

## Steam gasification and simplified gas cleaning for medium-scale biofuel production from biomass

COMSYN workshop: April 18<sup>th</sup>, 2018 - Stuttgart

Sanna Tuomi, Christian Frilund, Esa Kurkela, Pekka Simell, Johanna Kihlman



# COMSYN

## NEXT GENERATION BIO-FUEL TECHNOLOGY

Next generation biofuels have a significant role to play in the decarbonization of our economy. COMSYN project aims to bring the biofuel production costs down with intensified process technologies.

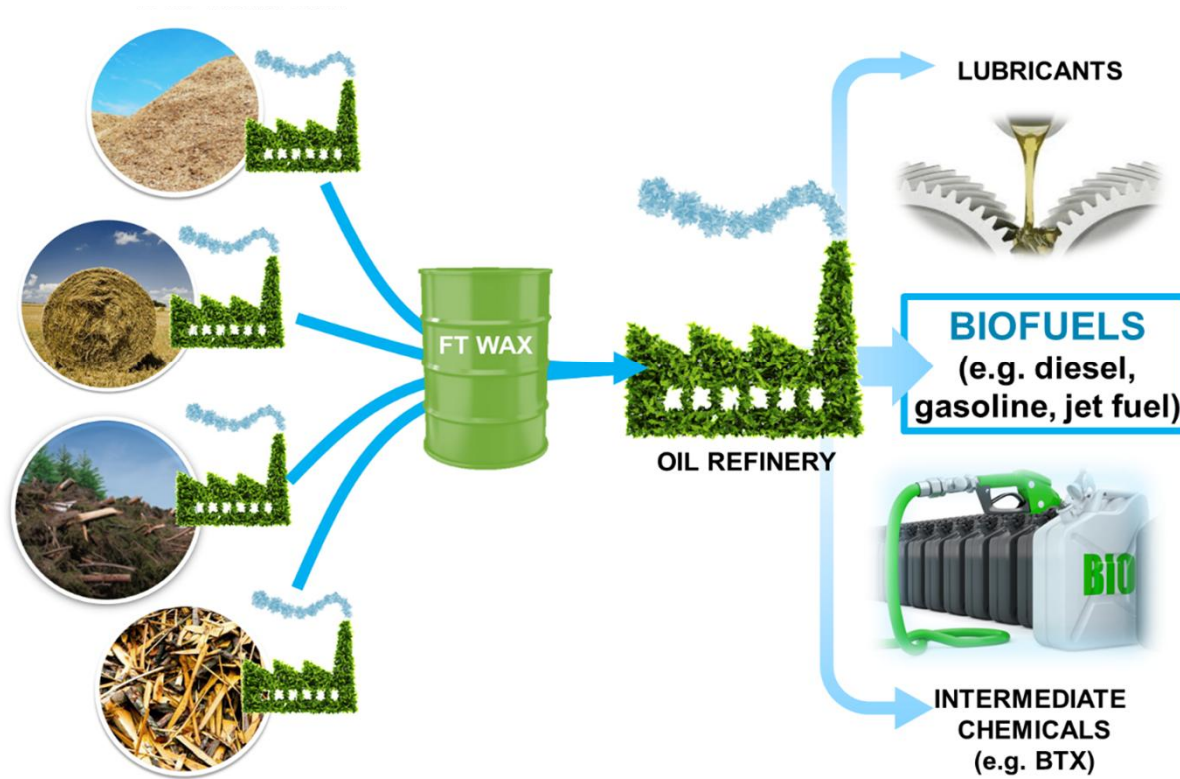


COMSYN project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727476.

