USE OF FT PRODUCT IN OIL REFINERIES

COMSYN & FLEXCHX WEBINAR

date: 19/01/2021
name: Jan Jenčík, Jiří Hájek, Radek Černý, Aleš Vráblík
unit: Department of Development and Innovation

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About ORLEN UniCRE

Current challenges to 2030

Reduction of carbon footprint

Alternative sources for energy and fuels

Reduction of waste

Further processing of by-products and waste products

Environmental and climate changes

Reduction of greenhouse gas emissions and ozone depleting substances

Health risks

Reducing emissions of harmful substances

Shortage of skilled workers

Promotion of professional secondary and tertiary education

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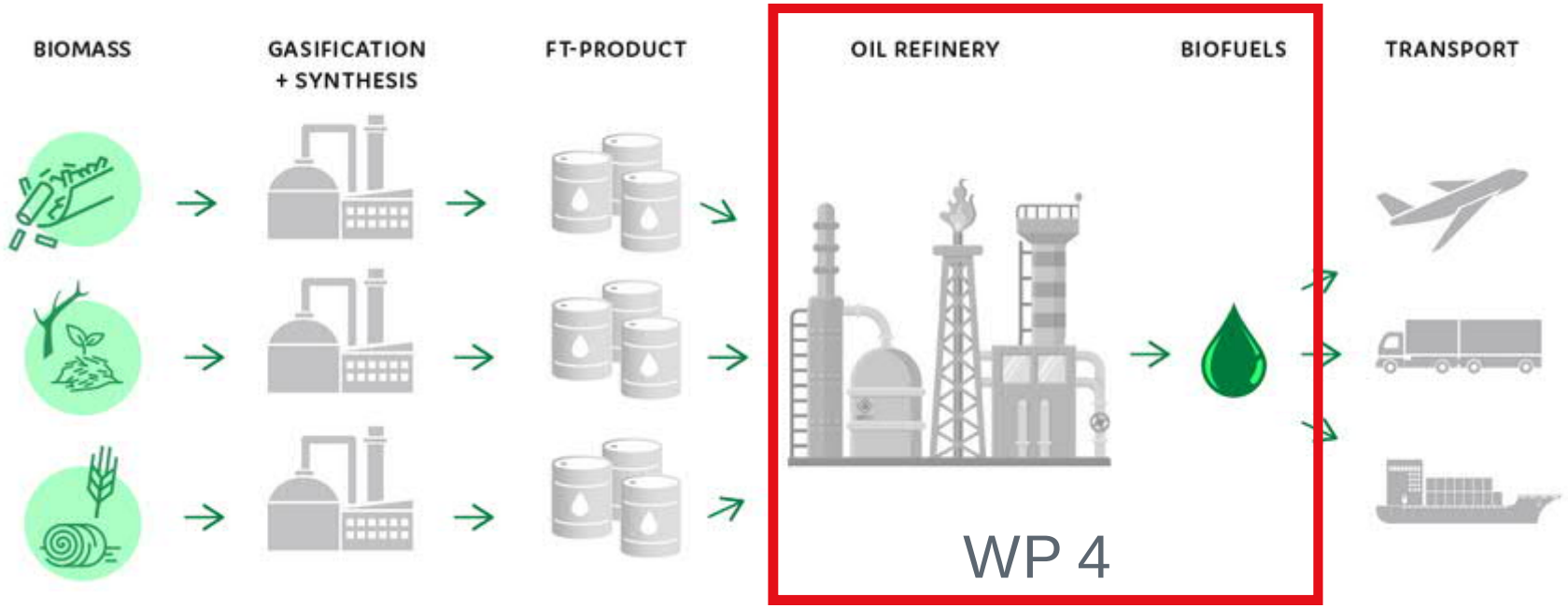
COMSYN PROCESS CONCEPT



Main Targets of the COMSYN project

- Concept: decentralized primary conversion of biomass in 30 – 150 MW units.
- Target: reduction of biofuel production cost up to 35% compared to alternative routes → production cost for diesel lower than 0.80 €/l.
- GHG savings: 80 %
- Overall efficiency to FT biocrude + heat: 80%

