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# Advanced biofuels by gasification – Status of R&D work in Güssing

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# Team of R&D

Institute of Chemical Engineering  
Working Group Future Energy Technology

- Scientific partners



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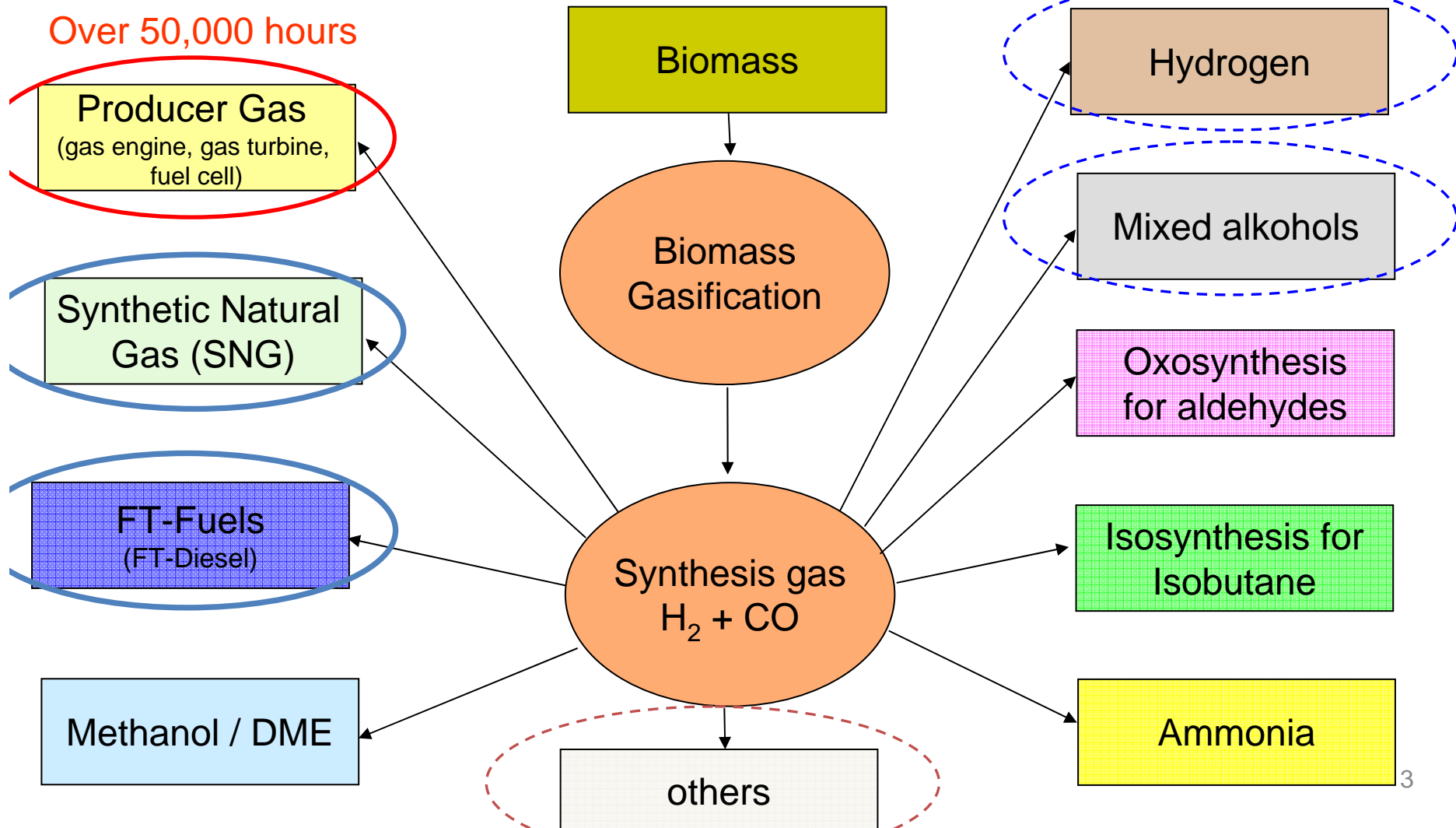
- Engineering (as example)

repotec  
renewable power technologies

- Operators (as example)