# COMSYN



## Compact Gasification and Synthesis process for Transport Fuels



Project duration: 1.5.2017-30.4.2021

Budget: 5.1 million €

### GASIFICATION & GAS CLEAN-UP



### FILTRATION



### FT SYNTHESIS



### REFINING



### TECHNO-ECONOMIC ASSESSMENTS & CASE STUDIES



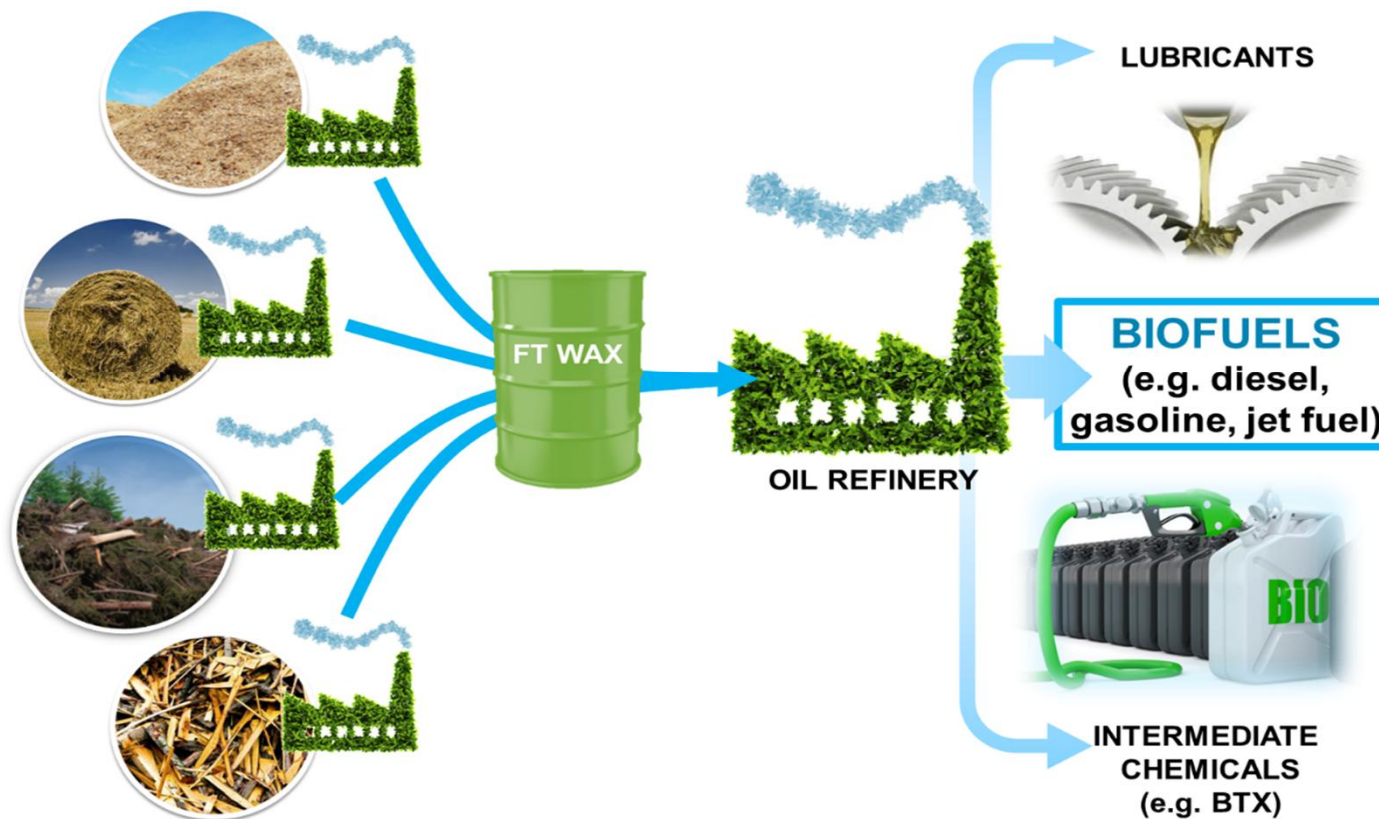
### MARKET STUDIES & BUSINESS CASES





# COMSYN

## Compact Gasification and Synthesis process for Transport Fuels

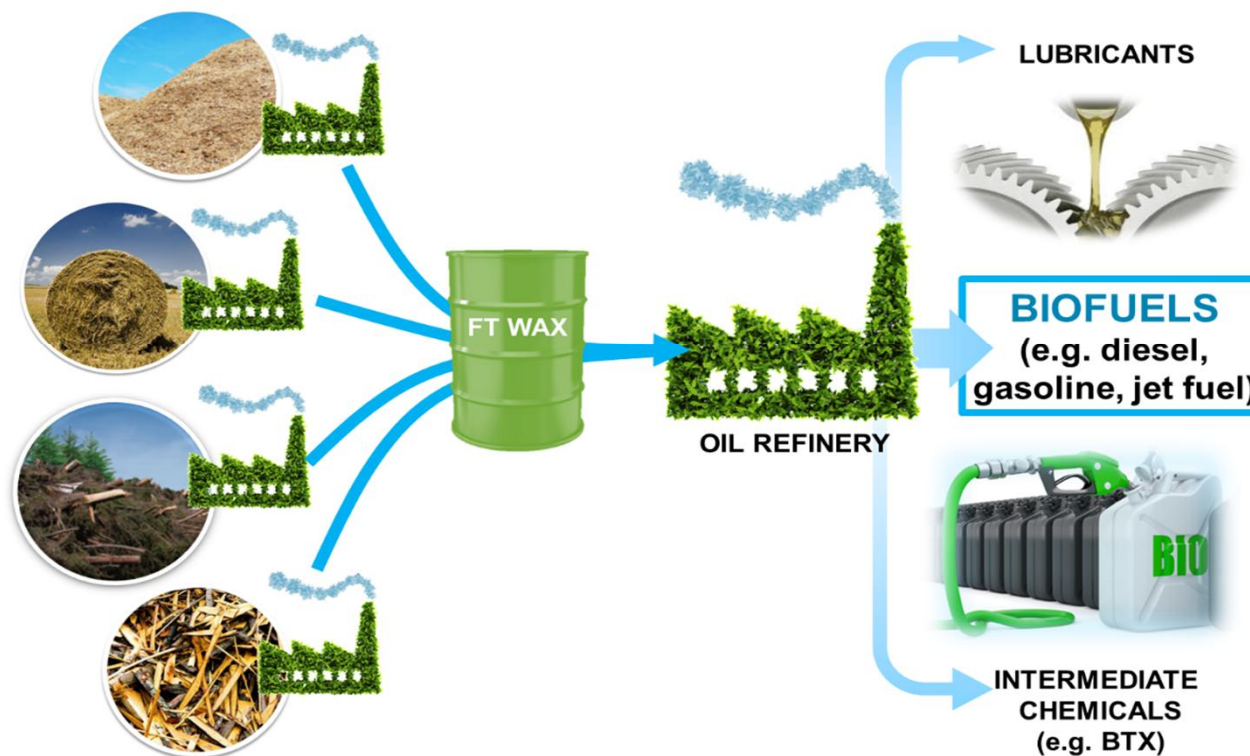


### OBJECTIVE

To develop a new BTL production concept that will reduce biofuel production cost up to 35 % compared to alternative routes (< 0.80 €/l production cost for diesel)

