

Gas Upgrading from Thermal Gasification

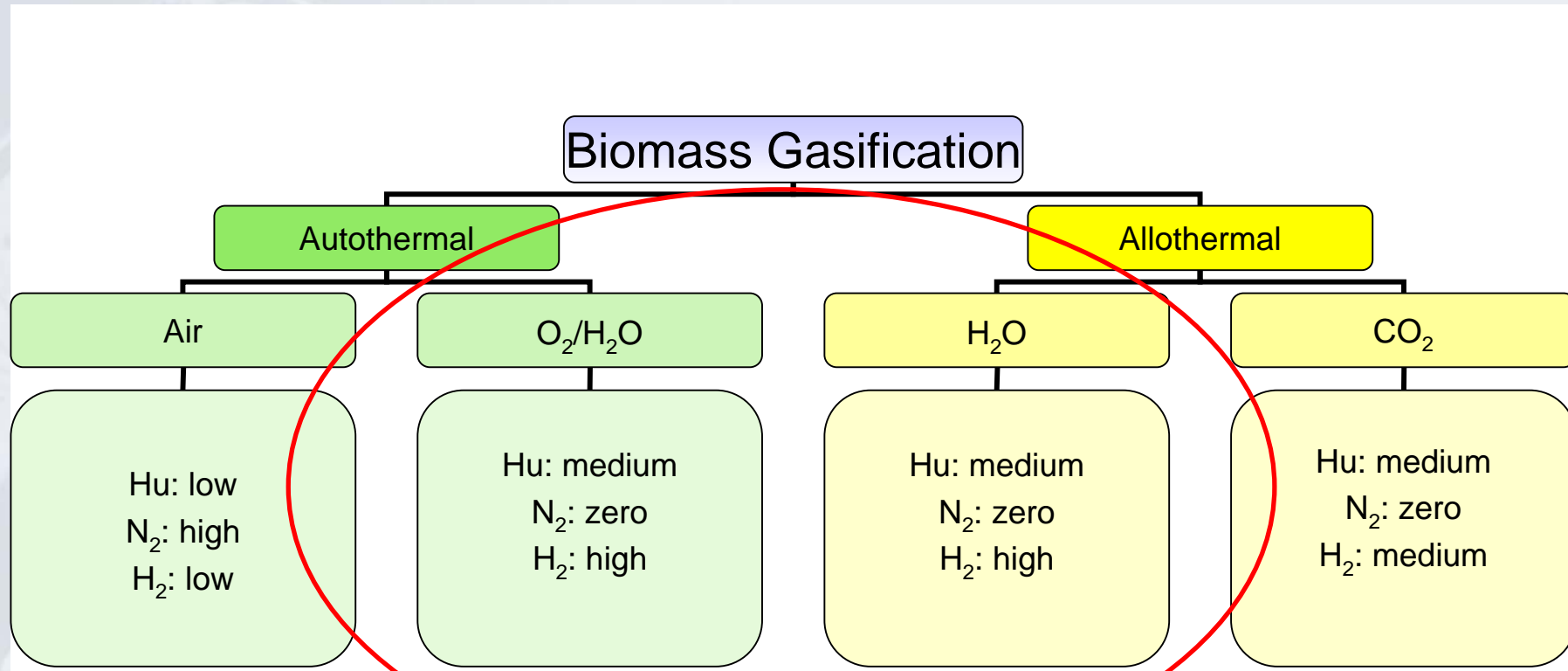
Dr. Reinhard Rauch

at

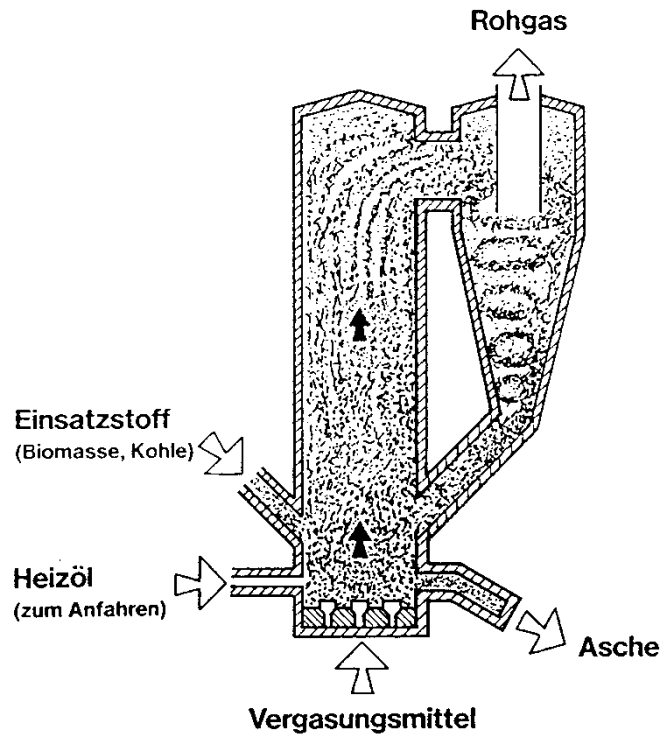
Task 37 “Energy from Biogas” Research Exchange Workshop