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COMSYN UPGRADING PROCESS - WP4

1) **CHARACTERISATION OF FT PRODUCTS AS A FEED FOR REFINERY**

2) **STAND-ALONE PROCESSING** - project results
   - Hydroisomerisation of FT diesel fraction

3) **CO-PROCESSING - project results**
   - Steam cracking
   - Hydrocracking

4) **POSSIBILITIES OF PROCESSING IN LITVÍNOV REFINERY (CZE)**

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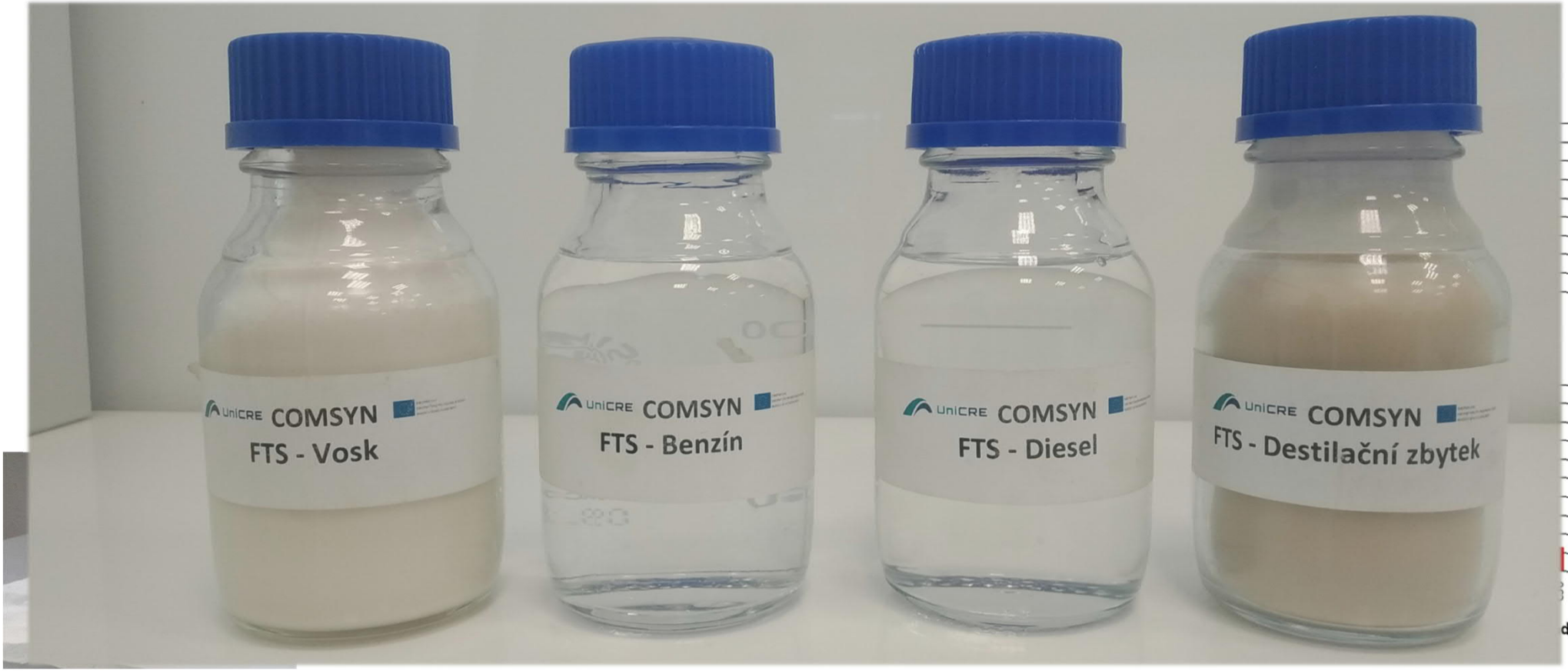
CHARACTERISATION OF FT PRODUCTS AS A FEED FOR REFINERY