# COMSYN

## Compact Gasification and Synthesis process for Transport Fuels



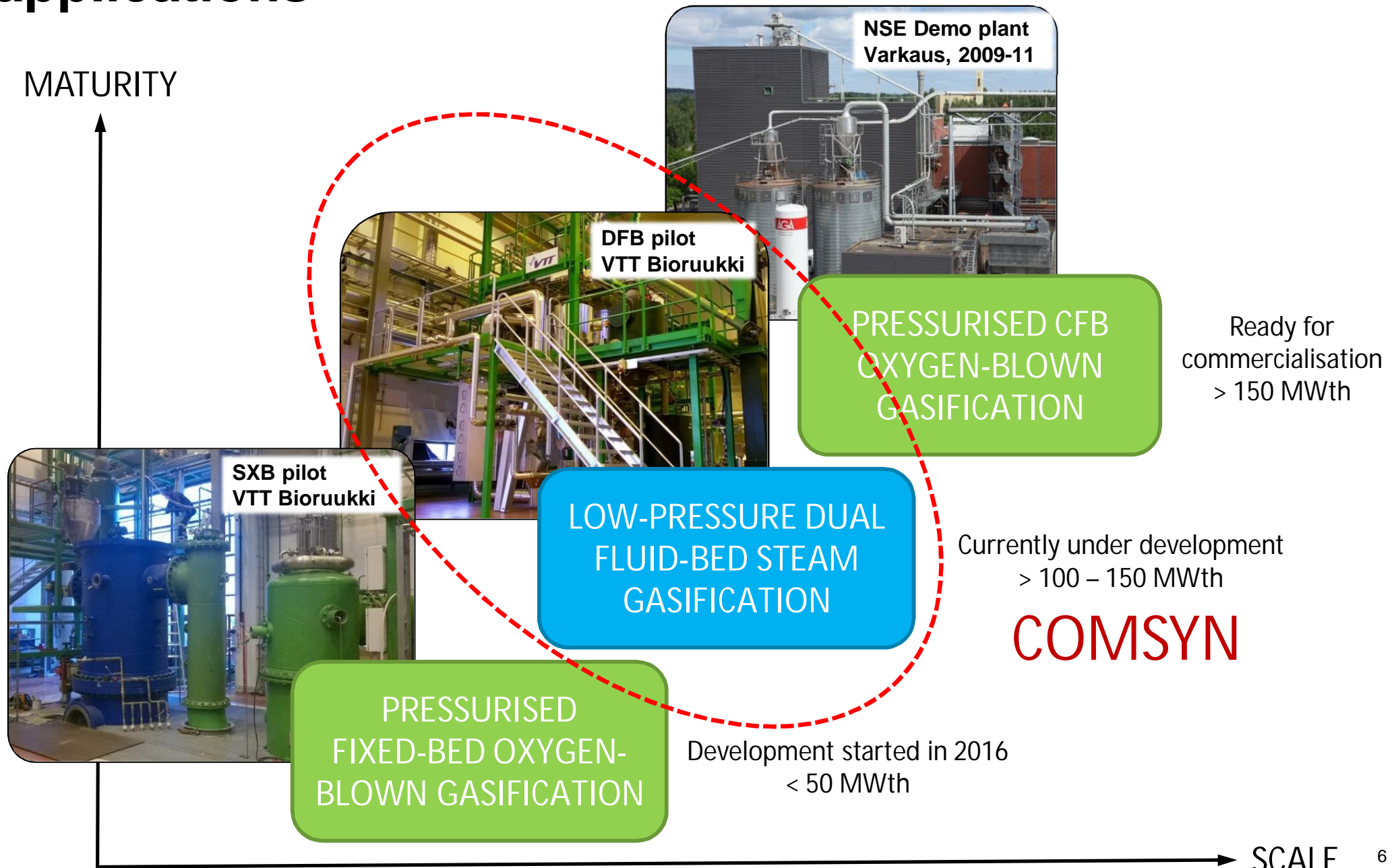
### PRIMARY CONVERSION

Distributed production of FT wax at small-to-medium scale gasification/synthesis units located close to biomass resources (50-150 MW fuel input)

### FINAL CONVERSION

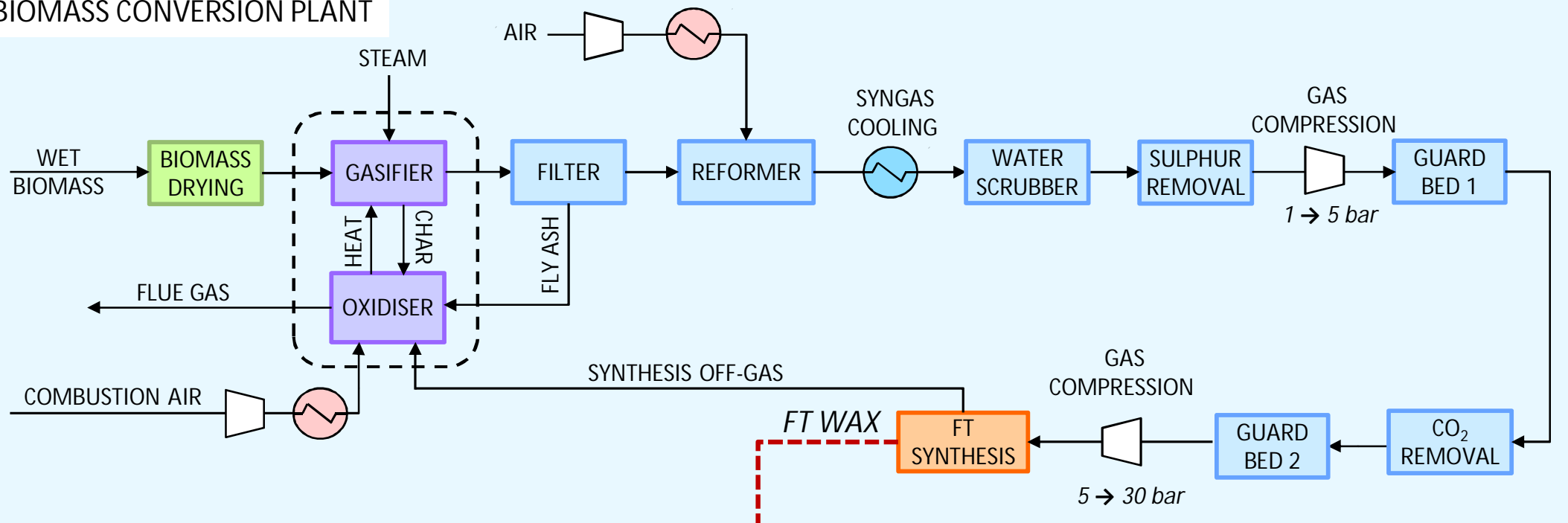
Refining of FT products to high quality drop-in liquid transport fuels at existing oil refineries