**BIOGAS UPGRADING**

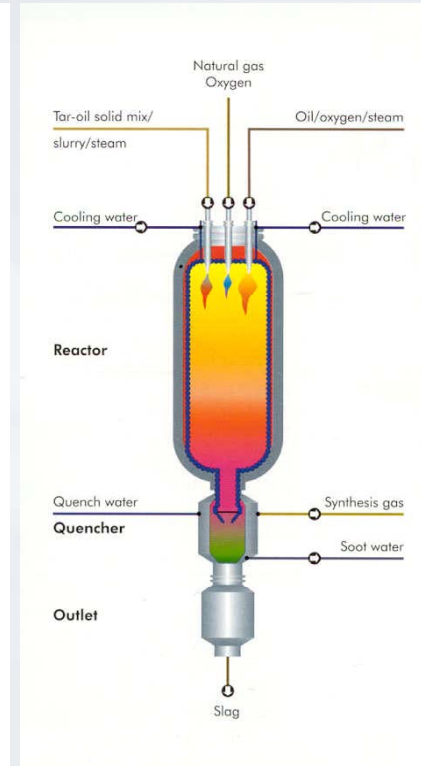
8. Oktober 2009 IFA-Tulln



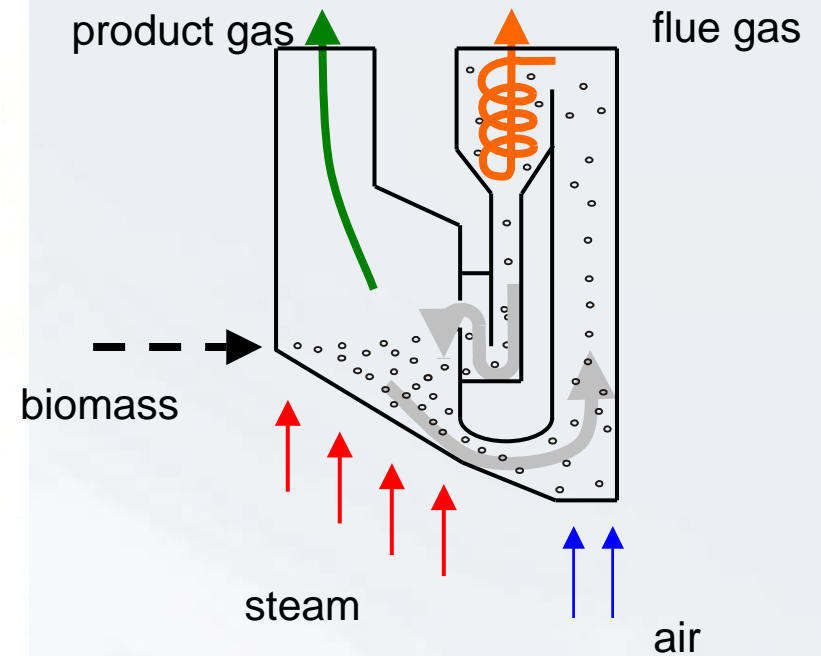
# Reactors for Gasification



Fluidised Bed (Steam/O<sub>2</sub>)

