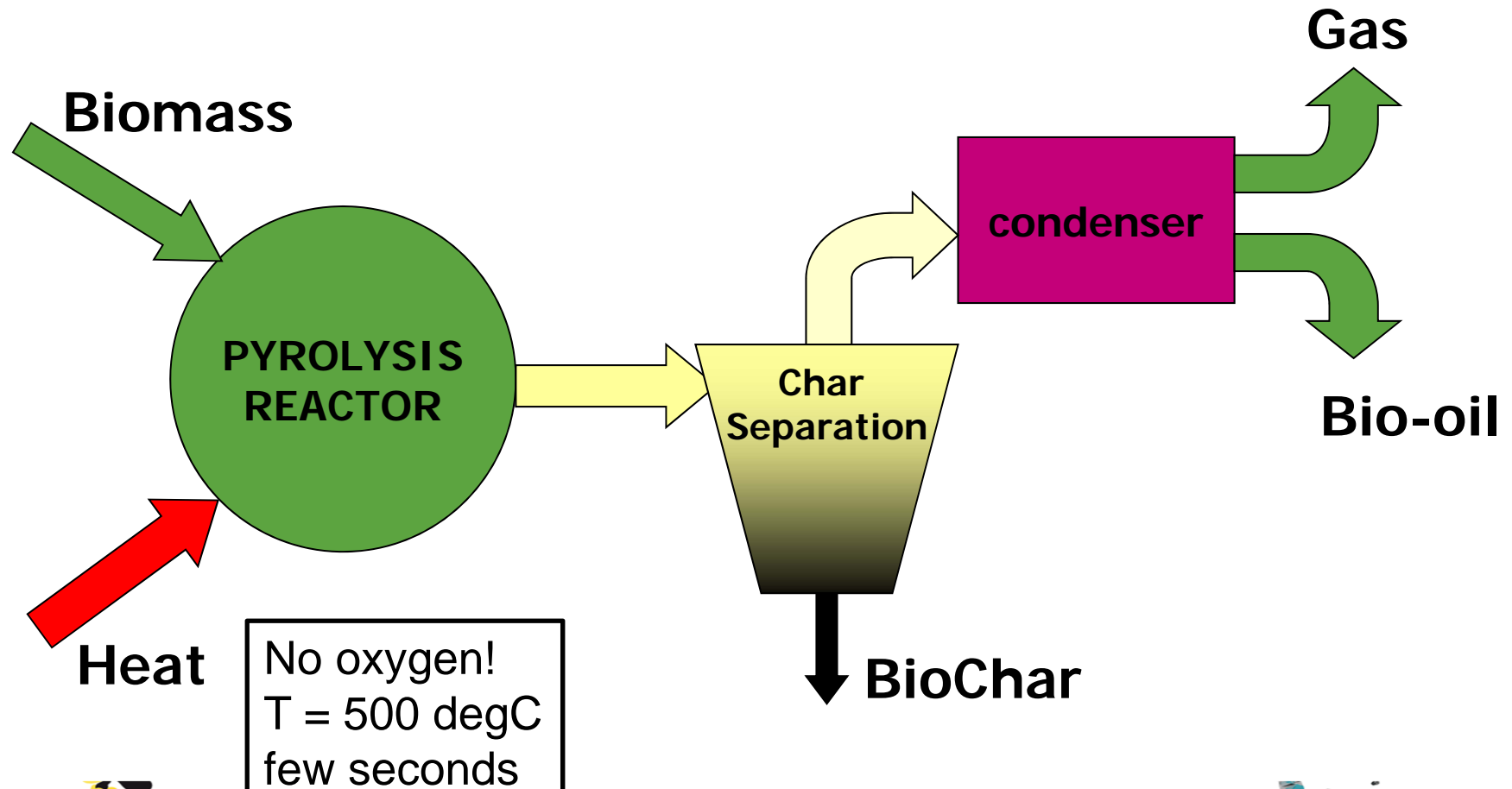
Ignition and combustion of biomass on a grate