# Status of biomass gasification for synthesis applications

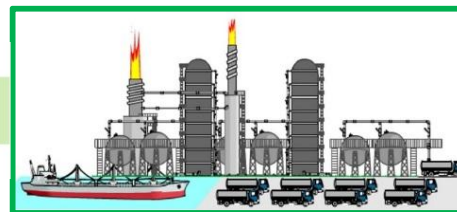


# COMSYN process configuration

## BIOMASS CONVERSION PLANT



TRANSPORTATION LIQUIDS

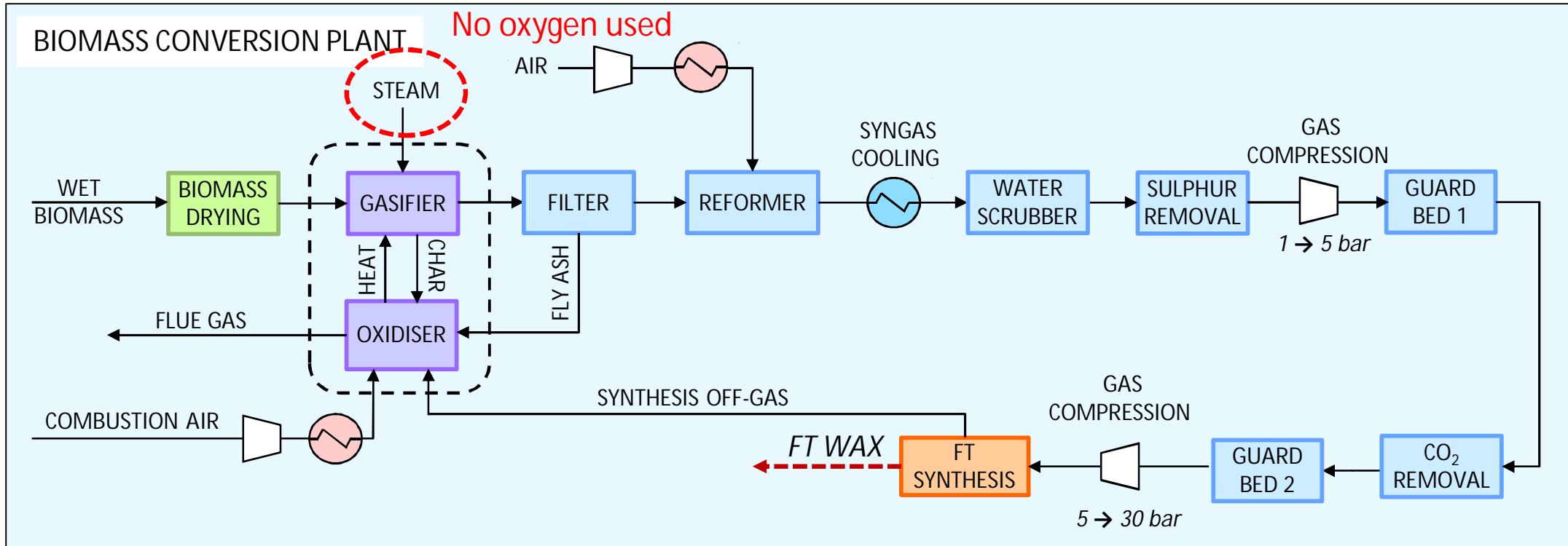


OIL REFINERY



INDUSTRY / DISTRICT HEATING

# Simplified BTL process based on dual fluidised-bed steam gasification

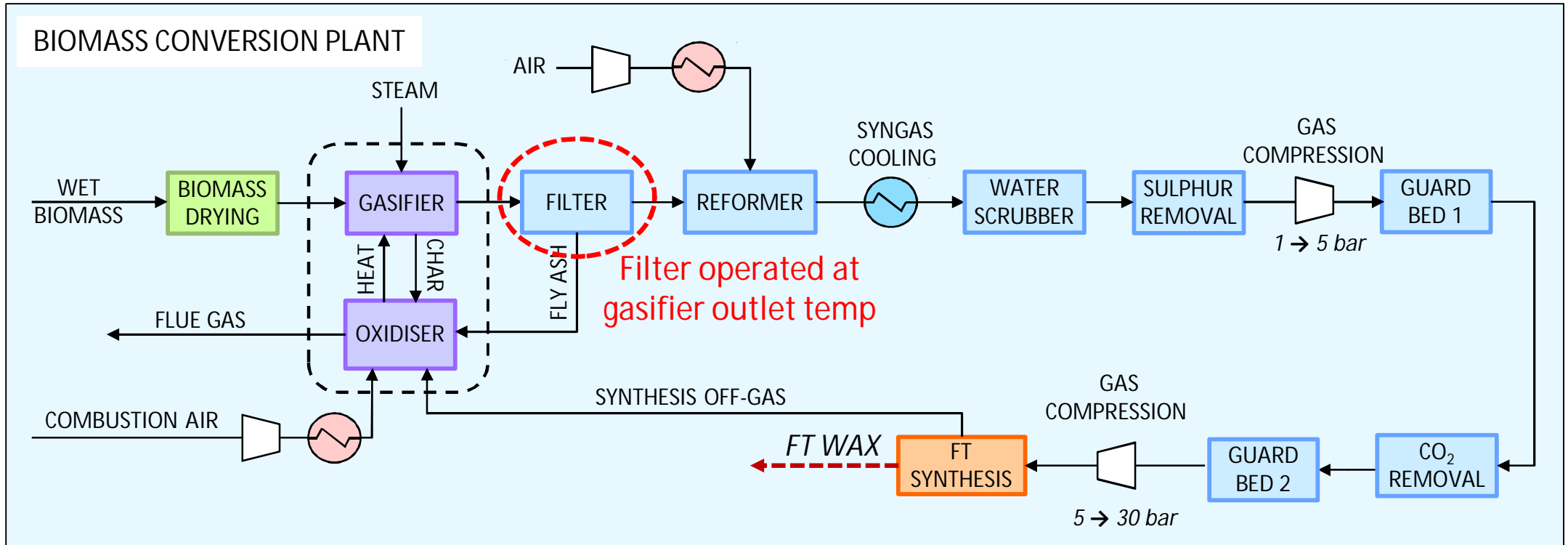


## SIMPLIFIED CONCEPT

- No need for an oxygen plant