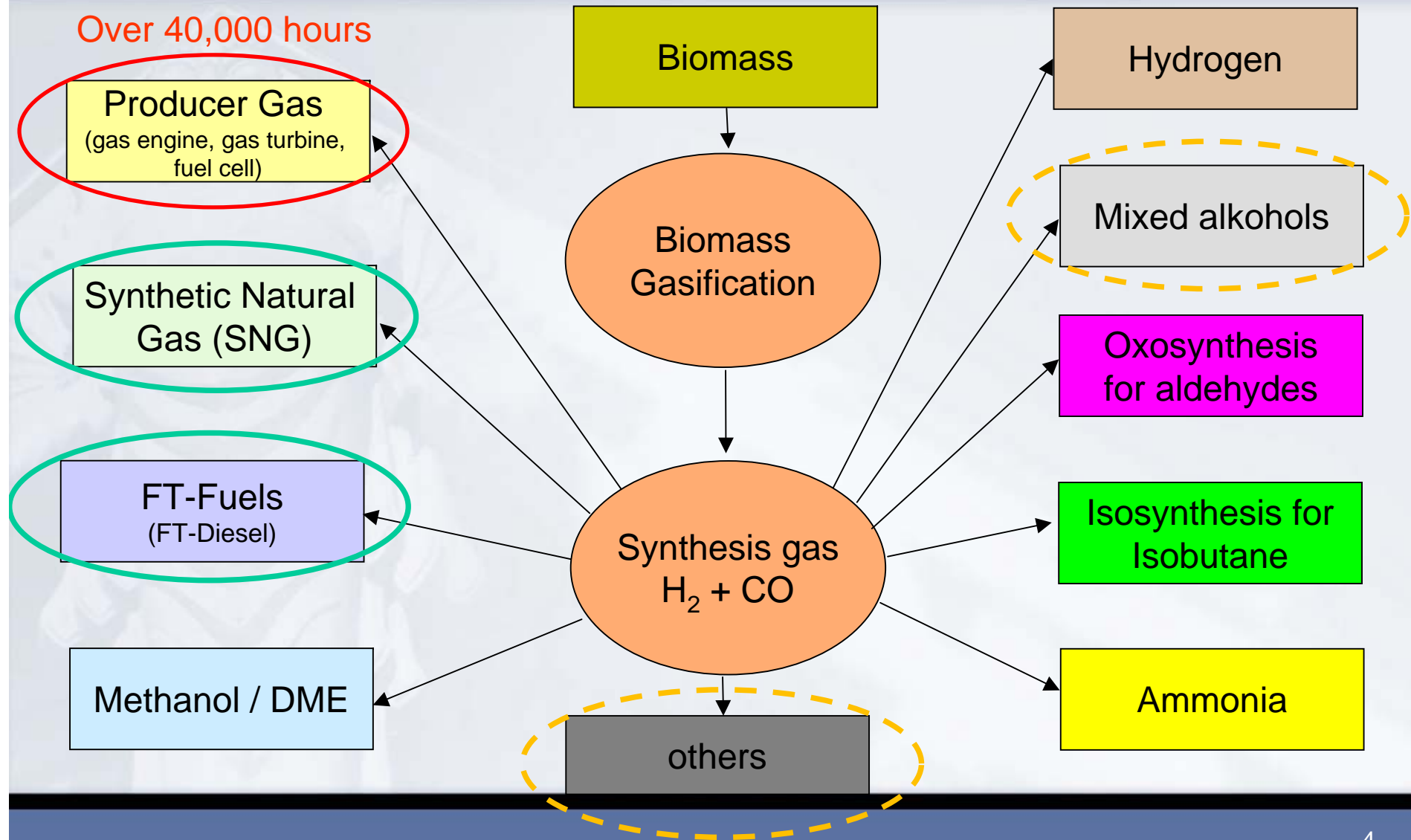


Entrained Flow (O<sub>2</sub>)



Dual Fluidised Bed (Steam)

# The basic concept – “Green Chemistry”



- Efficiency
- Usability of product
- Robust synthesis
- Know how available

Gothenburg Biomass Gasification Plant	Sweden	Feasibility study
Dakota Gas	USA	Commercial plant
BioSNG	Güssing Austria	Demonstration
Milena Gasification	Netherlands	R&D
Heat Pipe Reformer Agnion	Germany, Austria	R&D
ArtFuel Cutec	Germany	R&D