# The basic concept – “Green Chemistry”



# BioSNG demonstration plant



Gasifier

BioSNG PDU

Technikum

Fuelling Station

# Commercial FICFB gasifiers

Location	Electricity production	Fuel / electr. MW, MWeI	Start up	Status
Güssing, AT	Gas engine	8.0 / 2.0	2002	Operational
Oberwart, AT	Gas engine / ORC	8.5 / 2.8	2008	Operational
Villach, AT	Gas engine	15 / 3.7	2010	Commissioning
Klagenfurt, AT	Gas engine	25 / 5.5	2011	planing
Ulm, DE	Gas engine / ORC	14 / 5	2011	Under construction
Göteborg, Sweden	BioSNG	32/20 (BioSNG)	2012	planing

# Gas Composition (after gas cleaning)

Main Components		
H <sub>2</sub>	%	35-45
CO	%	22-25
CH <sub>4</sub>	%	~10
CO <sub>2</sub>	%	20-25

Minor Components		
C <sub>2</sub> H <sub>4</sub>	%	2-3
C <sub>2</sub> H <sub>6</sub>	%	~0.5
C <sub>3</sub> H <sub>4</sub>	%	~0,4
O <sub>2</sub>	%	< 0,1
N <sub>2</sub>	%	1-3
C <sub>6</sub> H <sub>6</sub>	g/m <sup>3</sup>	~8
C <sub>7</sub> H <sub>8</sub>	g/m <sup>3</sup>	~0,5
C <sub>10</sub> H <sub>8</sub>	g/m <sup>3</sup>	~2
TARS	mg/m <sup>3</sup>	20-30

Possible poisons		
H <sub>2</sub> S	mgS/Nm <sup>3</sup>	~200
COS	mgS/Nm <sup>3</sup>	~5
Mercaptans	mgS/Nm <sup>3</sup>	~30
Thiophens	mgS/Nm <sup>3</sup>	~7
HCl	ppm	~3
NH <sub>3</sub>	ppm	500-1000
HCN	ppm	~100
Dust	mg/Nm <sup>3</sup>	< 20

**H<sub>2</sub>:CO = from 1.7:1 to 2:1**

# BioSNG Demonstration Project

A 1 MW SNG Process Development Unit (PDU) is erected within the EU project BioSNG and allows the demonstration of the complete process chain from wood to SNG in half-commercial scale.

A consortium consisting of four partners is responsible for the PDU:

- CTU – Conzepte Technik Umwelt AG
- Repotec GmbH
- Paul Scherrer Institute
- Technical University Vienna

The project BioSNG is co-funded by

- the European Commission
- 6th Framework Programme  
PrNo TREN/05/FP6EN/  
S07.56632/019895
- Swiss electric research
- Bundesförderung Österreich
- WIBAG





# Results

- December 2008: First conversion of product gas into rawSNG
- June 2009: BioSNG at H-Gas quality produced
- June 24<sup>th</sup> : inauguration – CNG cars were fuelled using BioSNG from wood
- June 2009 CNG-car was successfully used for 1000km with BioSNG





# Quality BioSNG

	unit	Germany DVGW regulation G260	Austria ÖVGW regulation G31	BioSNG
Wobbe Index	[kWh/m <sup>3</sup> ]	12,8-15,7	13,3-15,7	14,15
Relative density	[-]	0,55-0,75	0,55-0,65	0,56
Higher heating value	[kWh/m <sup>3</sup> ]	8,4-13,1	10,7-12,8	10,7