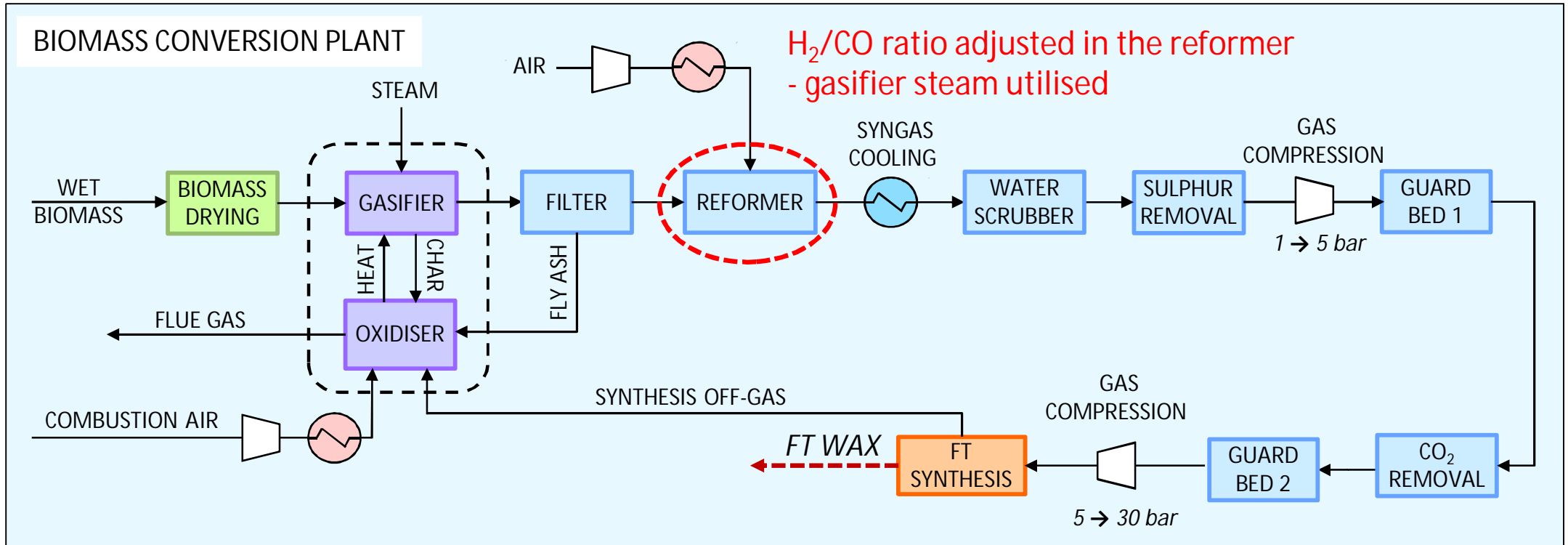
# Simplified BTL process based on dual fluidised-bed steam gasification



## SIMPLIFIED CONCEPT

- No need for an oxygen plant
- Intermediate cooling/reheating steps eliminated

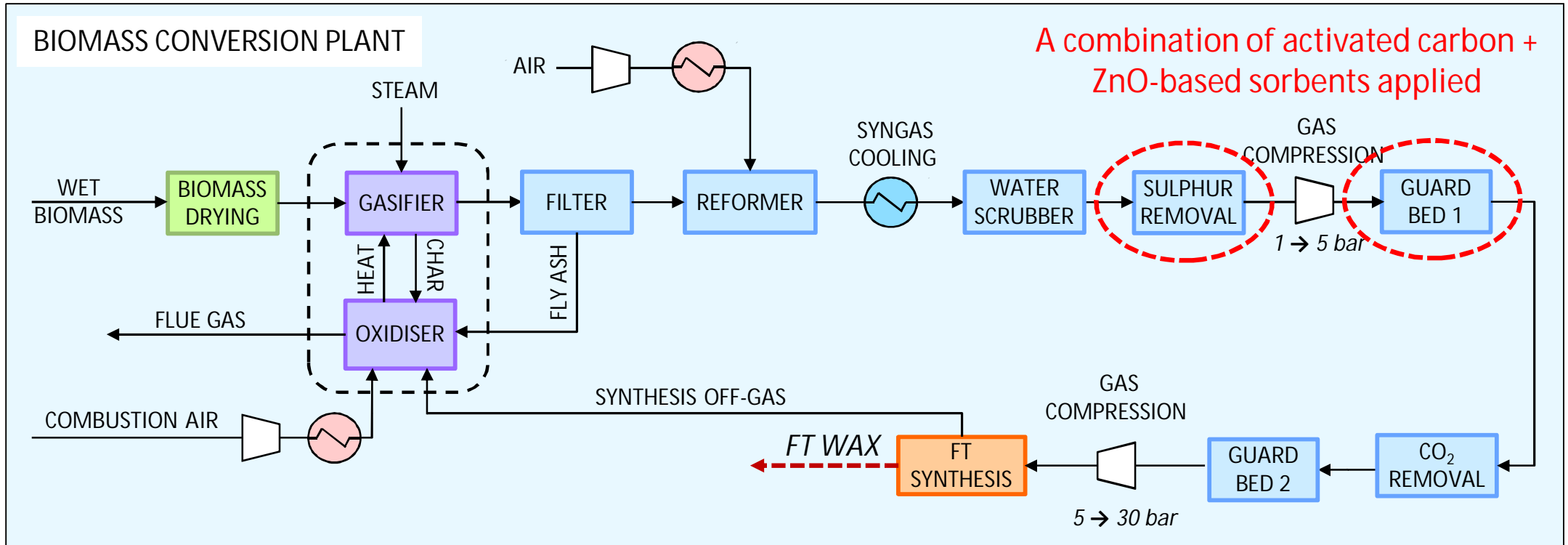
# Simplified BTL process based on dual fluidised-bed steam gasification



## SIMPLIFIED CONCEPT

- No need for an oxygen plant
- Intermediate cooling/reheating steps eliminated
- Separate WGS unit eliminated