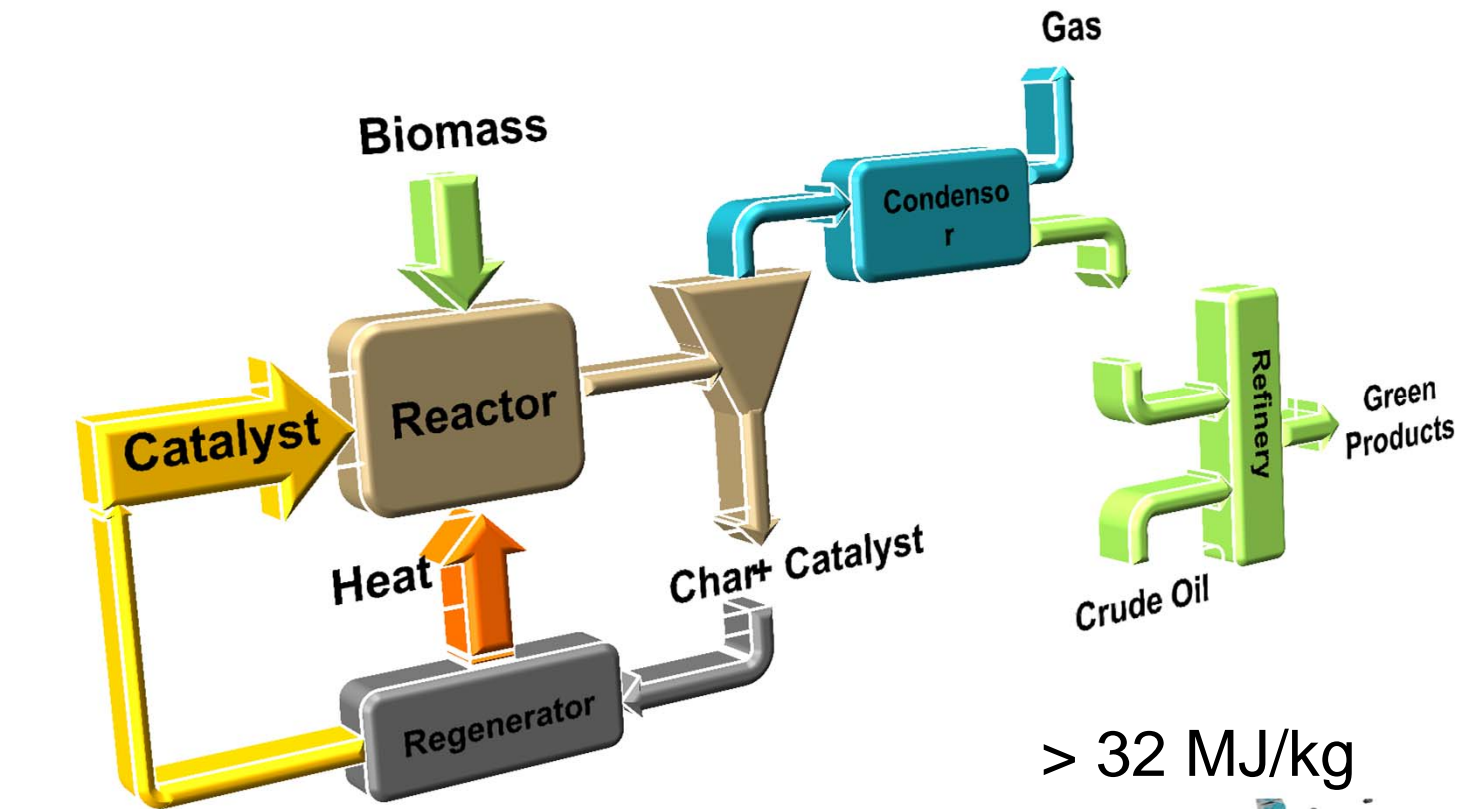
MSWC pilot-plant



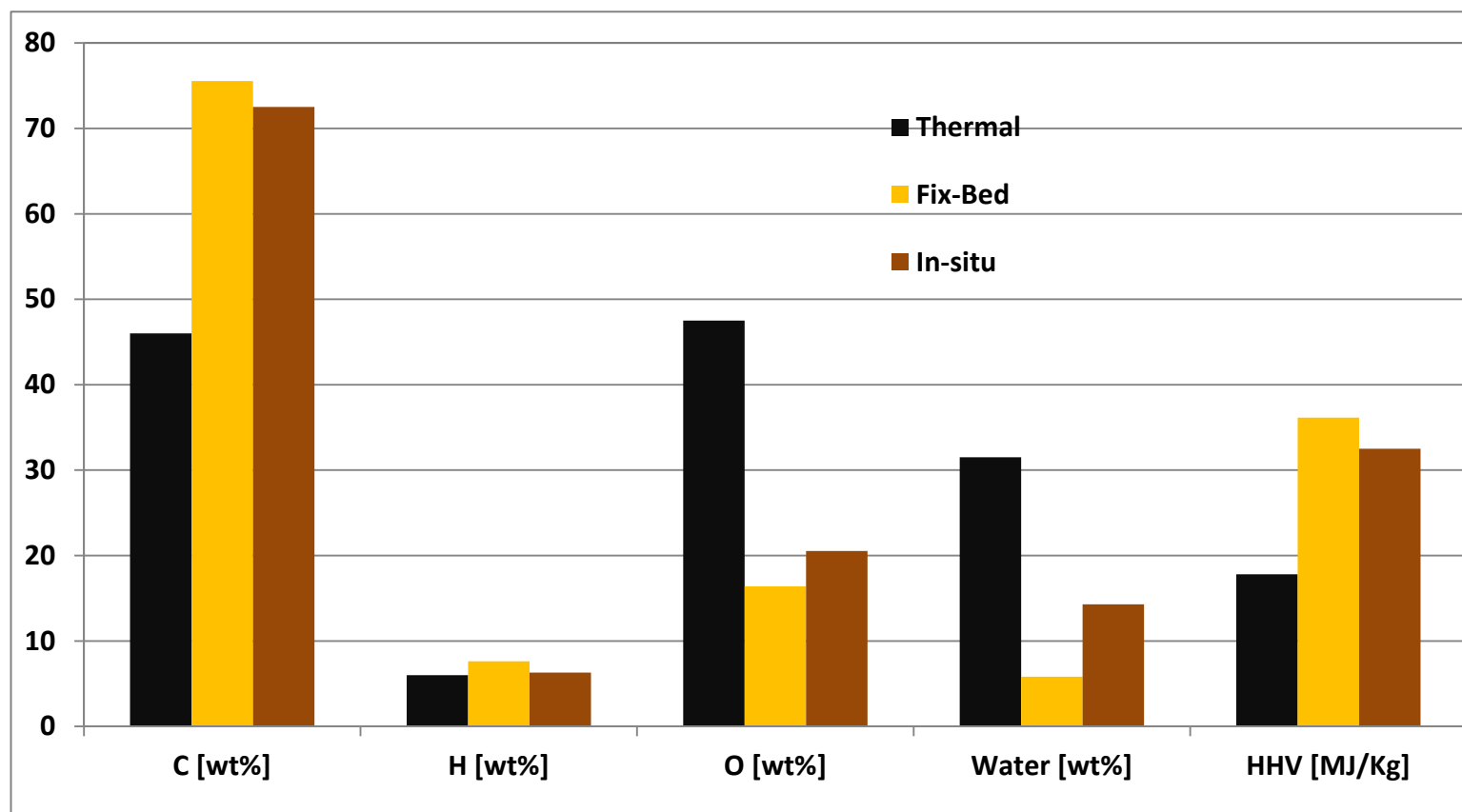
Flash pyrolysis



Catalytic Pyrolysis



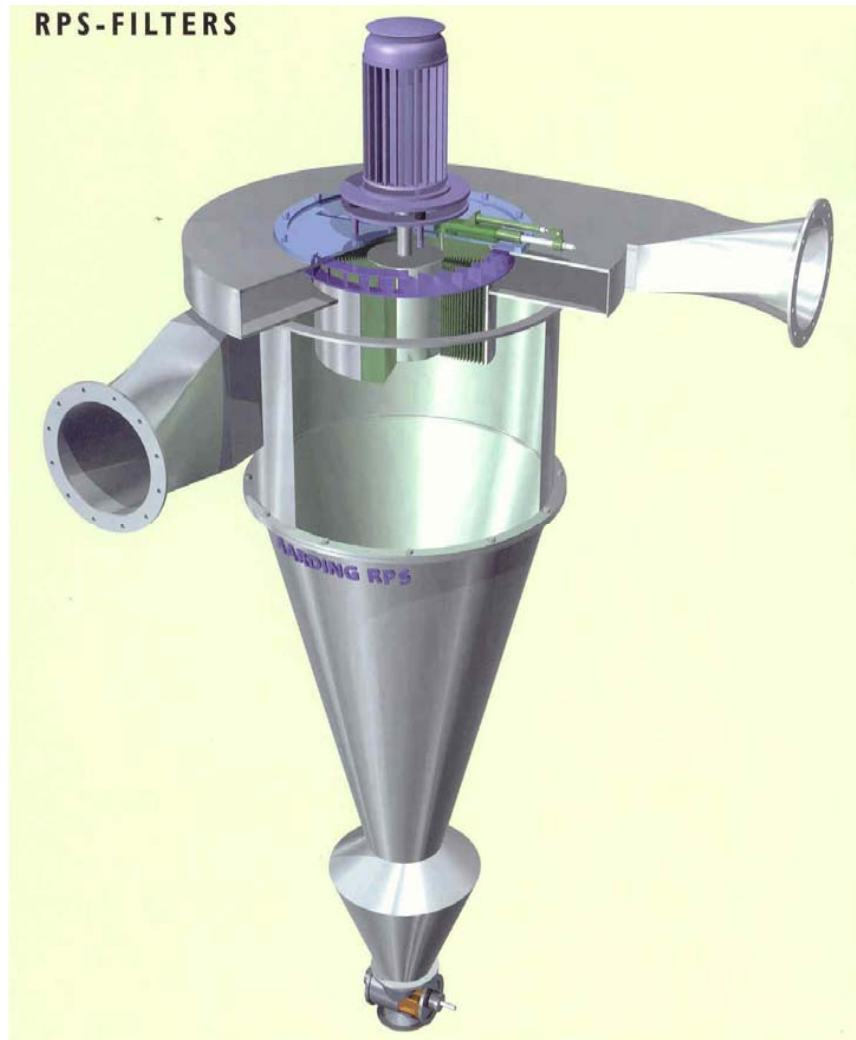