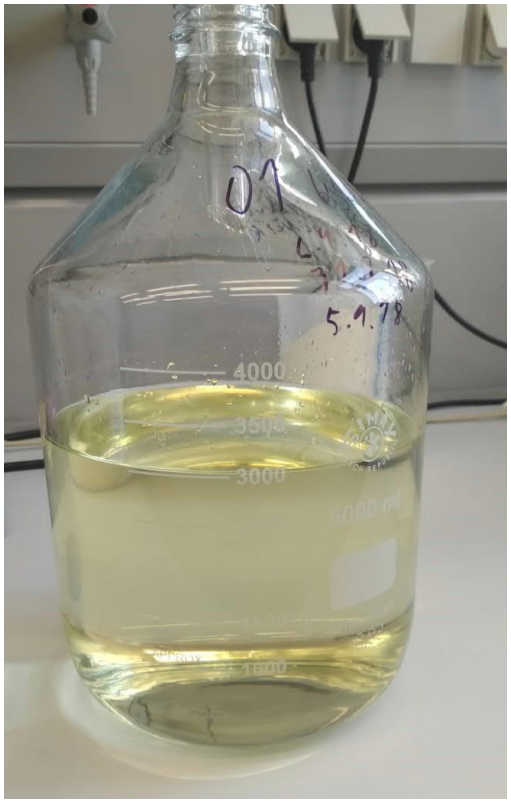


COMPARISON OF FT DIESEL FRACTION TO EN 590 AND EN 15940

		Diesel EN 590		Paraff. diesel EN 15940		FT diesel	
Parameter	unit	min.	max.	min.	max.	1st S.	2nd S.
Density at 15 °C	$kg.m^{-3}$	820	845	765	800	774.6	769.2
Kinematic viscosity at 40°C	$mm^2.s^{-1}$	2	4.5	2	4.5	2.3	2.1
Flash point	°C	>55	-	>55	-	93	84
CFPP, mild climate (grade A-F)*	°C	5	-20	5	-20	-6	-8
Cloud point	°C					-1.5	-1.7
Cetane index	-	46	-	65	-	86.7	82.8
Water content	$mg.kg^{-1}$	-	200	-	200	93.6	87.4
Sulphur content	$mg.kg^{-1}$	-	10	-	5	0.72	0.68

* 15.04. – 30.9. grade B (CFPP max. 0 °C)
01.10. – 15.11. grade D (CFPP max. -10°C)
16.11. – 28.02. grade F (CFPP max. -20 °C)
01.03. – 14.04. grade D (CFPP max. -10°C)