# Biomass CHP Güssing design data

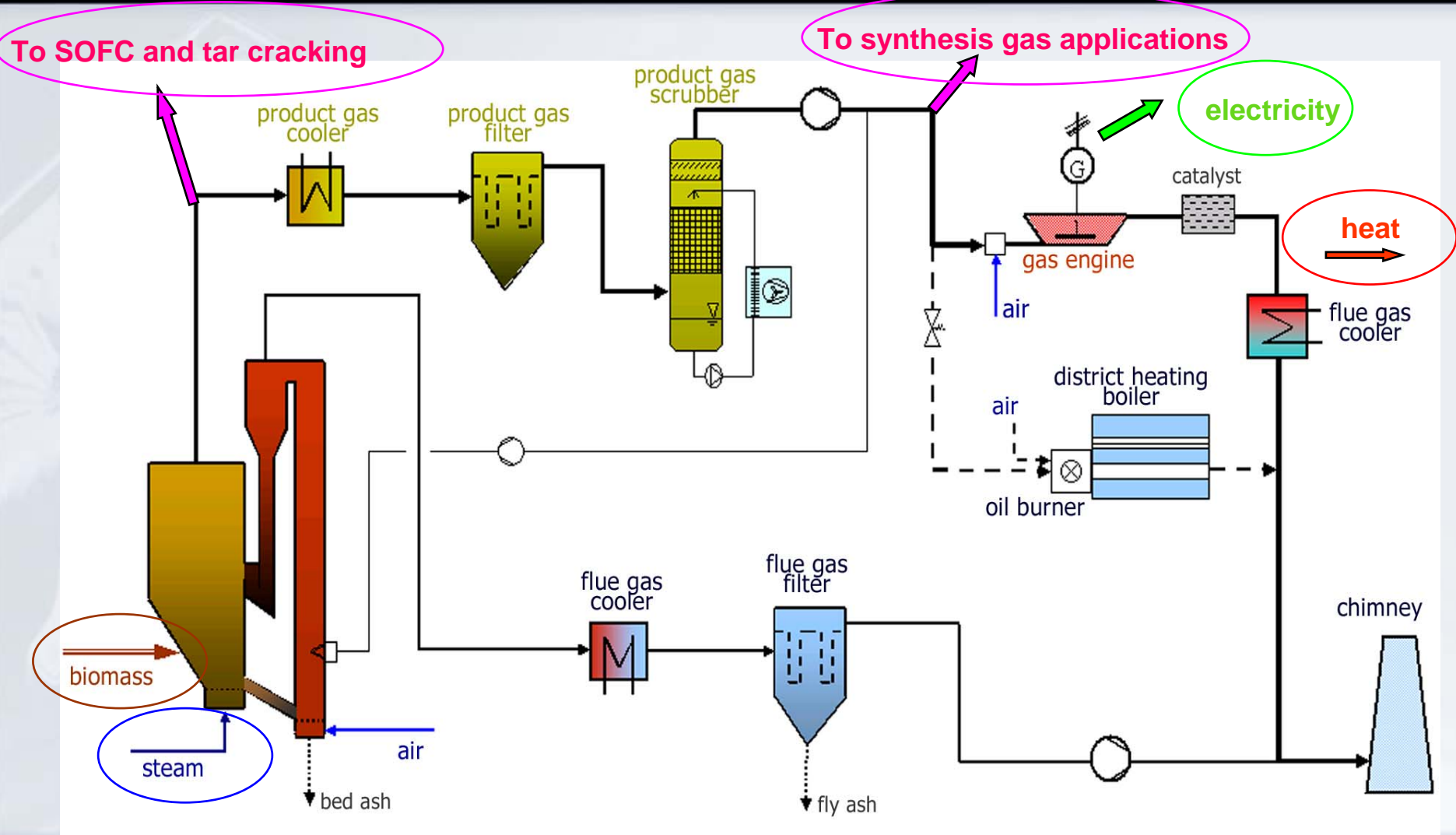


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- Start of construction      September 2000
- Start up                      January 2002
- Fuel                            2,2    to/h    (Wood chips)
- Water content              15    %        (35 %)
- Fuel power                    8      MW
- Electrical power              2      MW
- Thermal power               4,5    MW
- Electrical efficiency        25    %        (20%)
- Total efficiency              80    %
- Owner and operator        Biomass Power Station  
   Güssing Association

# CHP-PLANT GÜSSING



# Gas Composition (after gas cleaning)



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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>6</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
Mercaptans	mgS/Nm <sup>3</sup>	~30
Thiophens	mgS/Nm <sup>3</sup>	~7
HCl	ppm	~3
NH <sub>3</sub>	ppm	500-1000
Dust	mg/Nm <sup>3</sup>	< 20

