

Gasification project overview and online gas analysis development at VTT

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Gas Analysis Workshop
Risø

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Bioruukki piloting ecosystem - efficiency, speed and lower risks to development with piloting and demonstrations

- A new piloting ecosystem for process industry scale-up and demonstrations.
- A former printing plant transformed to world scale R&D centre.
- Located close to Otaniemi campus.

*BIORUVUKKI IS THE LARGEST OPEN
PILOT FACILITY IN BIOECONOMY
IN NORTHERN EUROPE*



8000 m²,
room for
several pilot
units and
laboratories

400
experts for
R&I
development

Bioruukki Pilot Centre - Value from integration



THERMOCHEMICAL CONVERSION PLATFORM

Gasification and
pyrolysis technologies
for biofuels and
biochemicals.
Recycling concepts.

Full operation started
Q3/2015



ENERGY STORAGE PLATFORM

Storage concepts
for solar and wind
energy through
mono carbon gases
to chemicals and
materials

Starts at Bioruukki
2016



BIOMASS PROCESSING PLATFORM

Innovative biomass
processing and
cellulose fibres for
new biobased
value chains

Starts at Bioruukki
2017



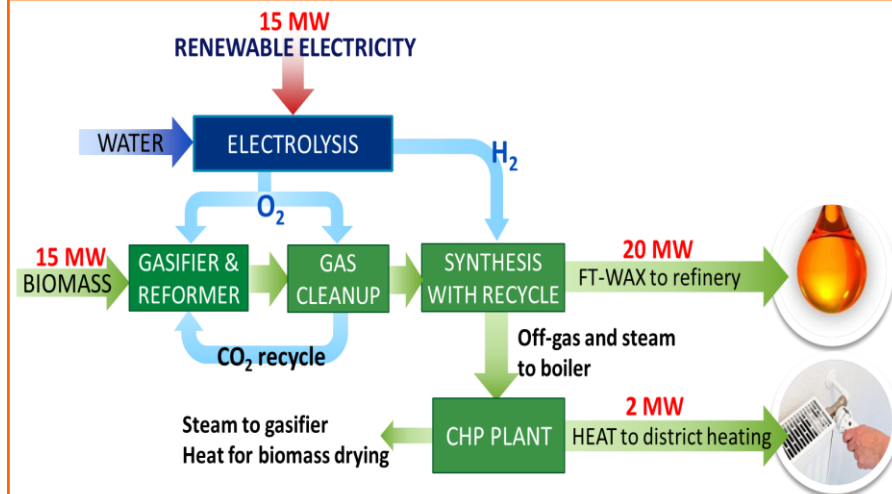
GREEN CHEMISTRY PLATFORM

Sustainable process
chemistry and
bioprocesses for
biochemicals and
tailored biobased
hybrid materials

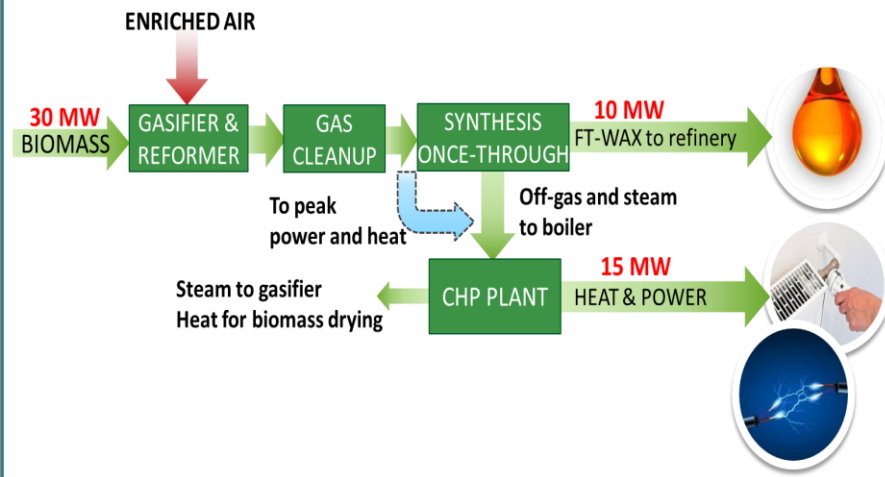
Starts at Bioruukki
2018

The key idea of FLEXCHX project

OPERATION DURING "SOLAR ENERGY SEASON"