THERMAL & CATALYTIC PYROLYSIS OF WOOD



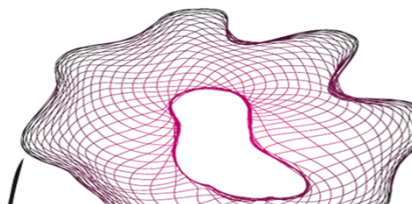
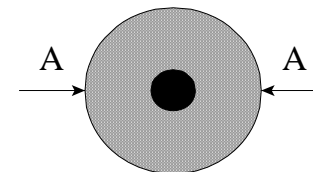
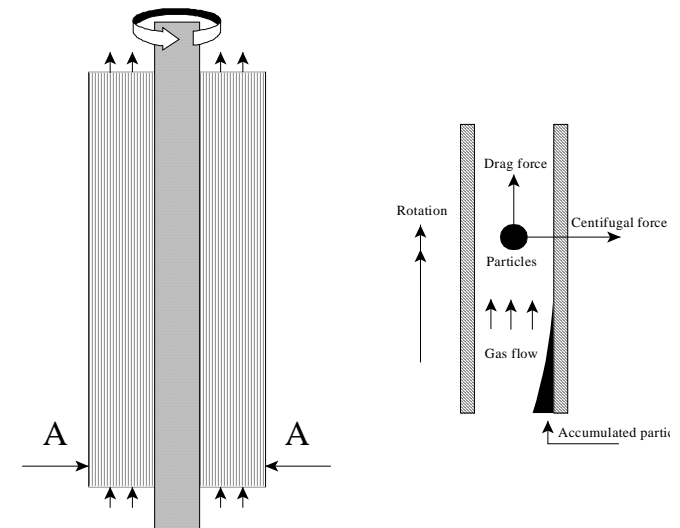
11/2/2015

UNIVERSITEIT TWENTE.