Hydroisomerisation step needed



Sample of FT diesel

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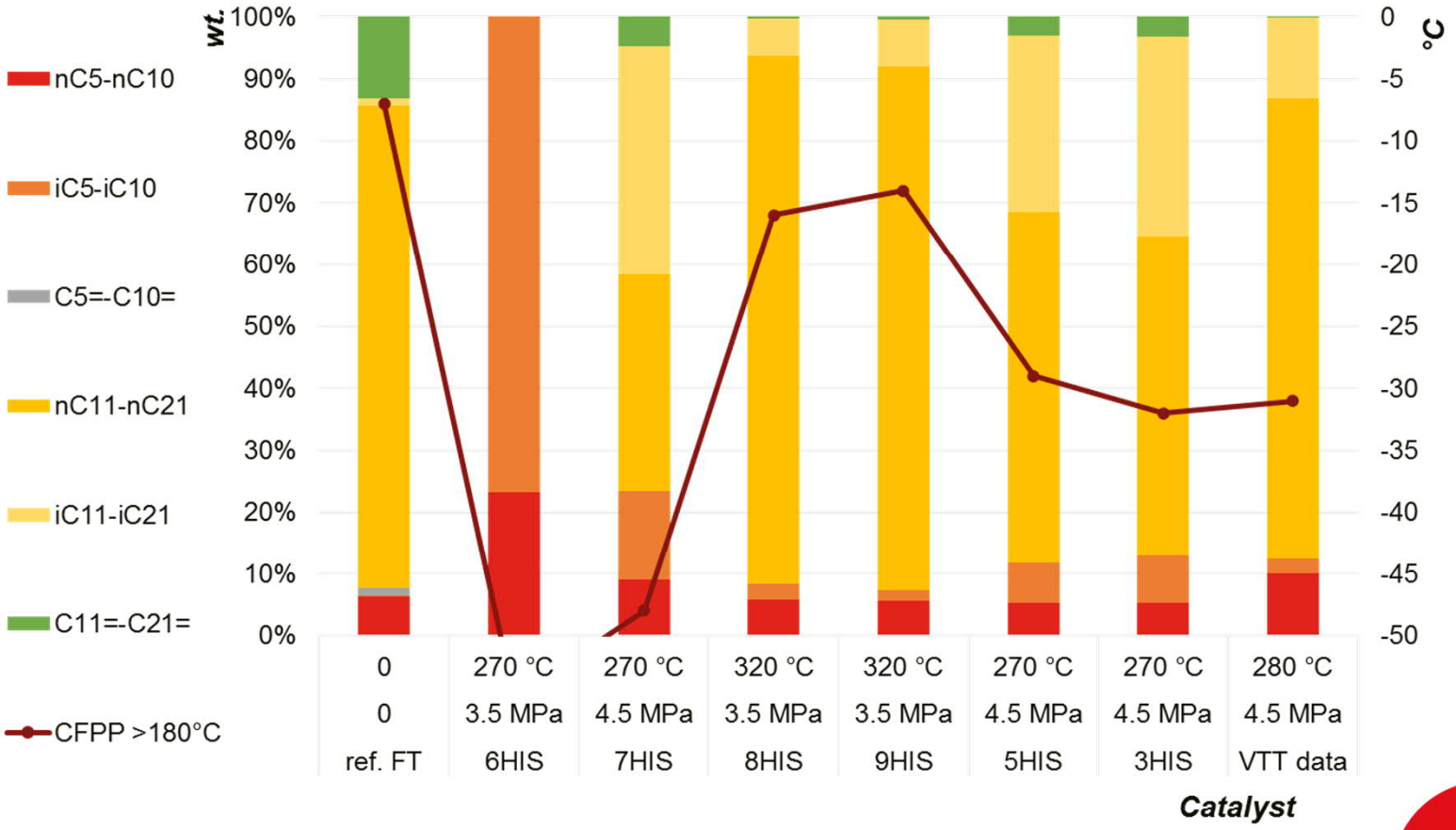
RESULTS OF HYDROISOMERISATION EXPERIMENTS

Reactor setup

Catalyst samples



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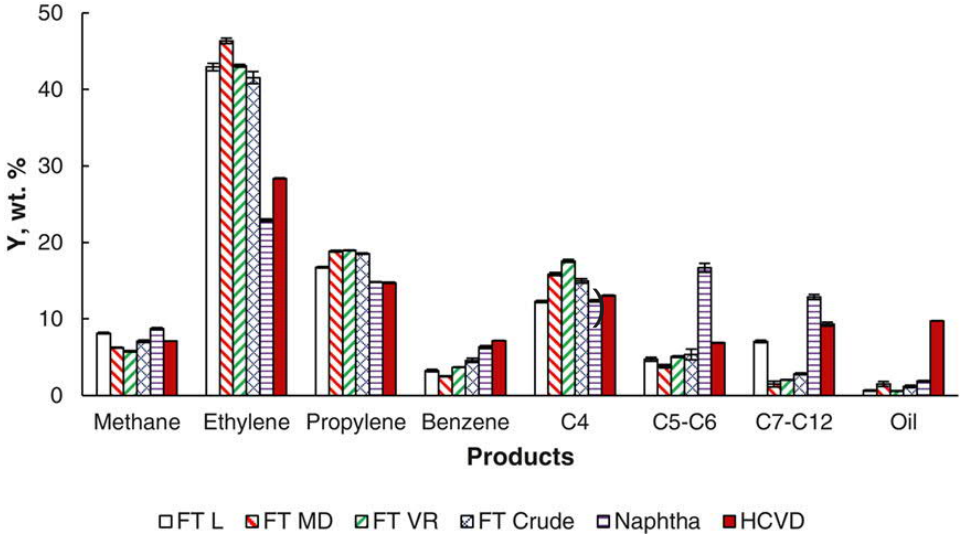
RESULTS OF STEAM CRACKING EXPERIMENTS