OPERATION DURING "DARK HEATING SEASON"

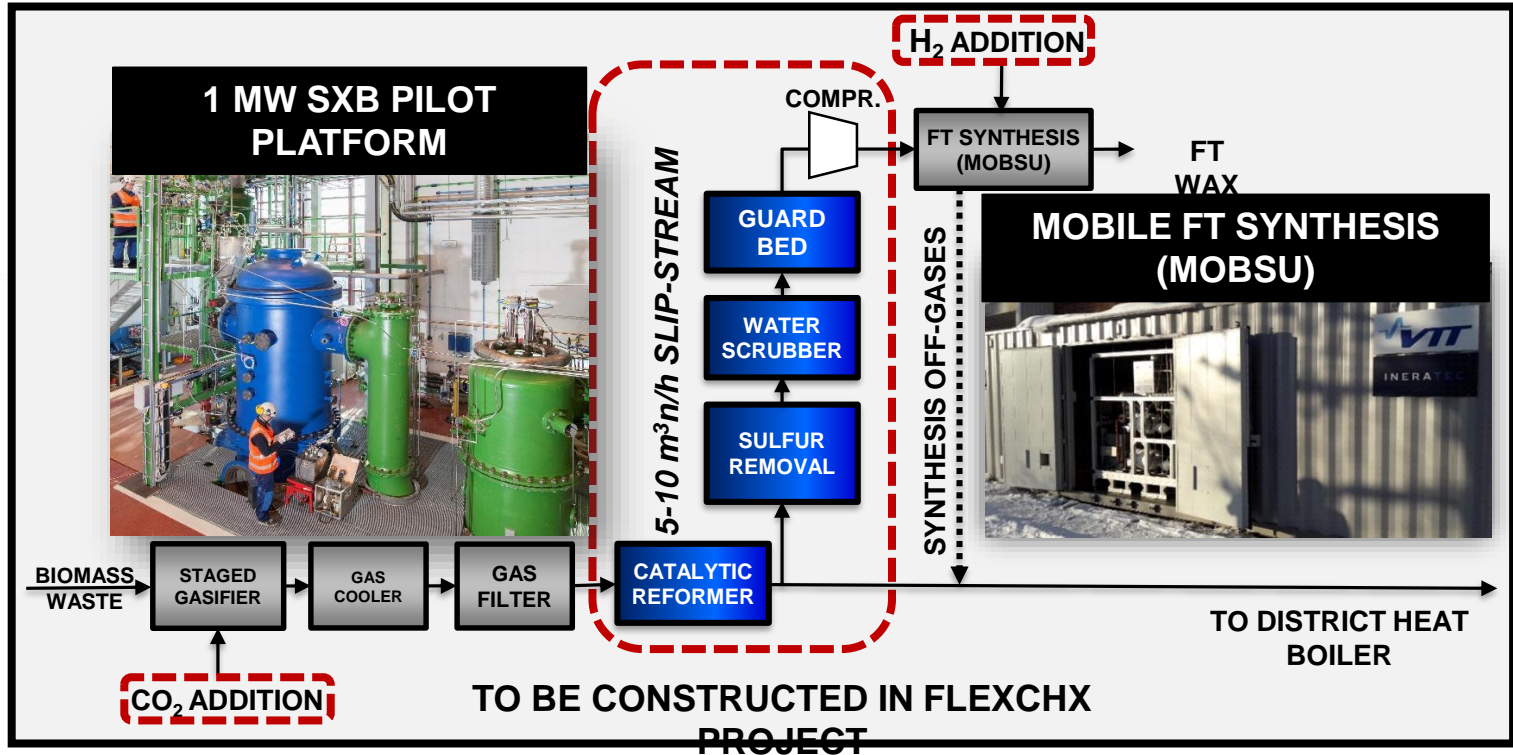


The **vision** is to realise a process for optimal use of the seasonal solar energy supply and available biomass resources to satisfy the seasonal demand for heat and power, and to simultaneously produce low-GHG fuels for the transport sector.