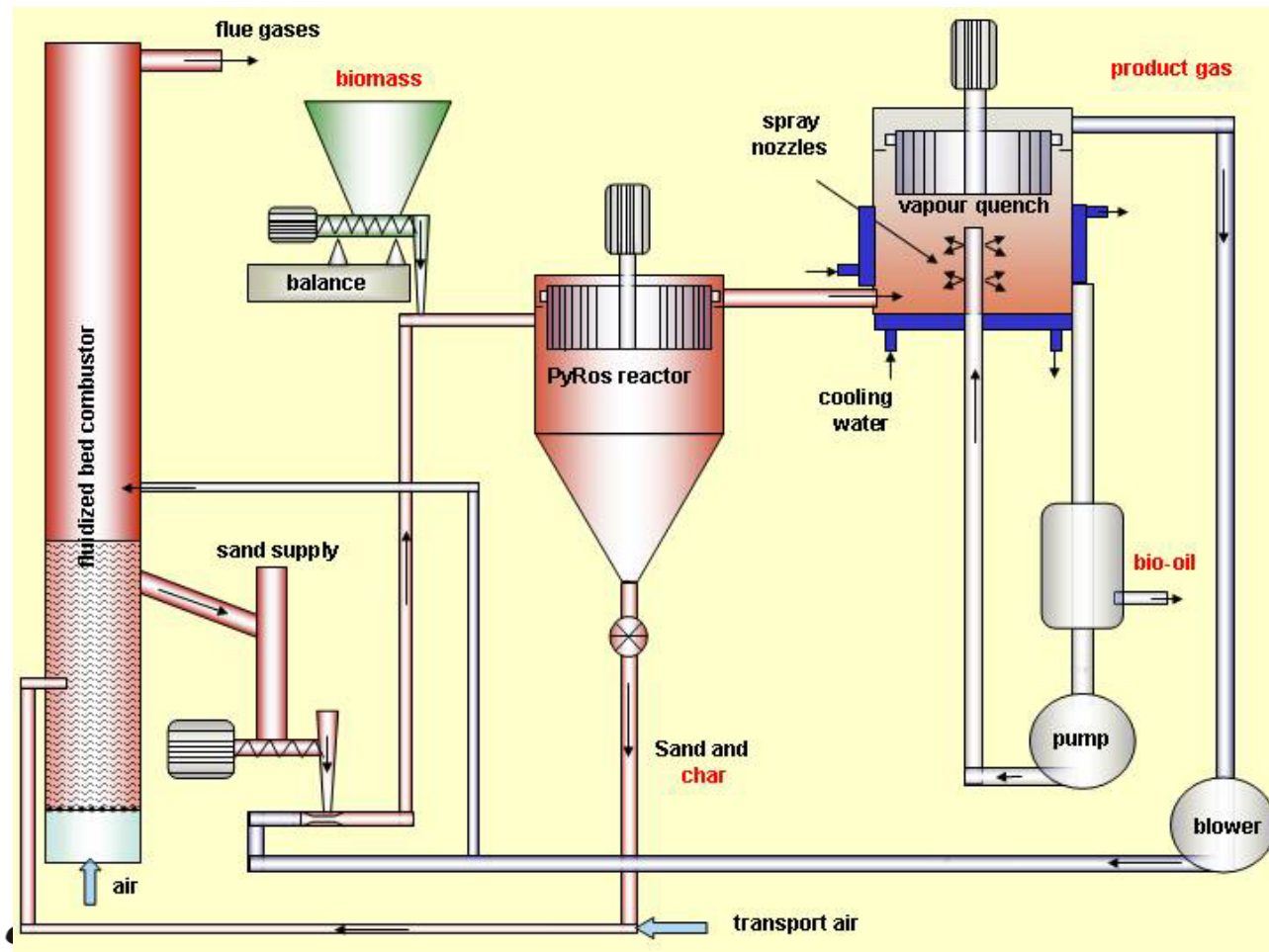
Rotational Particle Separator (RPS)



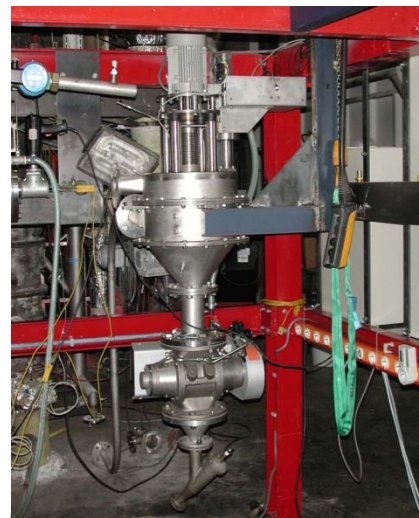
RPS filter integrated in cyclone



PyRos plant



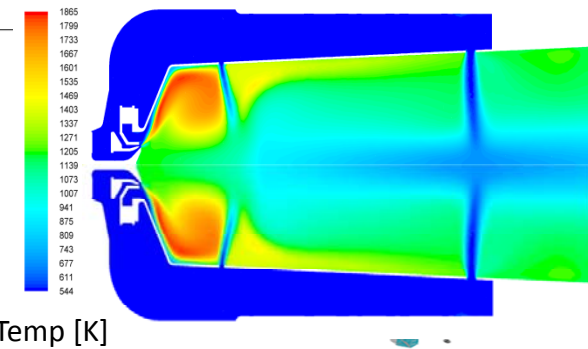
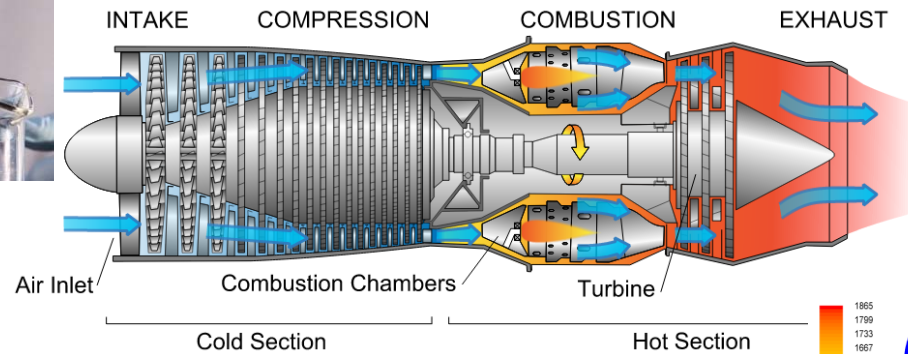
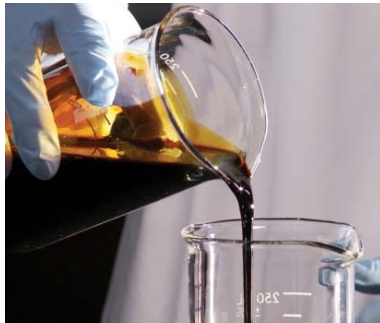
PyRos pilot-plant with 50 kg/h biomass feed