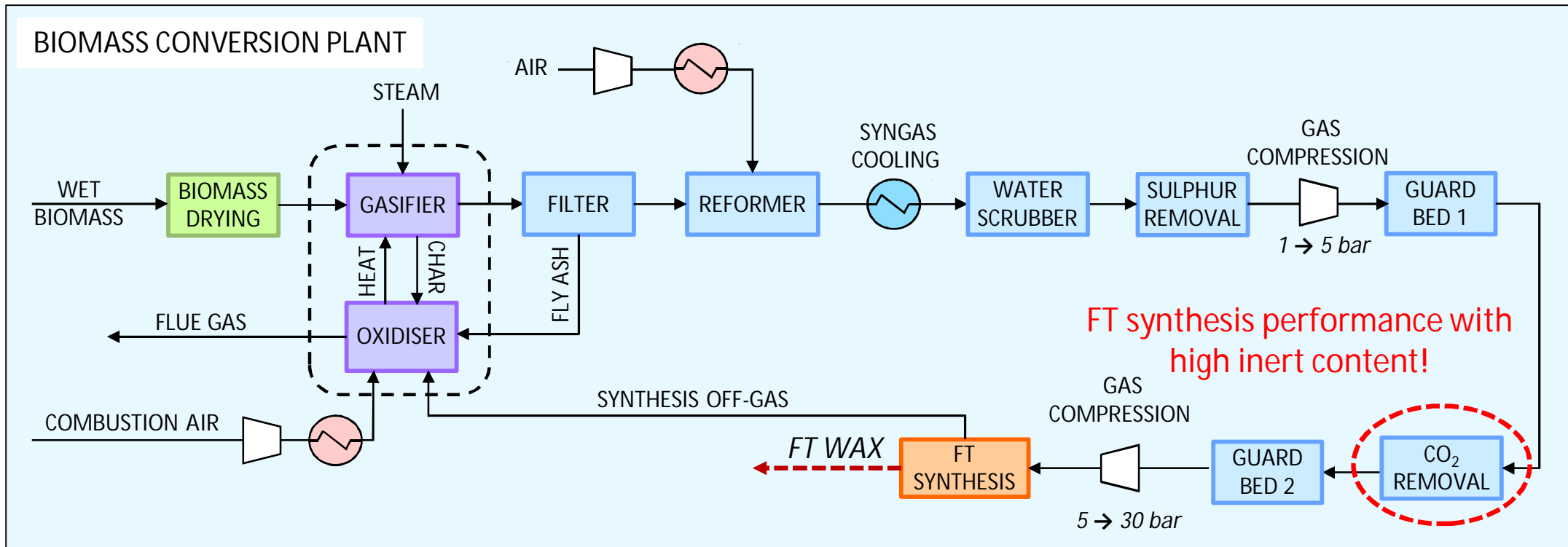
# Simplified BTL process based on dual fluidised-bed steam gasification



## SIMPLIFIED CONCEPT

- No need for an oxygen plant
- Intermediate cooling/reheating steps eliminated
- Separate WGS unit eliminated
- Simplified sulphur removal

# Simplified BTL process based on dual fluidised-bed steam gasification



## SIMPLIFIED CONCEPT

- No need for an oxygen plant
- Intermediate cooling/reheating steps eliminated
- Separate WGS unit eliminated
- Simplified sulphur removal
- No CO<sub>2</sub> removal or partial removal by pressure water scrubbing