**H<sub>2</sub>:CO = from 1.5:1 to 2:1**

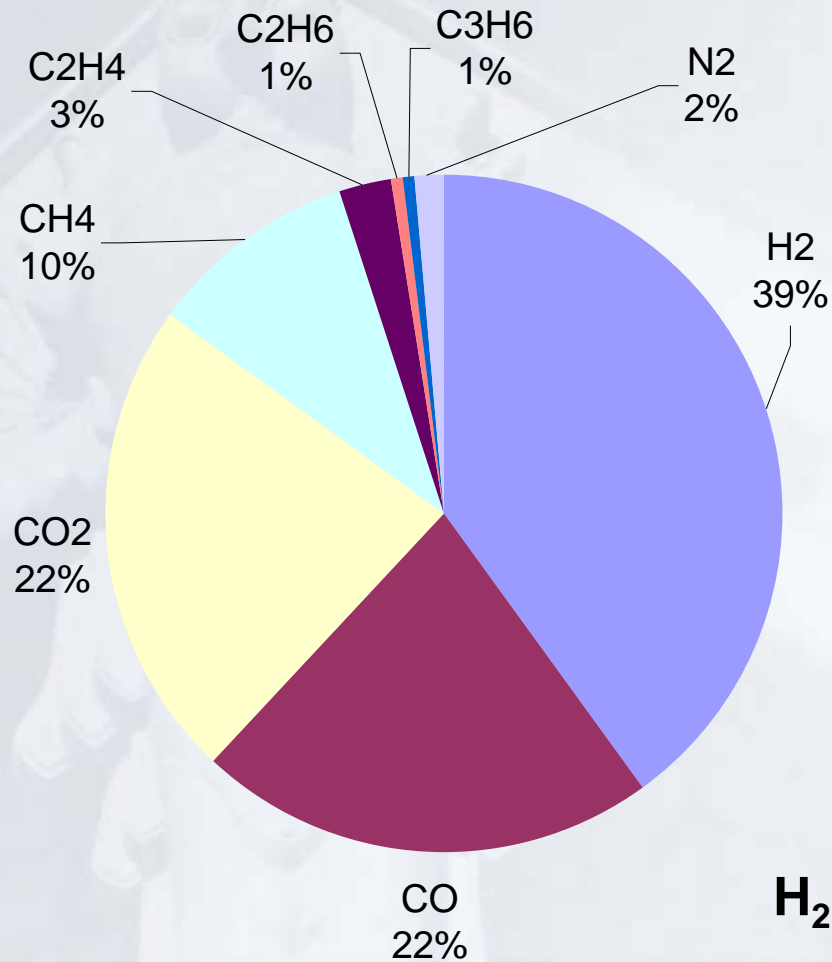
# Gas composition



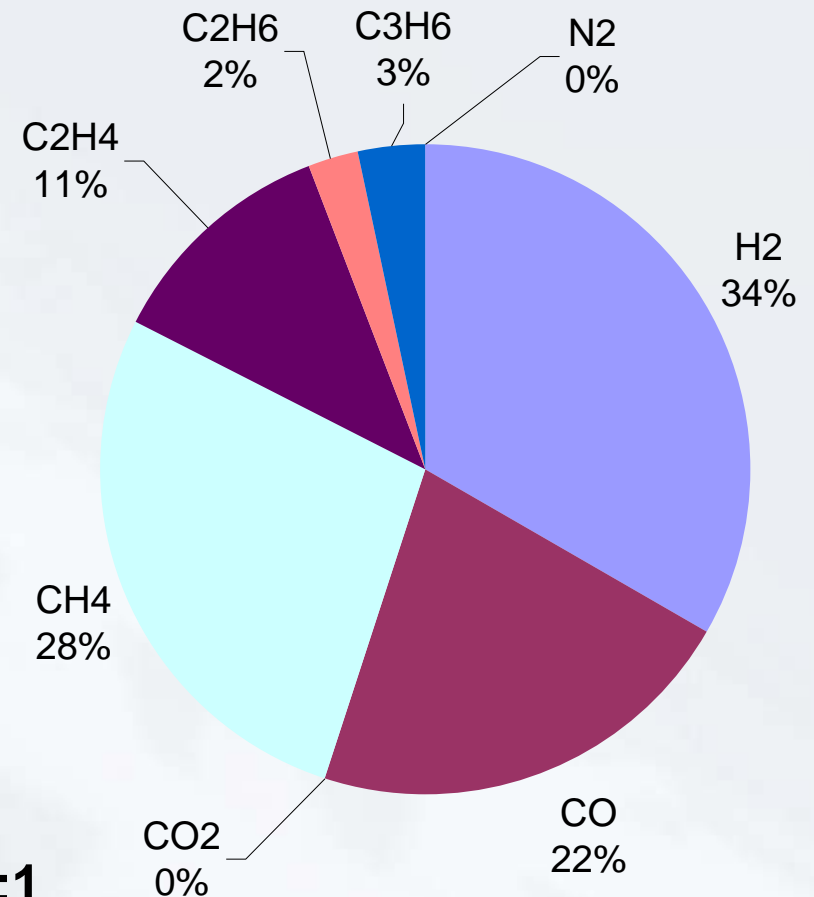
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### On volume basis



### On energy basis



$H_2:CO = 1.8:1$

Efficiencies over 60% from biomass to SNG are possible

# BioSNG Demo Plant



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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