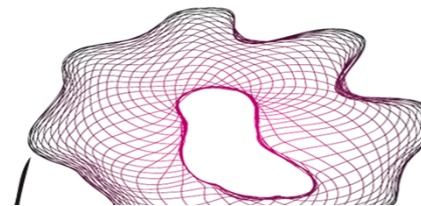
Biomass pyrolysis - movie



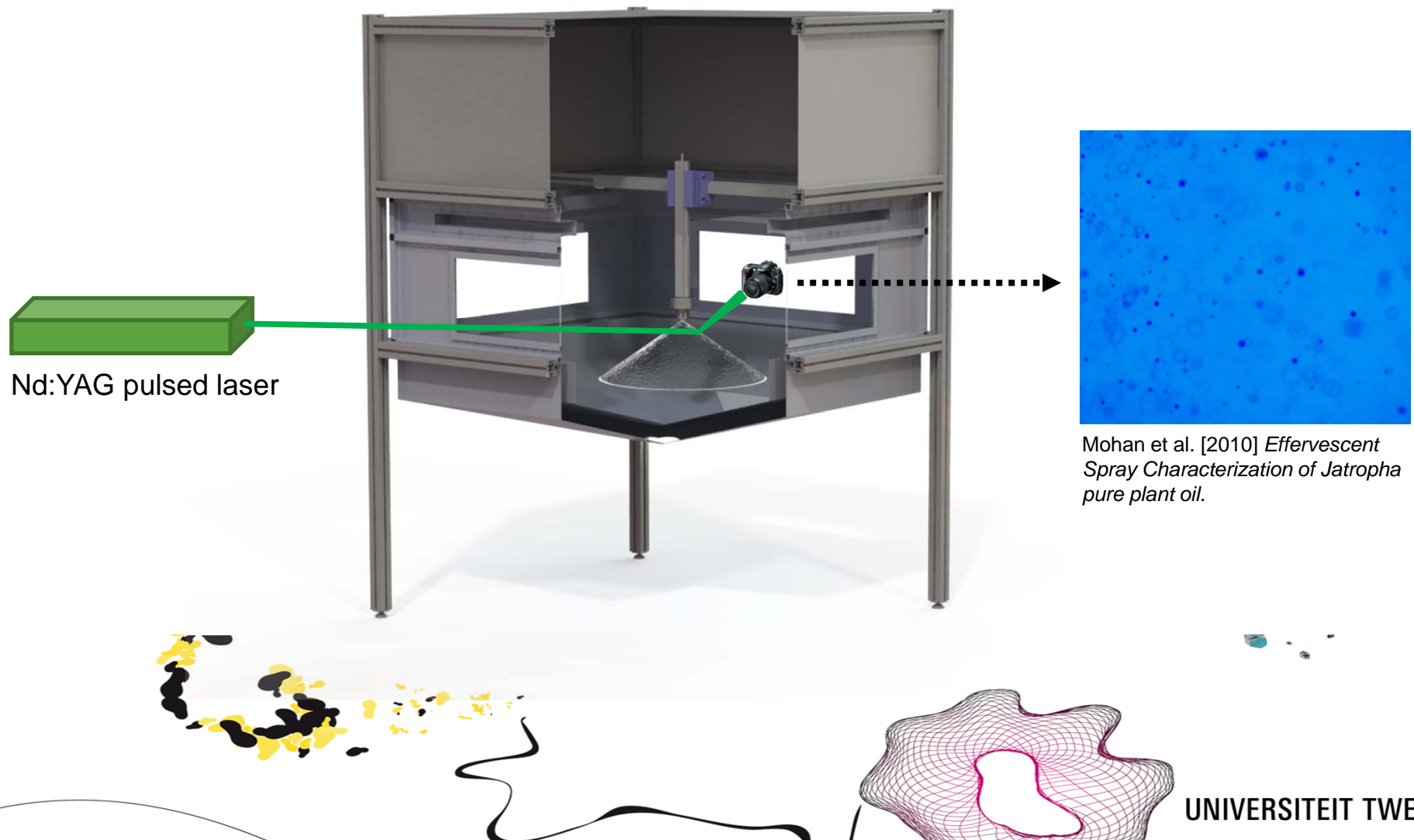
Application of Pyrolysis Oil in Gas Turbines



Temp [K]