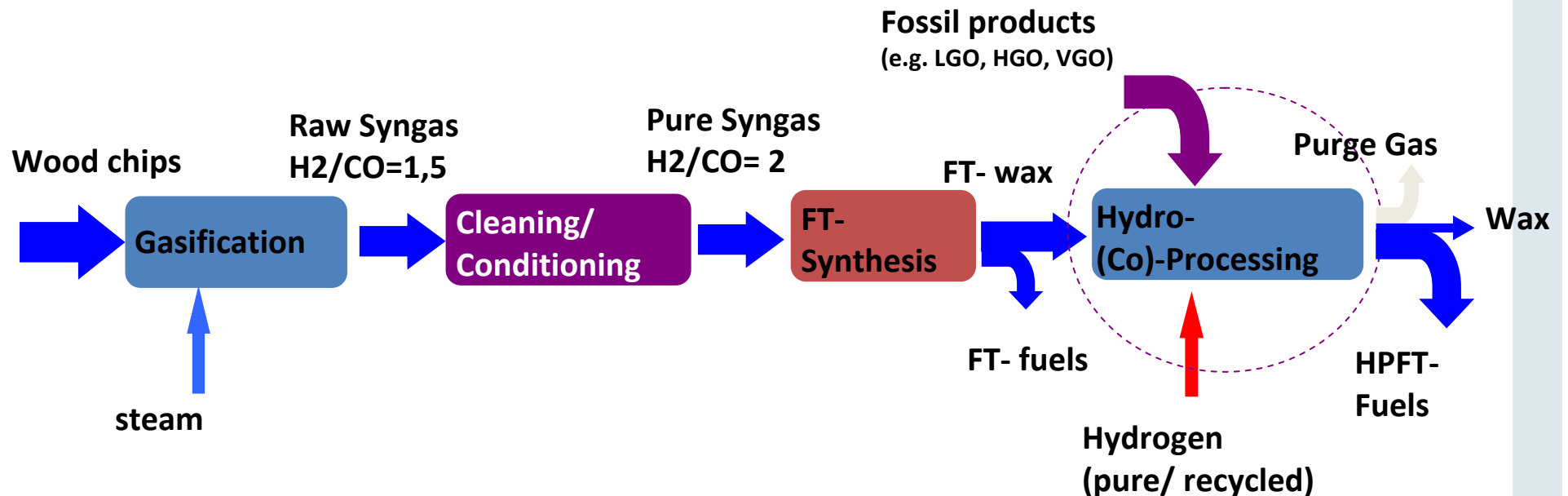
# Synthetic biofuels (FT- Route)