FLEXCHX

Flexible combined production of power, heat and transport fuels from renewable energy sources
Duration: 1.3.2018 – 28.2.2020; EU contribution: 4 489 545 €

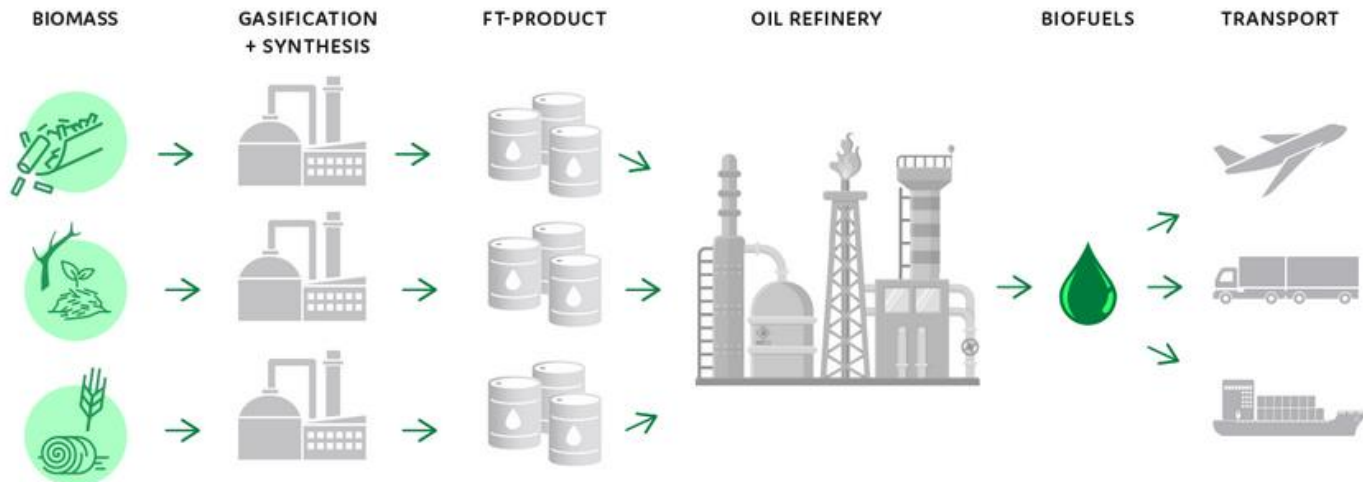
Partners:



Compact Gasification and Synthesis process for Transport Fuels

COMSYN

www.comsynproject.eu



PROJECT FACTS

2017 – 2021

7 partners

5.1 M€ budget

3 pilot campaigns from
biomass to biofuels

400 kg of biofuels produced
for research and
demonstration.

Decentralized primary conversion of biomass in 30 – 150 MW units.

Technology development for primary conversion, Fischer-Tropsch synthesis and oil refinery feeding systems.

Target reduction of the biofuel production cost is up to 35% compared to alternative routes.