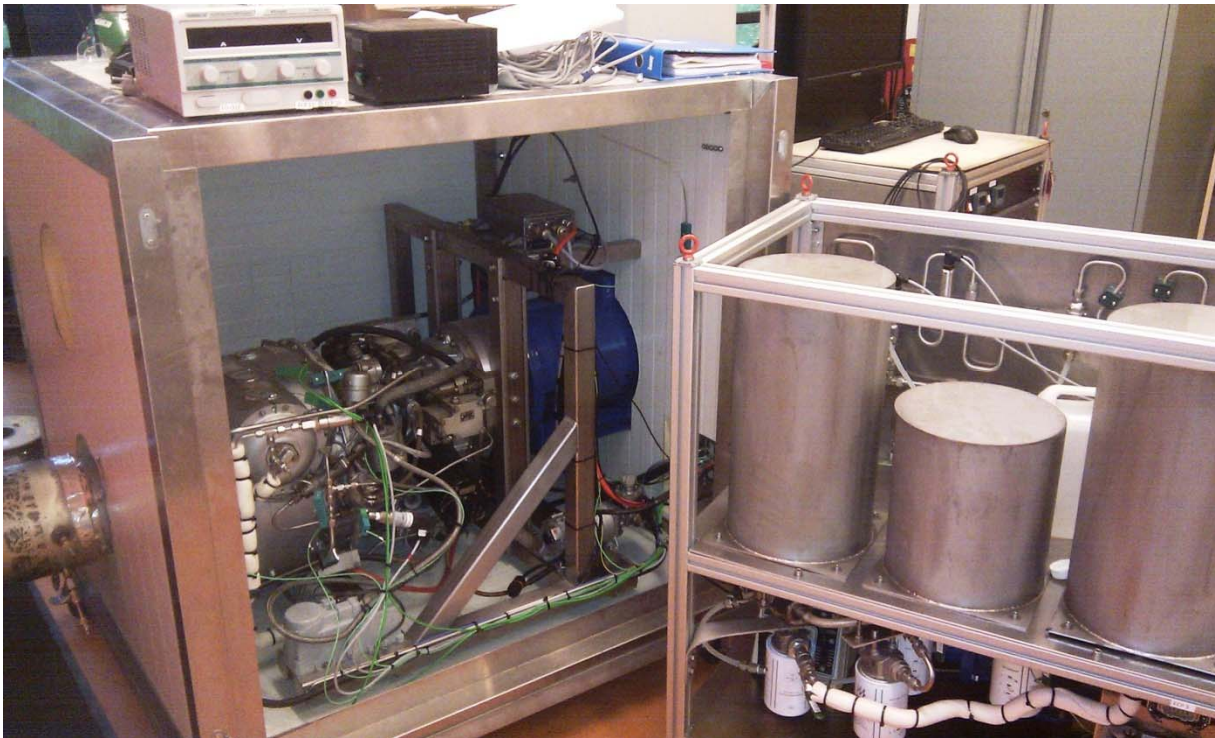


Atomization setup for full-scale nozzles



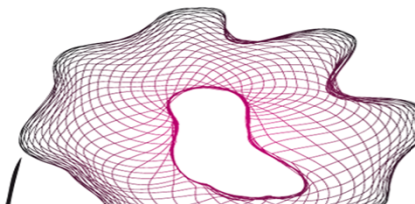
Gas turbine setup

Flexible setup for testing biofuels at different operating conditions

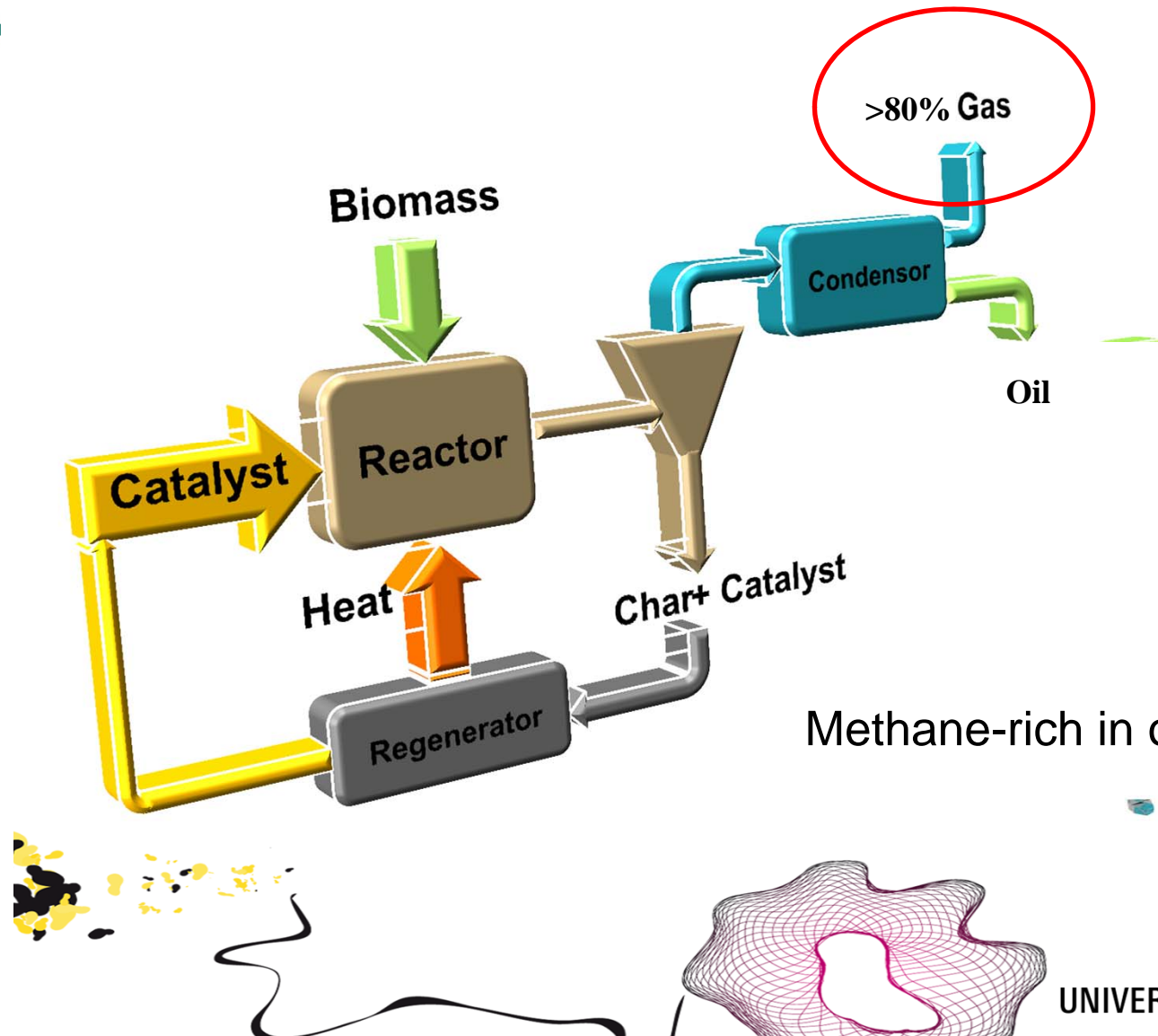


Fuels:

- diesel
- biodiesel
- ethanol
- vegetable oil
- pyrolysis oil

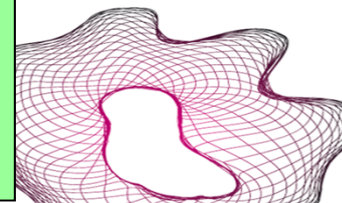
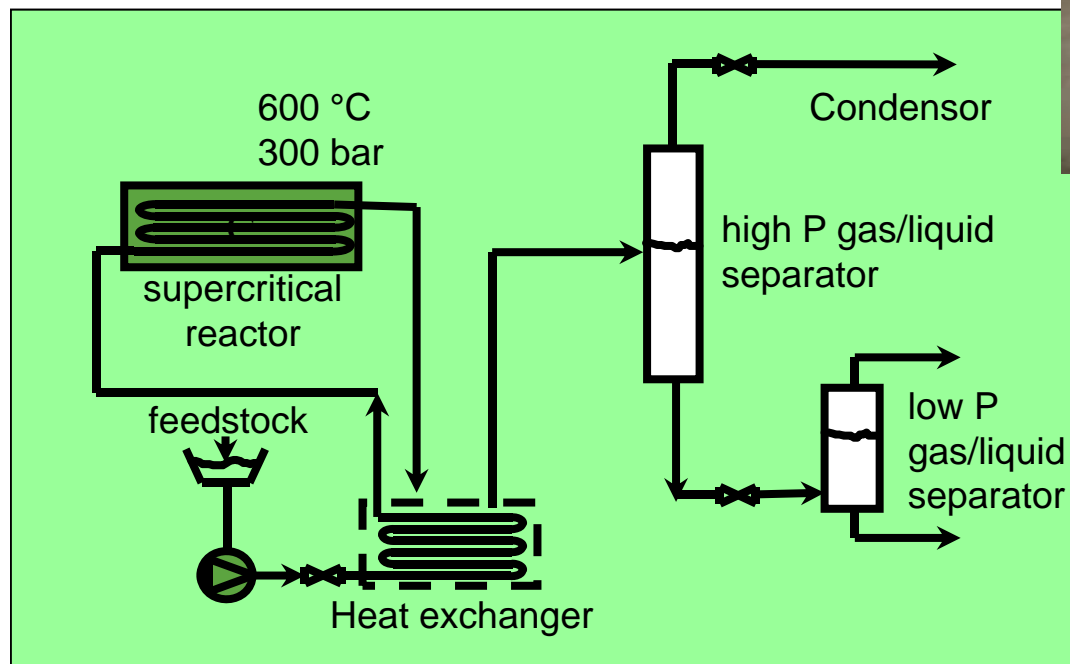


Green gas via pyrogasification

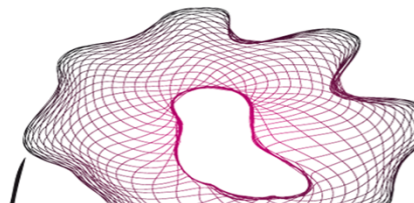
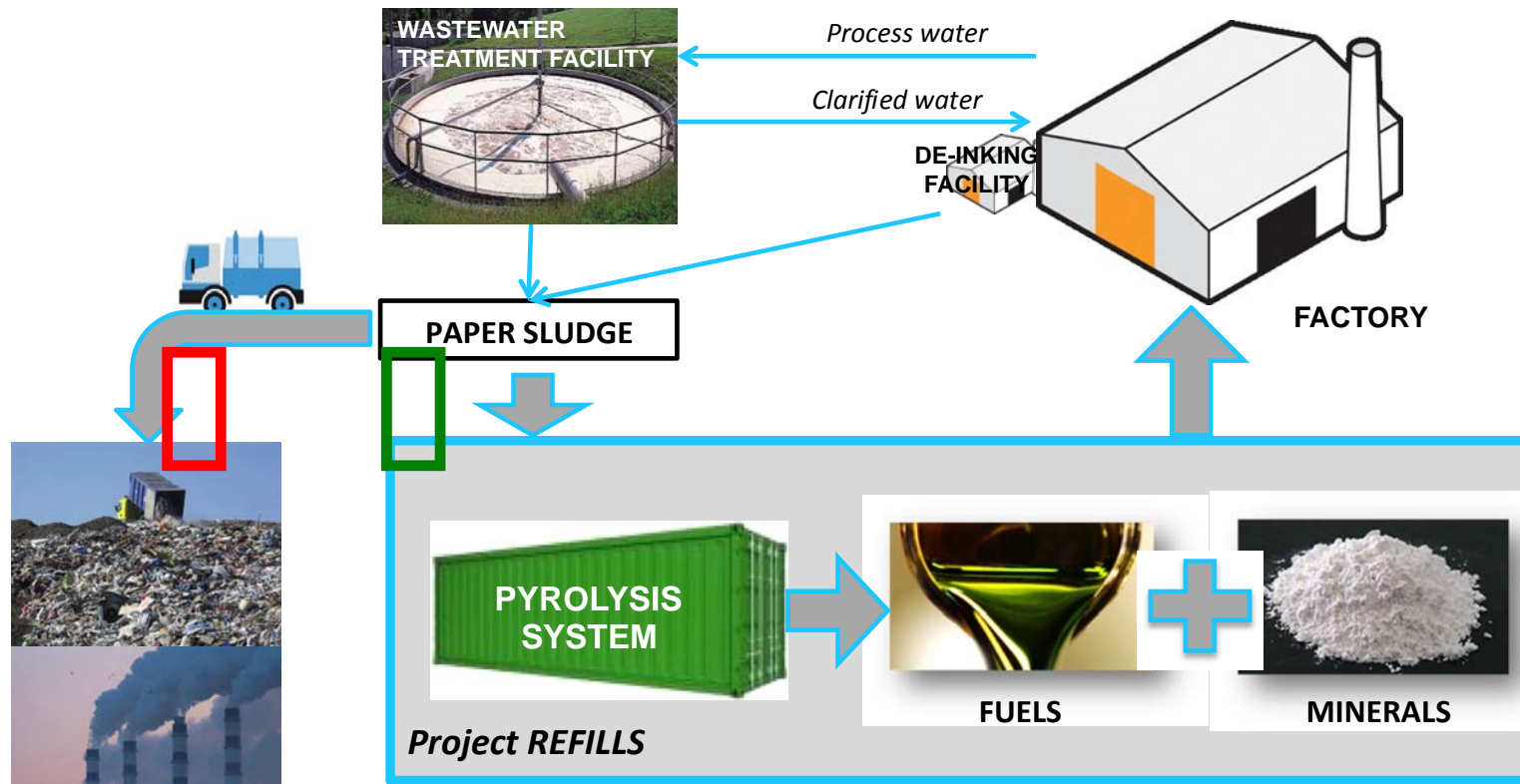