# COMSYN process validated at VTT's Pilot Centre Bioruukki

PRE-EXISTING DFB PILOT

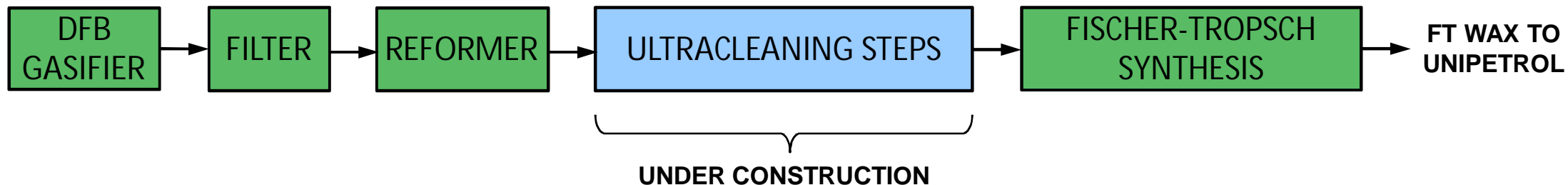


MOBILE SYNTHESIS UNIT

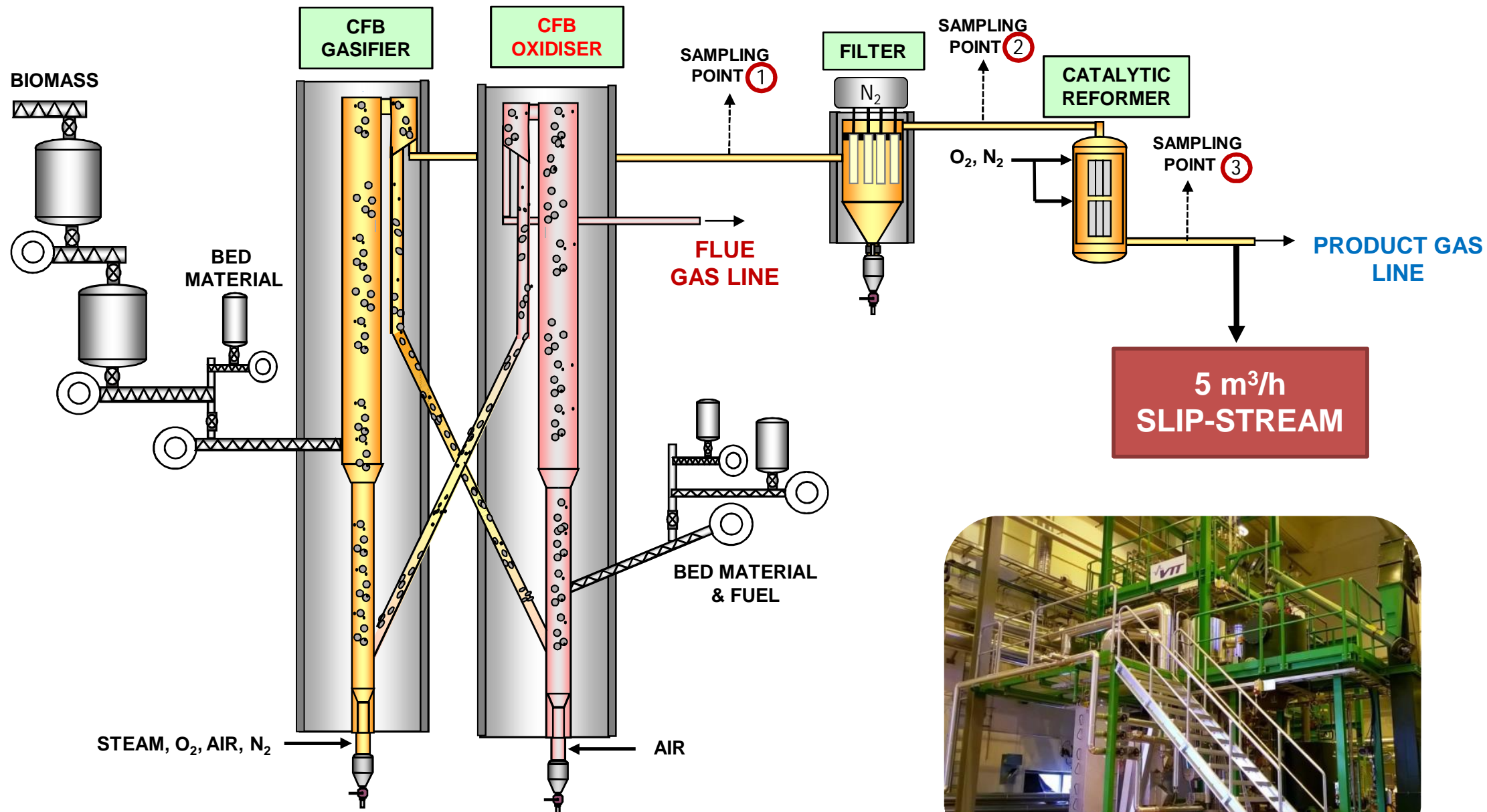


5 m<sup>3</sup>/h  
SLIP-STREAM TO SYNTHESIS

\*INERATEC'S FT SYNTHESIS REACTOR

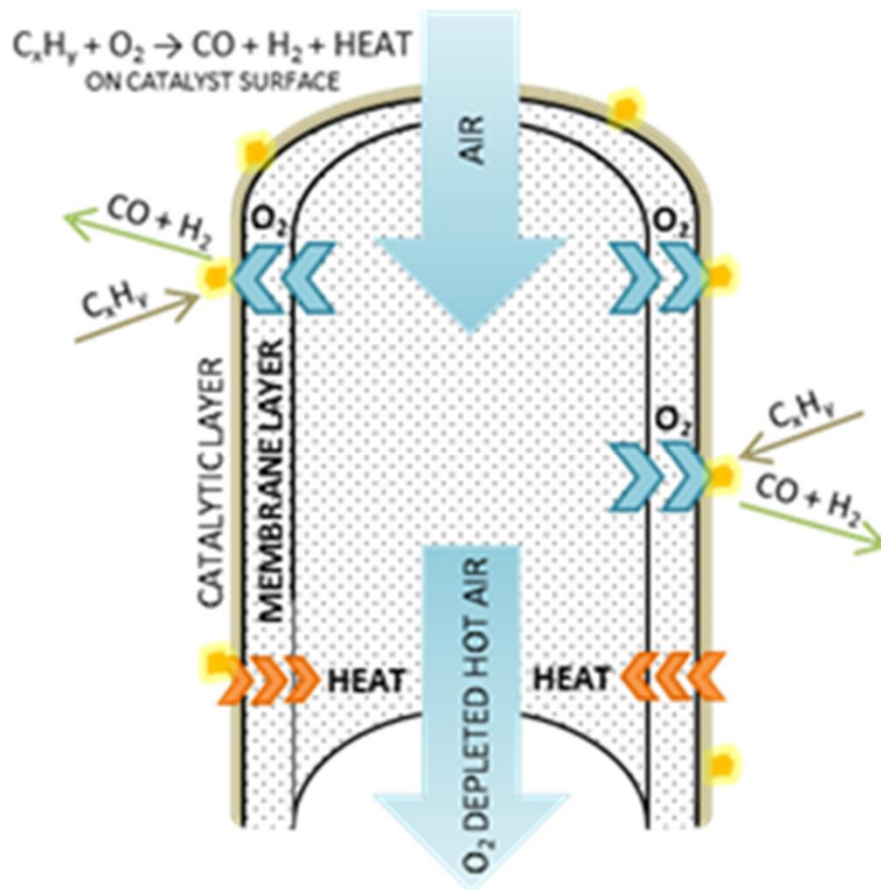


# DFB pilot at Bioruukki





# Catalytic reforming

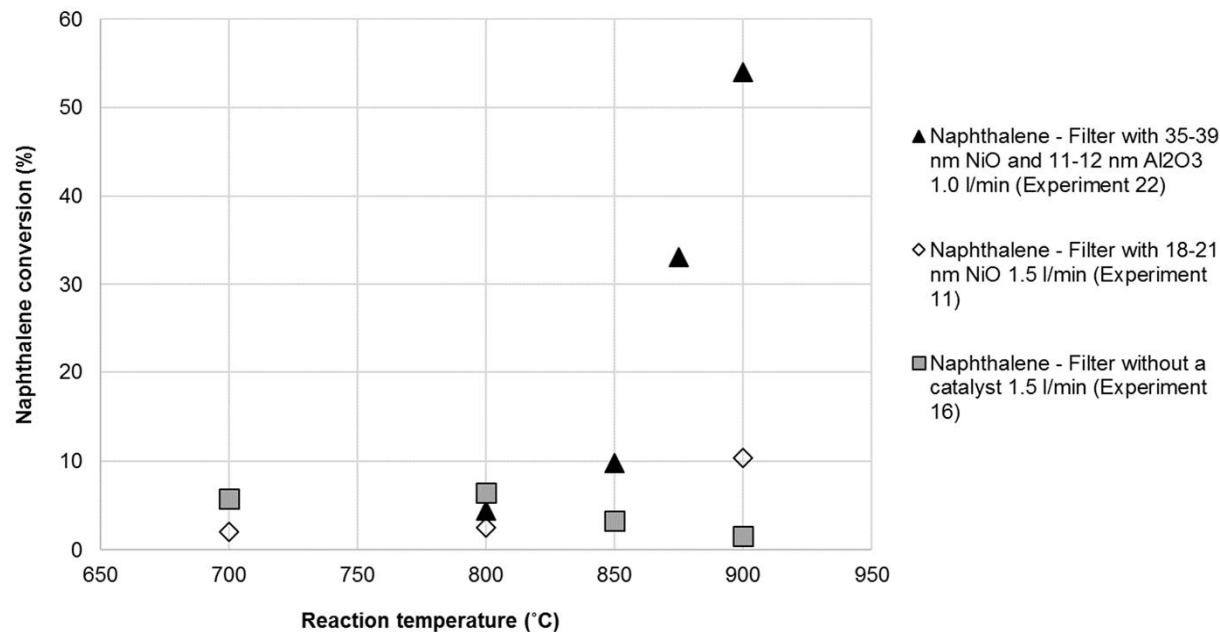


## OBJECTIVES

1. Development of an oxygen-permeable membrane reactor to enable better control of reaction temperature in the reformer (hot spots)