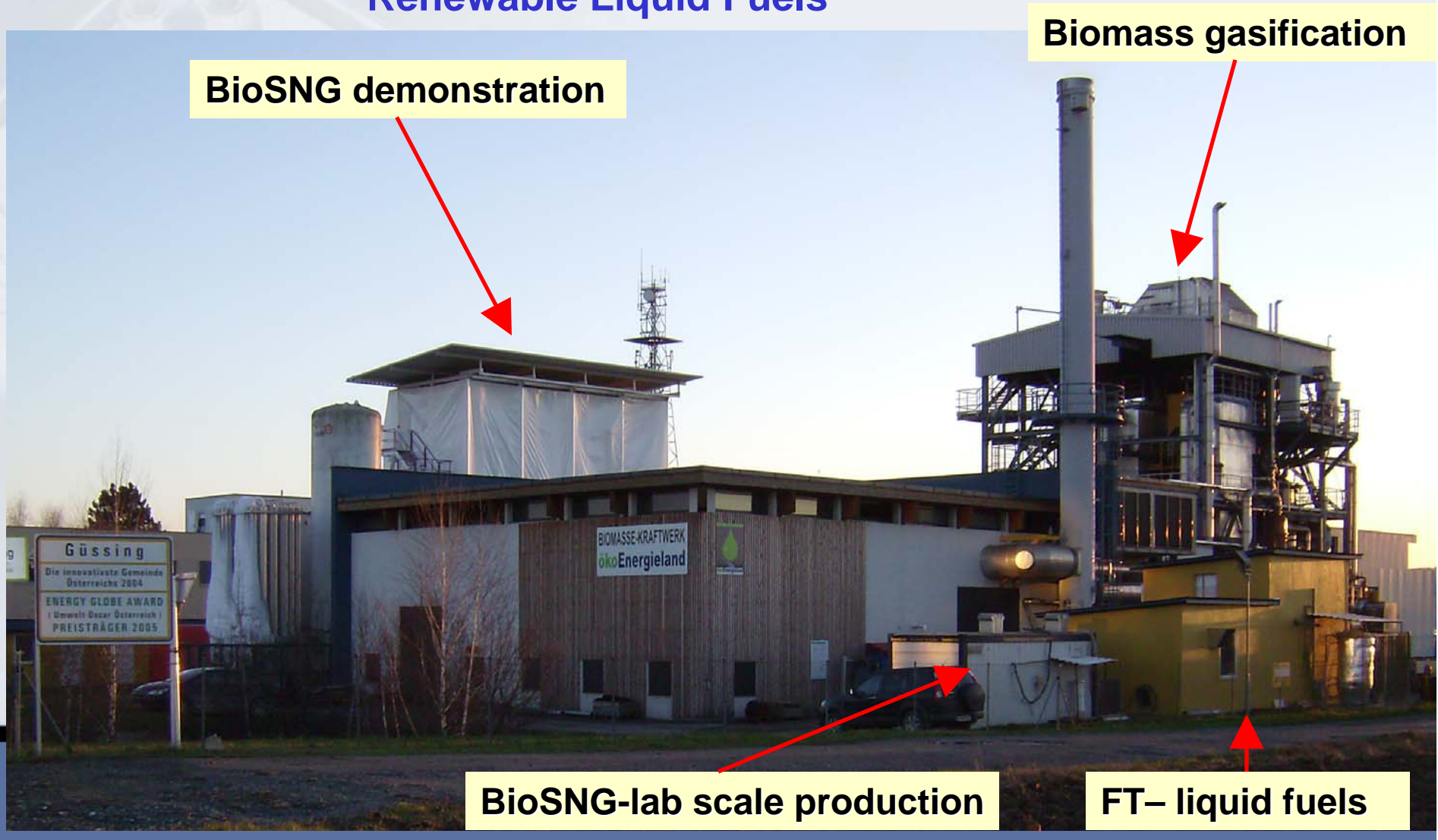
# Biomass CHP Güssing



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## Test plants – Renewable Synthetic Natural Gas (SNG), Renewable Liquid Fuels