Main pyrolysis products of pure feedstocks

Pyrolysis conditions: 815 °C, 65 NmL min^{-1}, 400 kPa



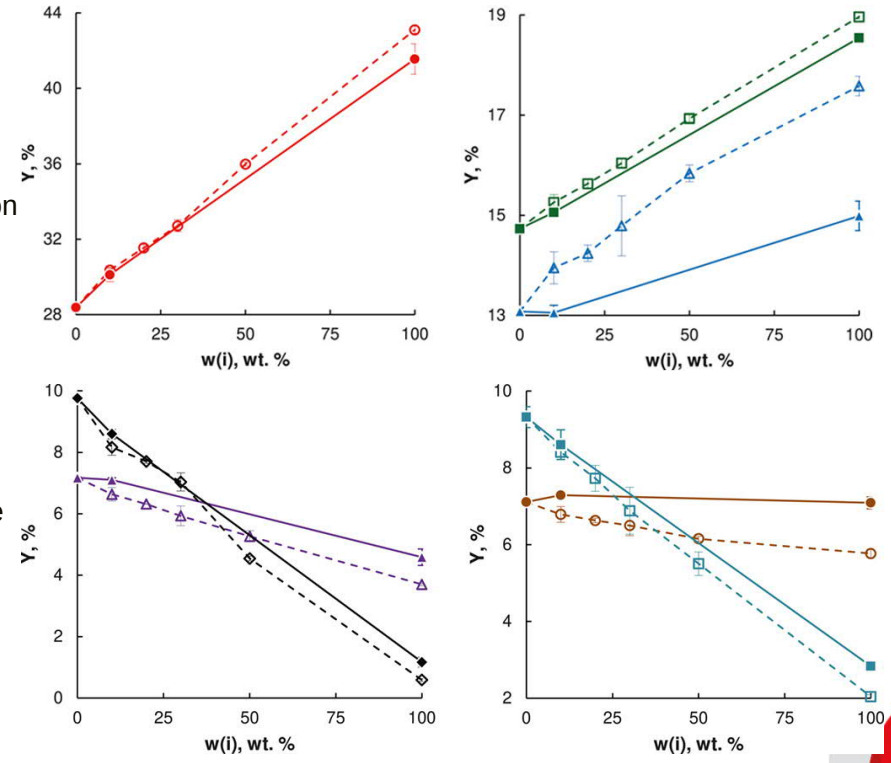
FT L – FT lights
FT MD – middle distillate
FT VR – vacuum residue
FT Cr – crude (Wax)
HCVD – hydrocracked vacuum distillate

Pyrolysis products of co-processing

Addition of FT Cr (▲ ♦ ● ■) and FT VR (Δ◊○□) of 0, 10, 20, 30, 50 and 100 wt.% in the HCVD feedstock