Cellulose, Polyose (Hemicellulose )  
Lignin

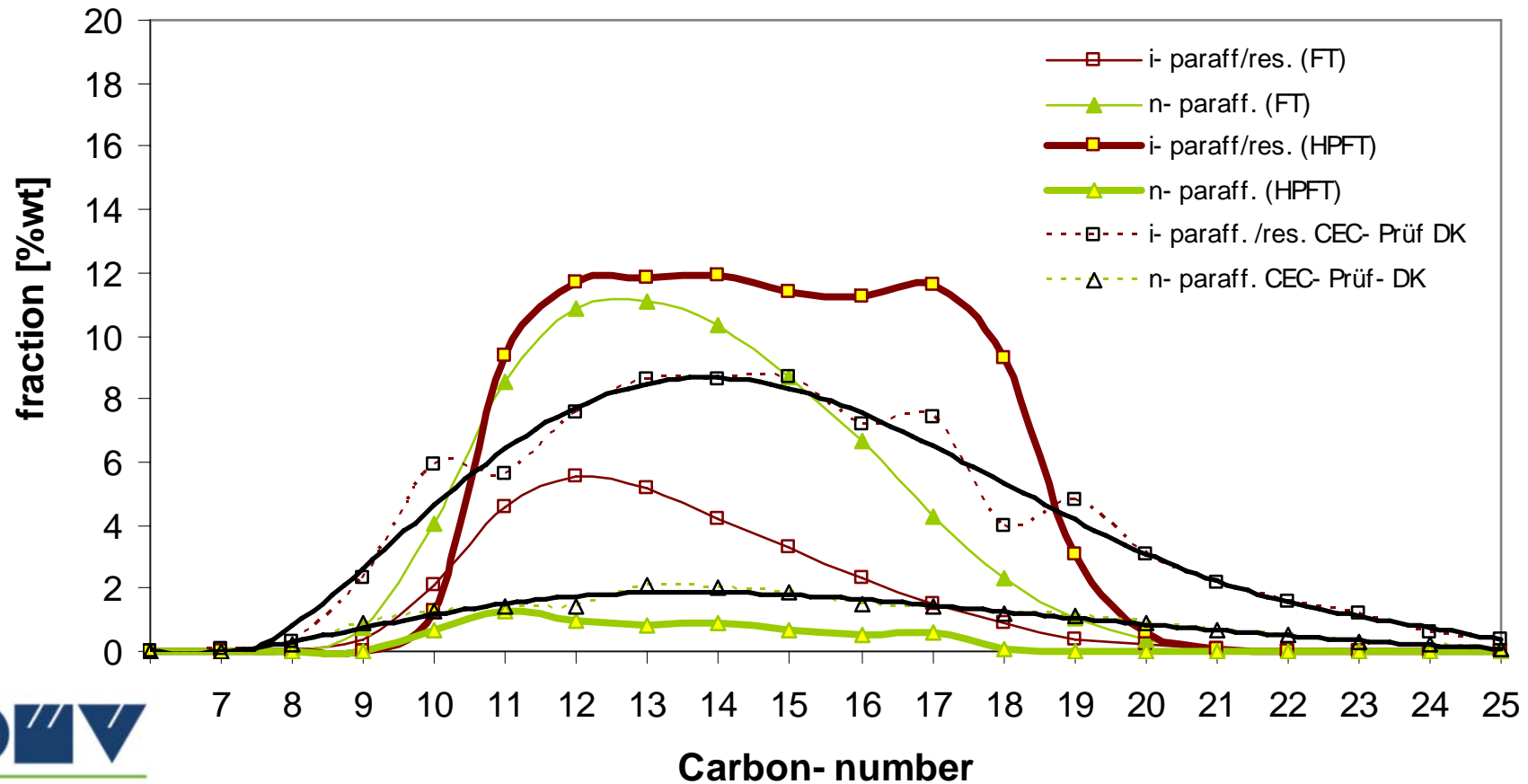


i/n- paraffins  
(hydrocarbons)