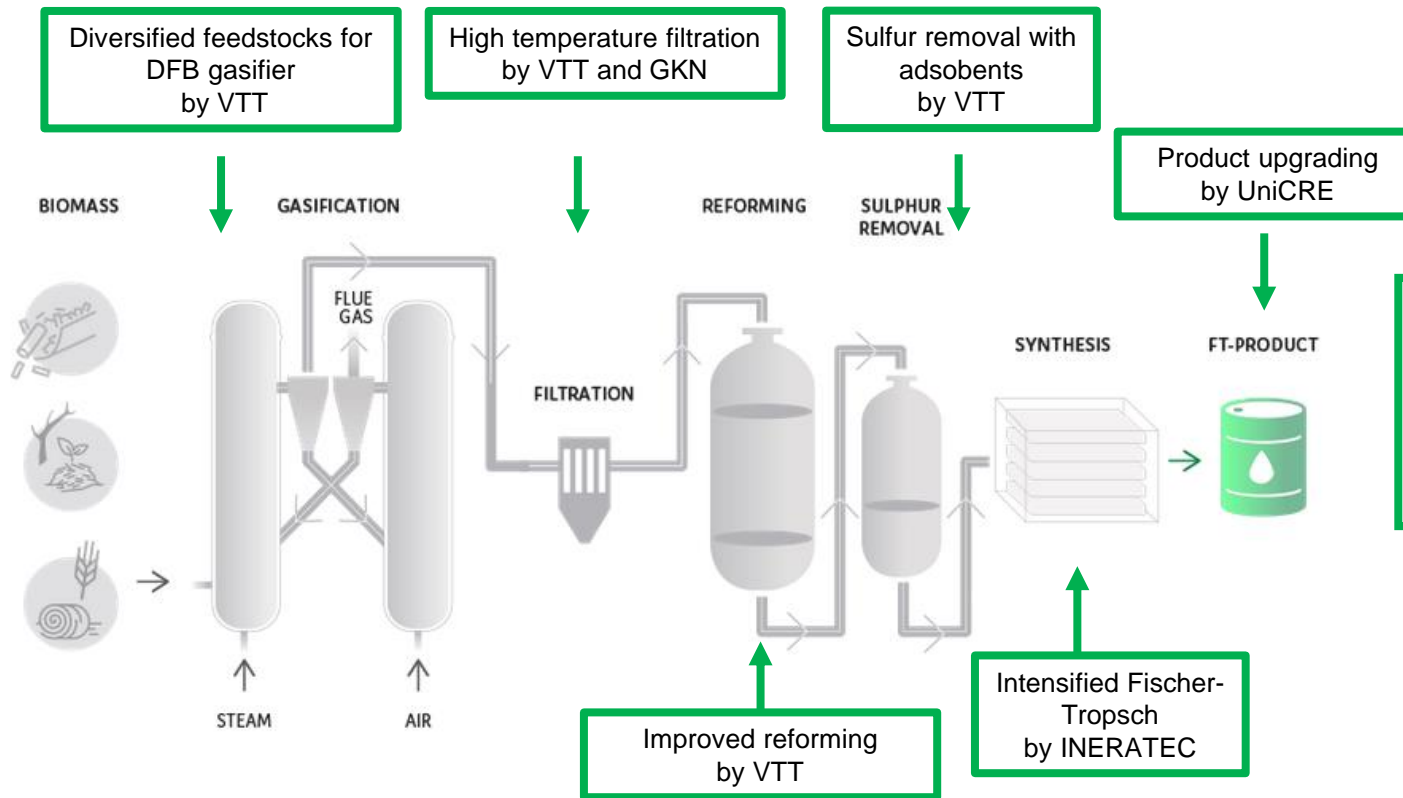
=> Less than 0.80 €/l production cost for diesel.



Technology development

COMSYN

www.comsynproject.eu



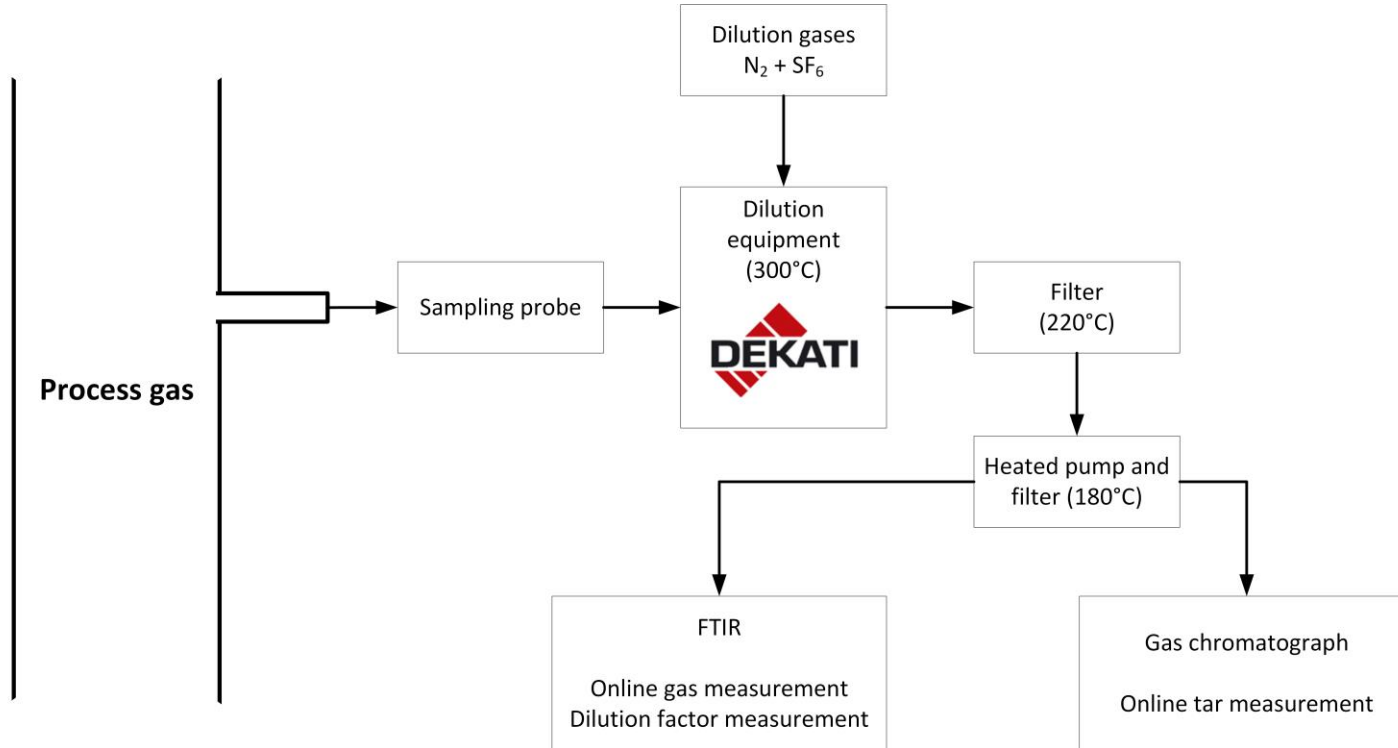
Process design
& techno-economic studies
& environmental assessments
by DLR and Wood