○• ethylene
□▪ propylene
Δ▲ C4 fraction

Δ▲ benzene
◊♦ oil
○• methane
□▪ C7–C12

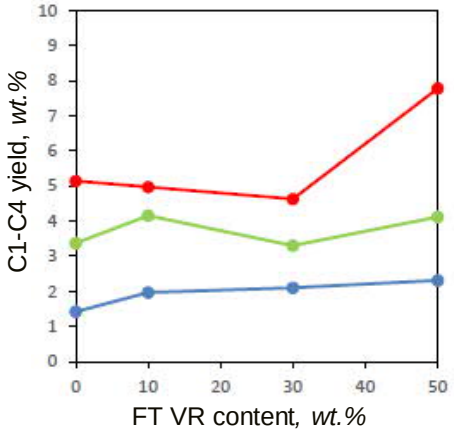


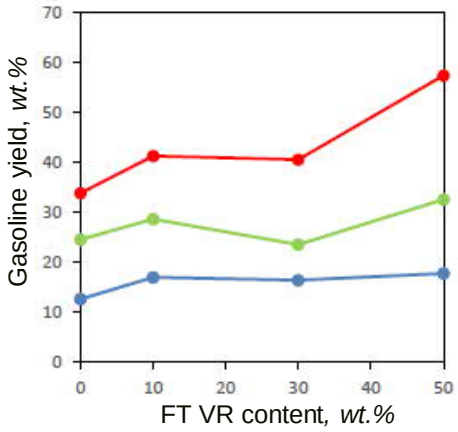
RESULTS OF HYDROCRACKING EXPERIMENTS

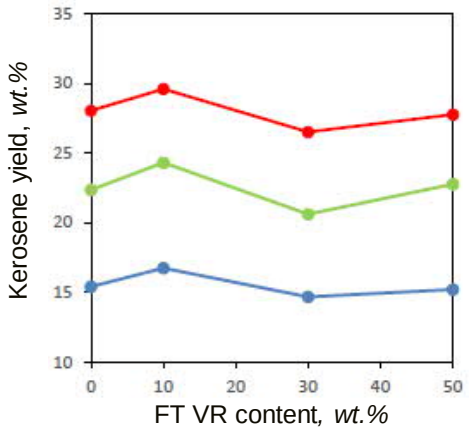
Hydrocracking of pure FT VR and co-processing

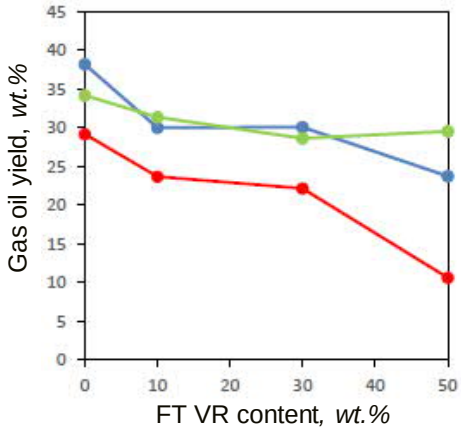
Addition of FT Vacuum Residue (FT VR) 0, 10, 20, 30, 50 and 100 wt.% in the Vacuum Distillate (VD) feedstock

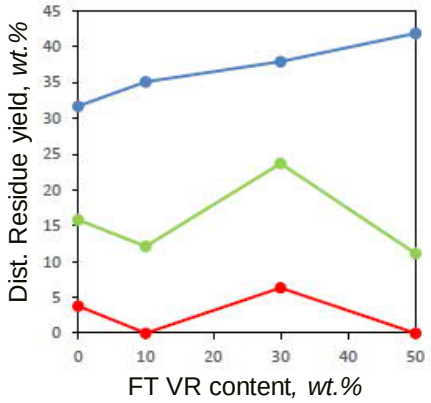
Hydrocracking experiments were performed at conditions: pressure of 16 MPa and reaction temp.: 390, 400 and 410 °C



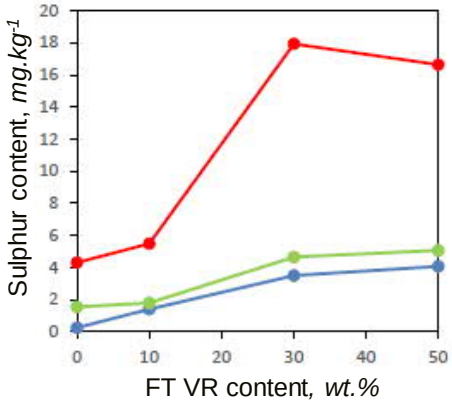








Gasoline yield C5 –150 °C
Kerosene yield 150–230 °C
Gas oil yield 230–360 °C
Dist. residue > 360 °C