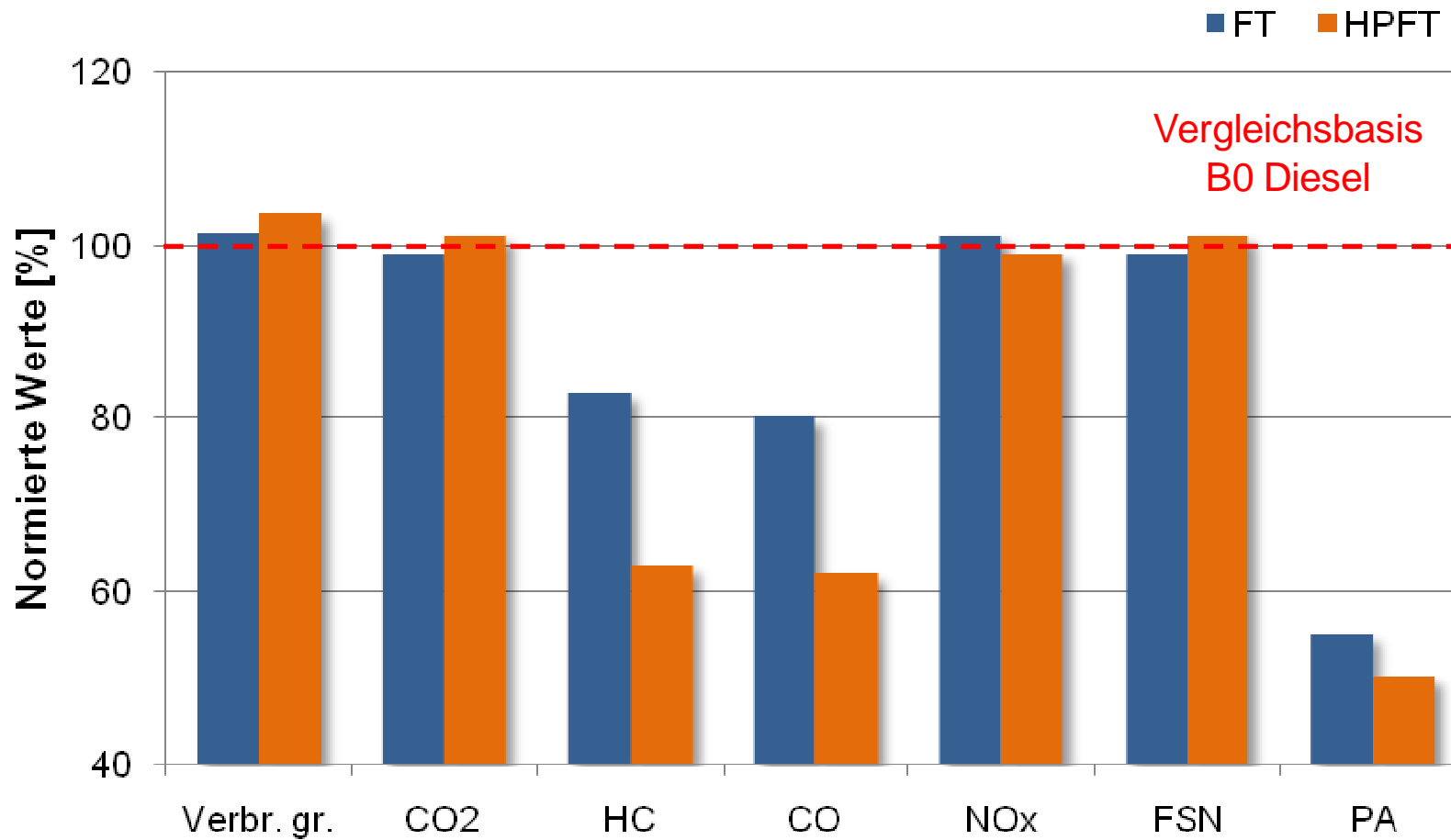


# Comparison of produced FT Fuels

	FT- Diesel	HPFT- Diesel	CEC- Prüf.
ACN:	>72 $t_d = 2,5$ s	68,5 $t_d = 2,91$ s	>51,8 /
CFPP/CP/FP:	-12/ -9/ - °C	-62/ -60 / -98°C	-18/ -5 °C



# Results on engine tests with 20% blends



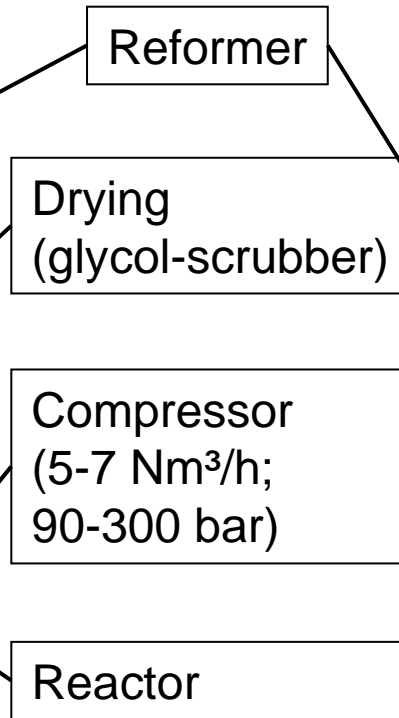
# Mixed alcohols

- Funded by „Klima und Energiefonds“ and Bioenergy 2020+
- Aim is to get fundamental know how in the synthesis of mixed alcohols from biomass
- Main advantage is very simple gas cleaning, due to sulphur resistant catalyst

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# Actual status: first experiments are done