Market studies and business cases
by ÅF Consult

Dilution sampling campaign

- Online measurement campaign during COMSYN –project gasification test runs
- Online GC & FTIR analysis for:
 - H_2S
 - NH_3 and HCN
 - Tar compounds
- Cavity ring-down spectroscopy for H_2S

Dilution sampling equipment diagram



Dilution sampling

Based on technology patented by VTT
(e.g. US 8302495, FI 119450,
WO/2007/080221)

Can be applied to both atmospheric and
pressurised systems

Temperature range 280-800°C

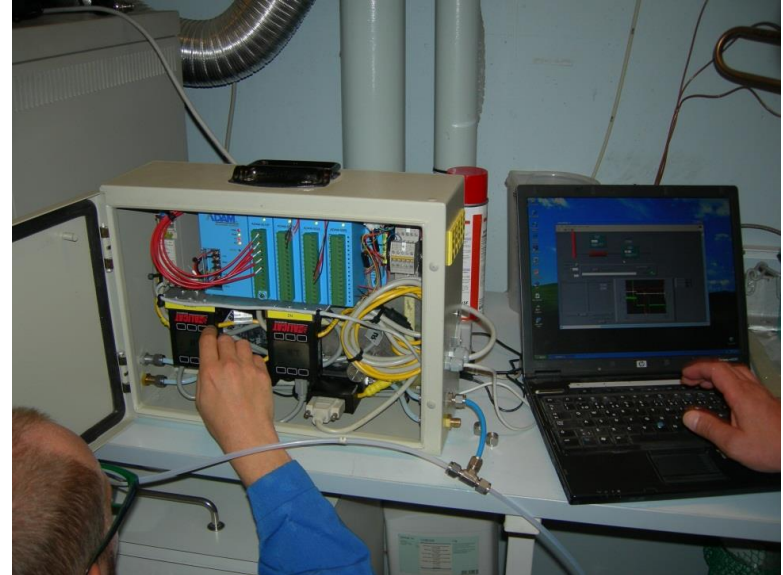
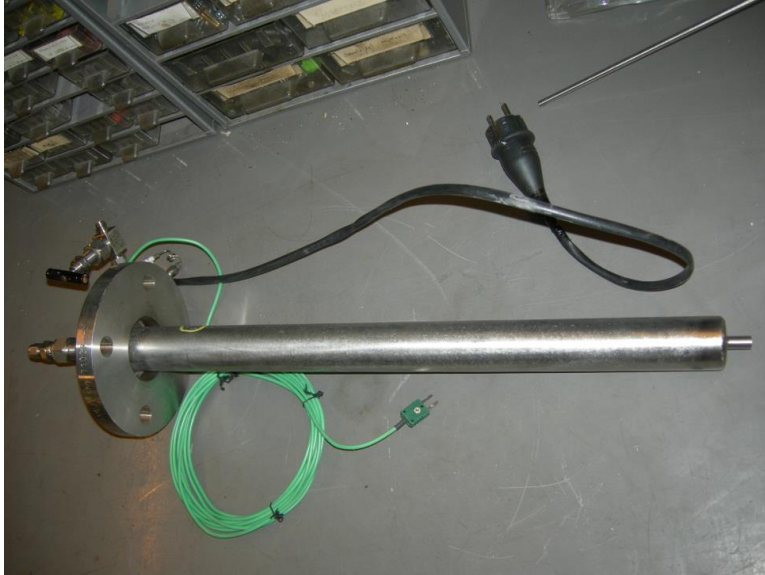
Dilution ratio typically 0-100