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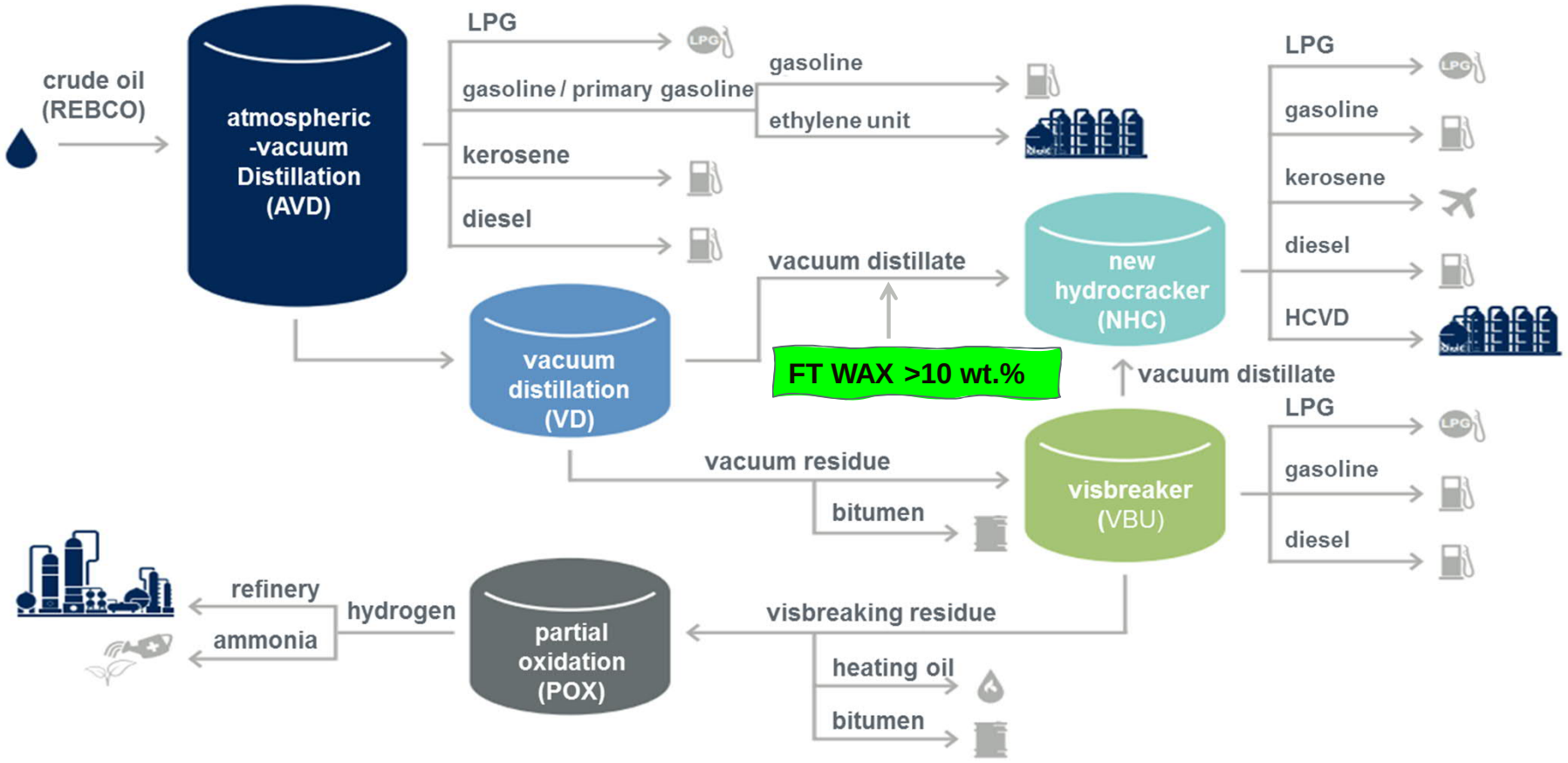
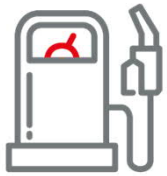


CONCLUSIONS

- Reduction of crude oil consumption.
- GHG savings via processing of renewable materials.



- COMSYN final FT diesel meets European standards for automotive fuels = drop-in fuel.
- Addition of FT products into fossil feed will not impair the quality of fuels.

- Addition of FT products showed a positive influence on the conversion of the fraction boiling above 400 °C to lighter fractions consequently causing higher production of basic plastics (already with recycled biomaterial).

- Processing and co-processing of waste materials in the existing refineries will help to preserve an employment in regions currently dependent on crude oil refining.

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ACKNOWLEDGEMENT

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DLR, German Aerospace Center, Germany

Wood, Italy

AFRY, Finland

CONSORTIUM

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THANK YOU FOR YOUR ATTENTION