2. Catalyst development: ALD coating to increase the activity as well as sulphur and coke tolerance of the catalyst

# Hot gas filtration

- Filtration based on GKN's innovative metal filter elements
  - Iron-chromium-aluminium alloy
  - Corrosion resistant & withstand high temperatures and mechanical loads

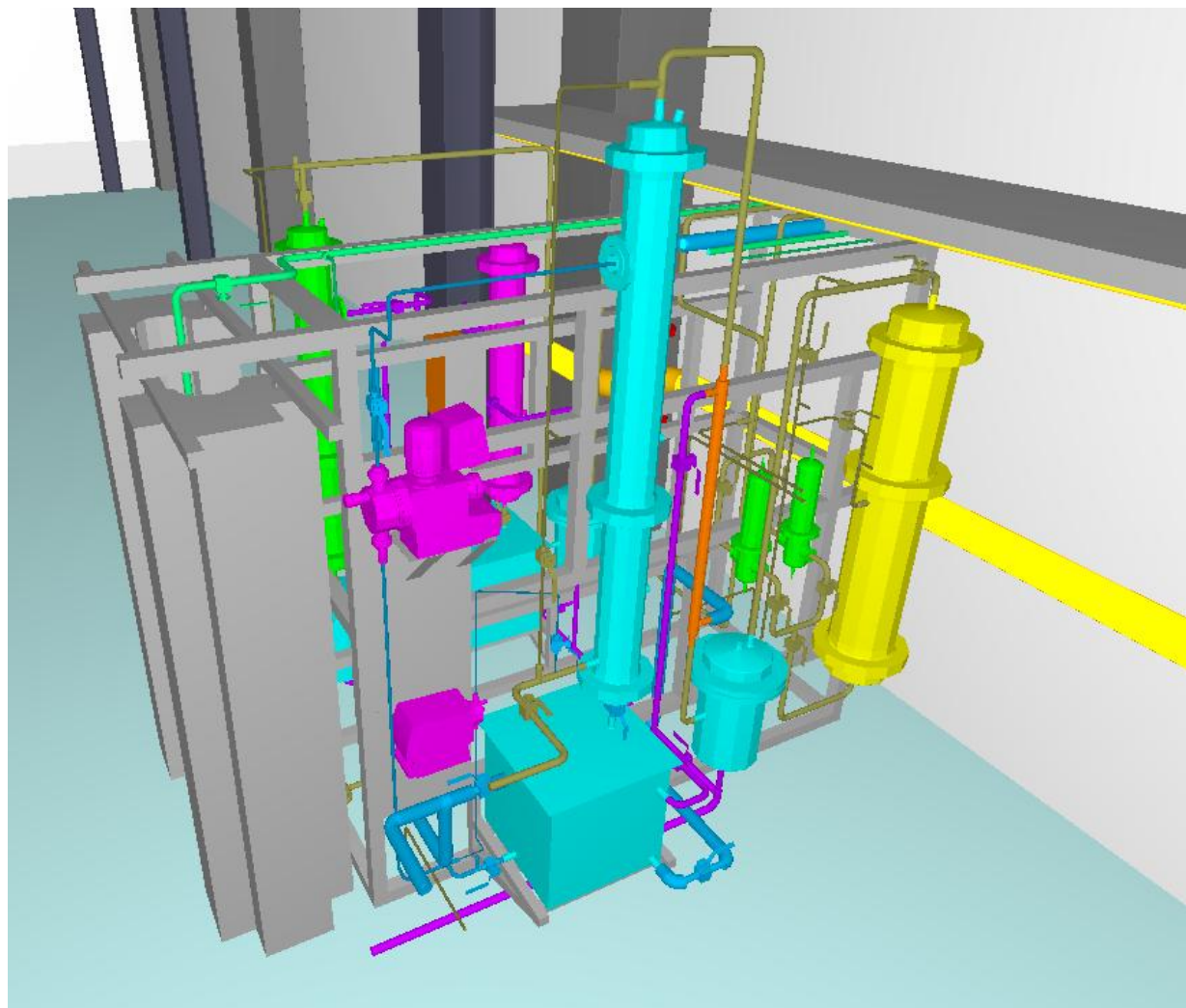


## OBJECTIVES

1. Filtration at high temperature (ca. 800 °C) with simultaneous decomposition of tars
2. Development of catalytically activated filters using ALD technology



# Ultracleaning – COMSYN slipstream



# Bioruukki

<http://www.comsynproject.eu>