Gasification of Sewage Sludge in Supercritical Water

- Wet biomass
- Process conditions: 600 °C and 300 bar
- Production of a hydrogen or methane rich
- Process integrated reactor
- CO₂ separation



Minerals and Oil from Paper Sludge





PROJECT REFILLS – PHASE 1



PHASE OF DEVELOPMENT

3. "DEMO"

World 1st paper
sludge recycling
plant - industrial
capacity

2. "MOBILE"

Autonomous
complete system
in

1. "PILOT"

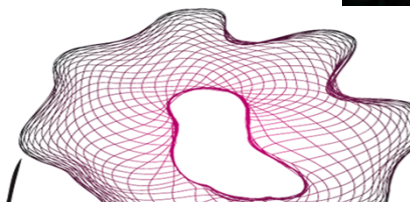
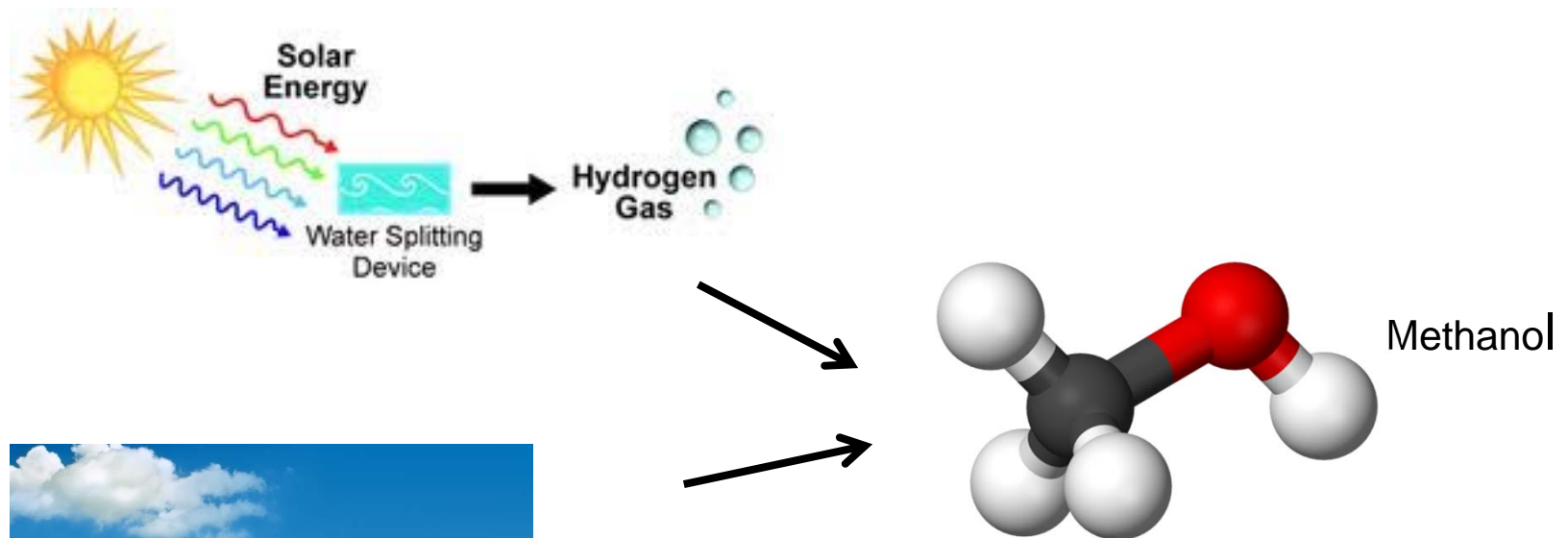
Test Reactor
and closed loop
at UT lab

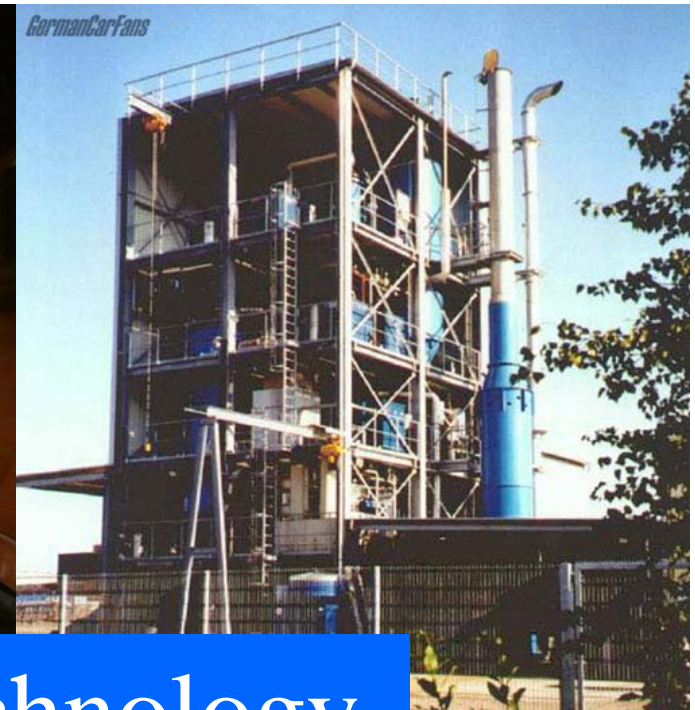
Phase 1
completed very
successfully

Aug 2015



Solar fuels





Sustainable Energy Technology



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