# BioH<sub>2</sub>-4Refineries

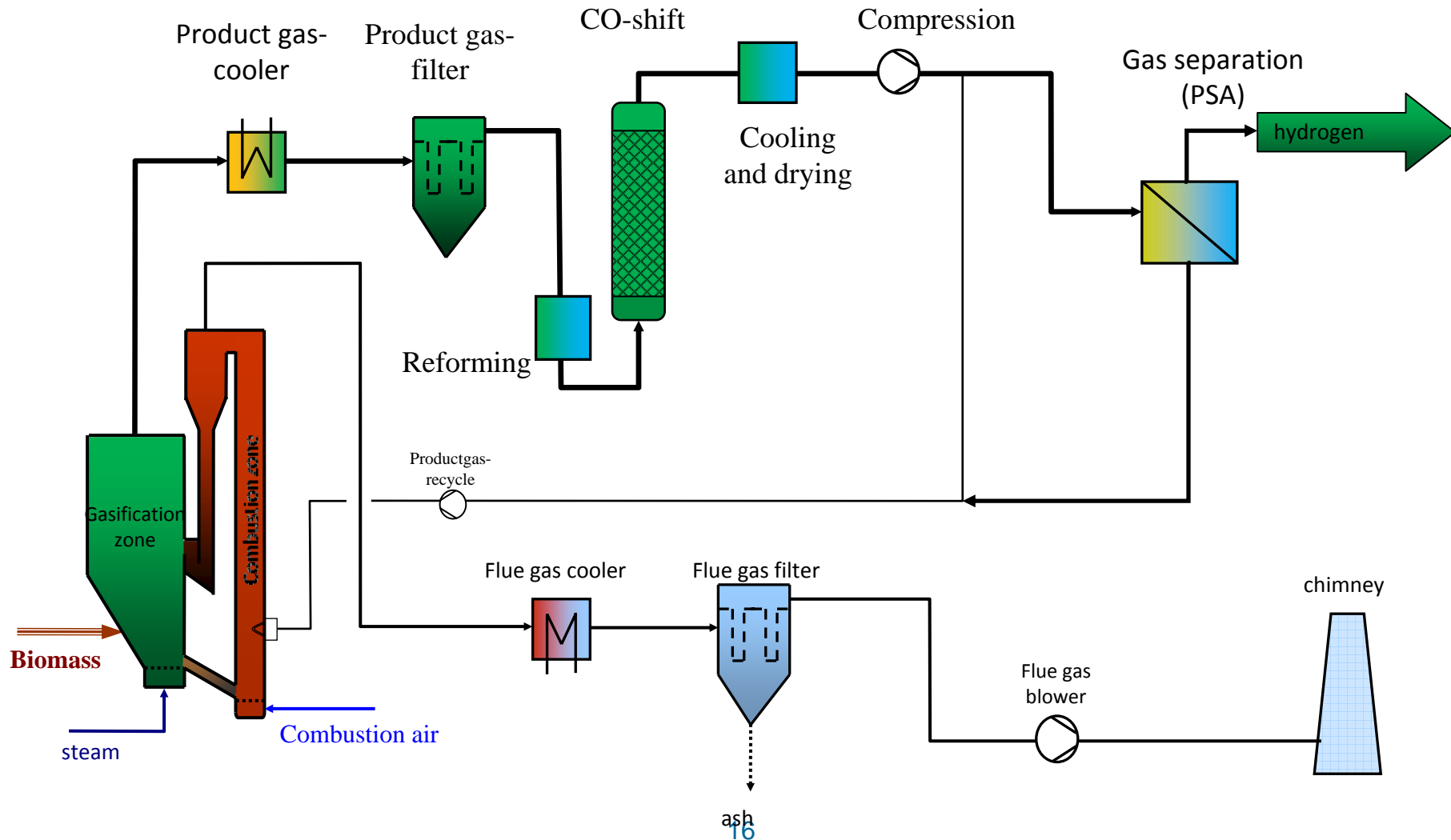
Economic evaluation of production of hydrogen for a refinery

- Coordination by OMV
- 50 MW fuel plant to replace fossil hydrogen
- Evaluation of the biomass resources available for such a plant
- Basic - engineering of the gasifier as well as of all other sub units, including pipelines, utility systems, logistic needs
- Optimal use of by-products
- Economic evaluation





# Simplified flow chart



# Summary

- Biomass CHP Güssing has excellent frame conditions for R&D on synthesis gas applications
- Focus of R&D is on small CHP and on synthesis gas applications (BioSNG, Fischer Tropsch, Mixed Alcohols, Hydrogen)
- Gasification enables the conversion of biomass to many useful products

More info at  
<http://www.ficfb.at>