Preliminary results with very tarry raw gas
have been promising

- Results consistent with controlled off-line sampling
- No problem with condensation of tars in the sampling lines
- Good repeatability



Dilution sampling probe with control unit



GC-FID-TCD-HID

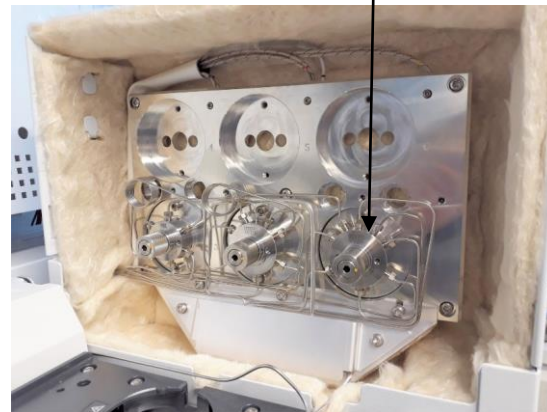
Extra-large valve box



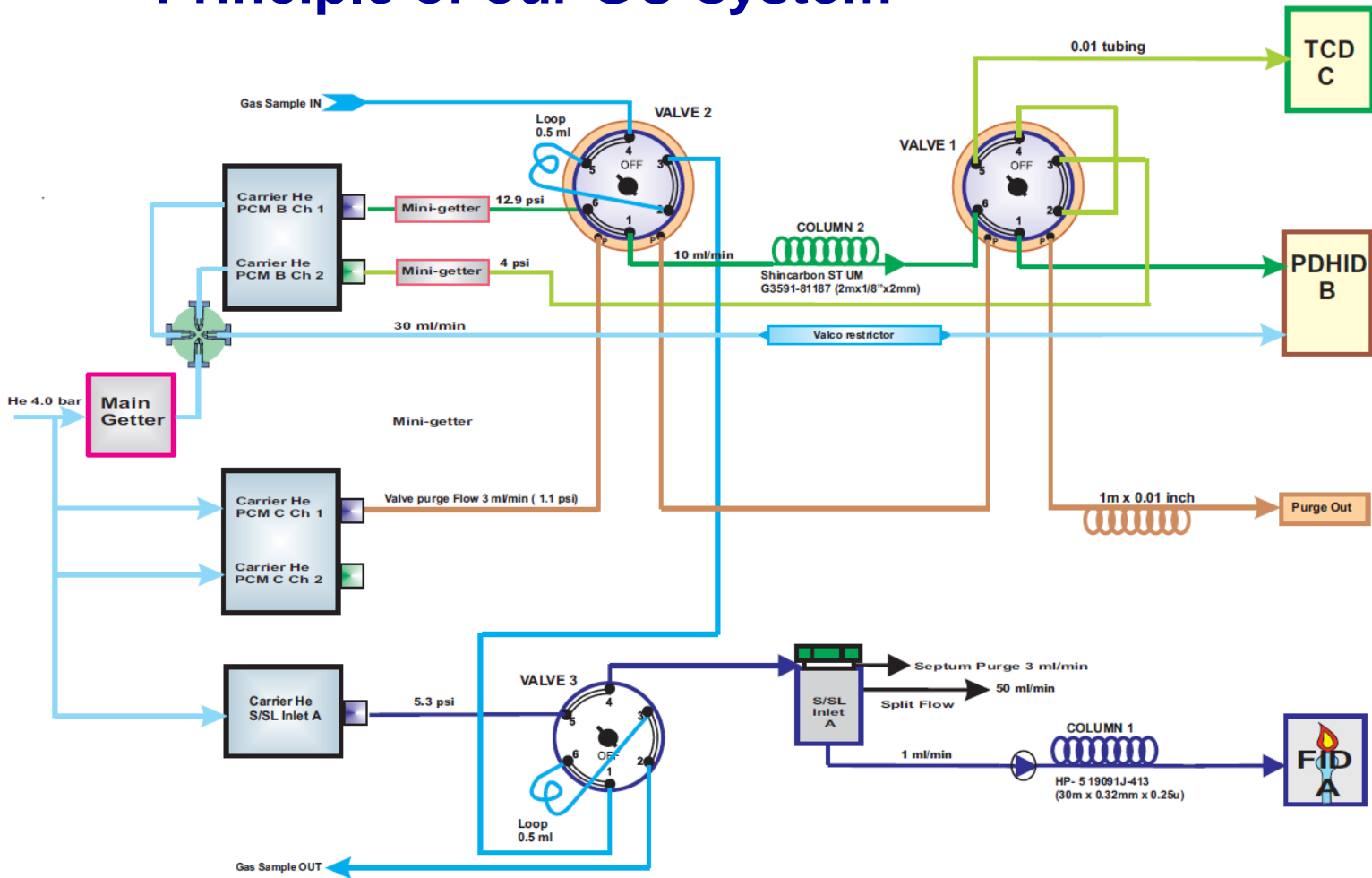
PD-HID



He-purged valves



Principle of our GC-system





www.vttresearch.com
#vttpeople / @VTTFinland



Project Acronym: **FLEXCHX** and Number: **763919** Call: LCE-07-2017 Topic: Combined Heat and Power

Project title: **FLEXIBLE COMBINED PRODUCTION OF POWER, HEAT AND TRANSPORT FUELS FROM RENEWABLE ENERGY SOURCES**

Specific Challenge: Combined Heat and Power: Transforming renewable energy into intermediates

Technological approach of the Project:

FLEXCHX presents an economical way to utilize combined heat and power plants and district heating networks as part of the future European energy system. Tri-generation of power, heat and intermediate product (FT wax) for the transport sector is used to address the challenge of the poor match between the availability of solar energy and the demand for heating.

Expected Impact: The FLEXCHX project relates to the topic LCE-07-2017 “Developing the next generation technologies of renewable electricity and heating/cooling” and more specifically to the subtopic h) Combined Heat and Power production - transforming renewable energy into intermediates.

Contribution of the Project: The key goal of the FLEXCHX project is to develop a process concept that will enable flexible co-generation of heat, power and 2nd generation biofuels in the small-to-medium size range (5-50 MW biomass and 0-30 MW electricity input) using various low-cost biomass feedstocks and excess electricity during the sunny season.

Highlights: In this project, a **flexible and integrated hybrid process, which combines electrolysis of water with gasification of biomass and catalytic liquefaction, will be developed.** This process produces heat, power and an intermediate energy carrier (FT wax), which can be refined to transportation fuels using existing oil refining equipment. **The key enabling technologies will be developed and validated to TRL5 enabling follow-on demonstration activities.**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 763919

Project Acronym: **COMSYN** Project Number: **727476** Call: **H2020-LCE-2016-RES-CCS-RIA**
Topic: **LCE-08-2016-2017 Development of next generation biofuel technologies**
Project title: **Compact Gasification and Synthesis process for Transport Fuels**

Specific Challenge: New sustainable biofuels technologies need to be developed that improve performance, notably with regards to the following sub-challenges: a) improving the technology competitiveness by upgrading the conversion efficiency and possibly diversifying the technology; b) improving the feedstock supply by reducing the supply costs and possibly diversifying the biomass feedstock

Technological approach of the Project: COMSYN aims to develop a concept for competitive bio-based fuels by means of a compact gasification and synthesis process. The concept is based on distributed primary conversion of diverse biomass residues to liquid intermediate products at 30–150 MW (biomass feed) units located close to biomass resources.

Expected Impact: The developed technology should: improve the economic, environmental and social benefits of biofuels; have favourable energy and GHG balances; have a significant cost reduction; be secure and affordable energy supply; have diversified, cheap feedstock supply; enhance Europe's competitiveness.

Contribution of the Project: The target reduction of the biofuel production cost is up to 35% compared to alternative routes, which translates to less than 0.80 €/l production cost for diesel. The biomass feedstock is diversified by utilizing low-cost materials, such as demolition wood and agricultural waste.

Highlights (technological/non-technological): The syngas cleaning efficiency is improved by developing filtration, reforming and sulfur removal technologies. The synthesis process utilizes a modern intensified Fischer-Tropsch reactor, specially designed for decentralized biofuel production.



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