BioSNG demonstration

Biomass gasification

BioSNG-lab scale production

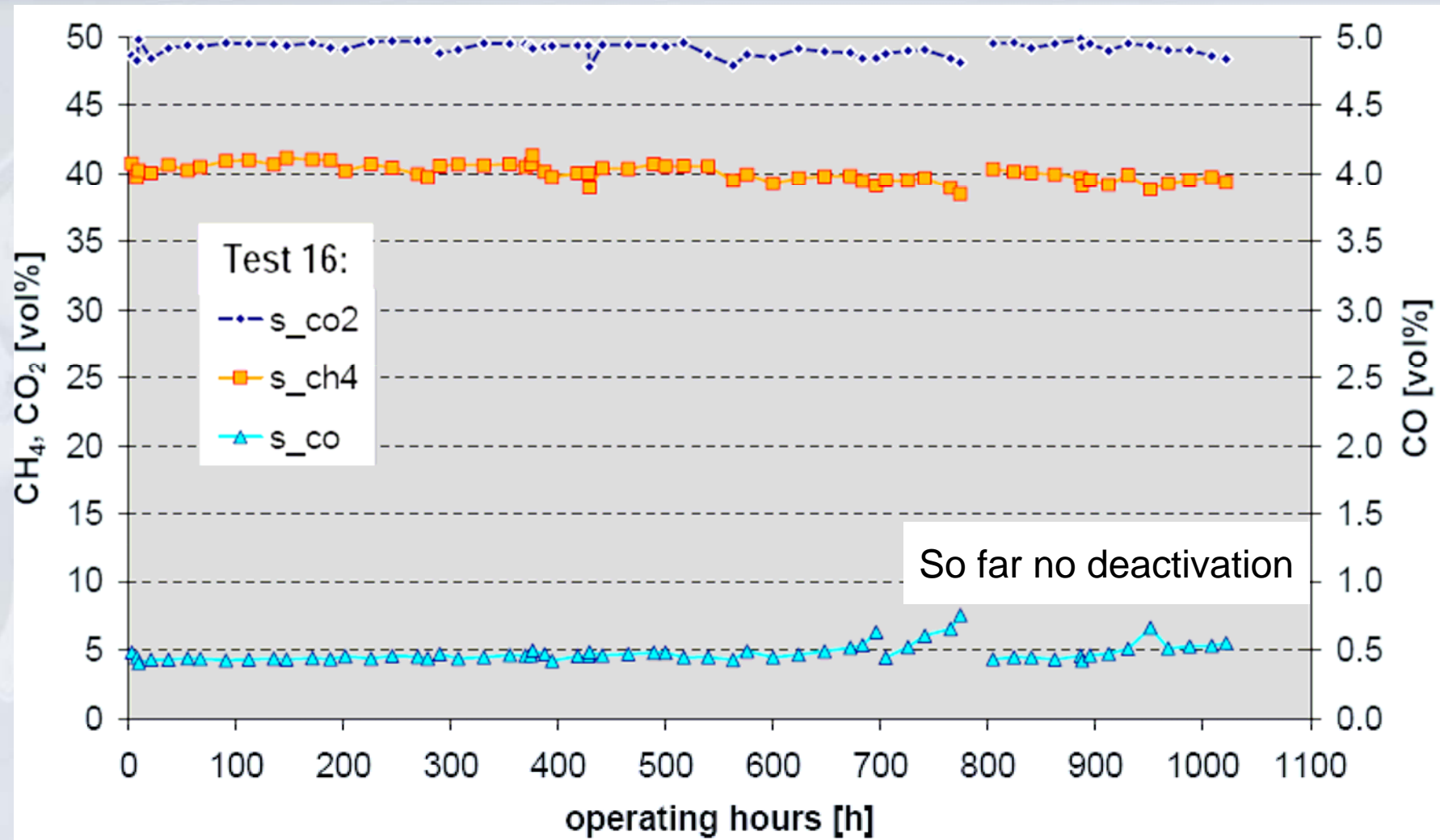
FT- liquid fuels

# Results BioSNG lab scale



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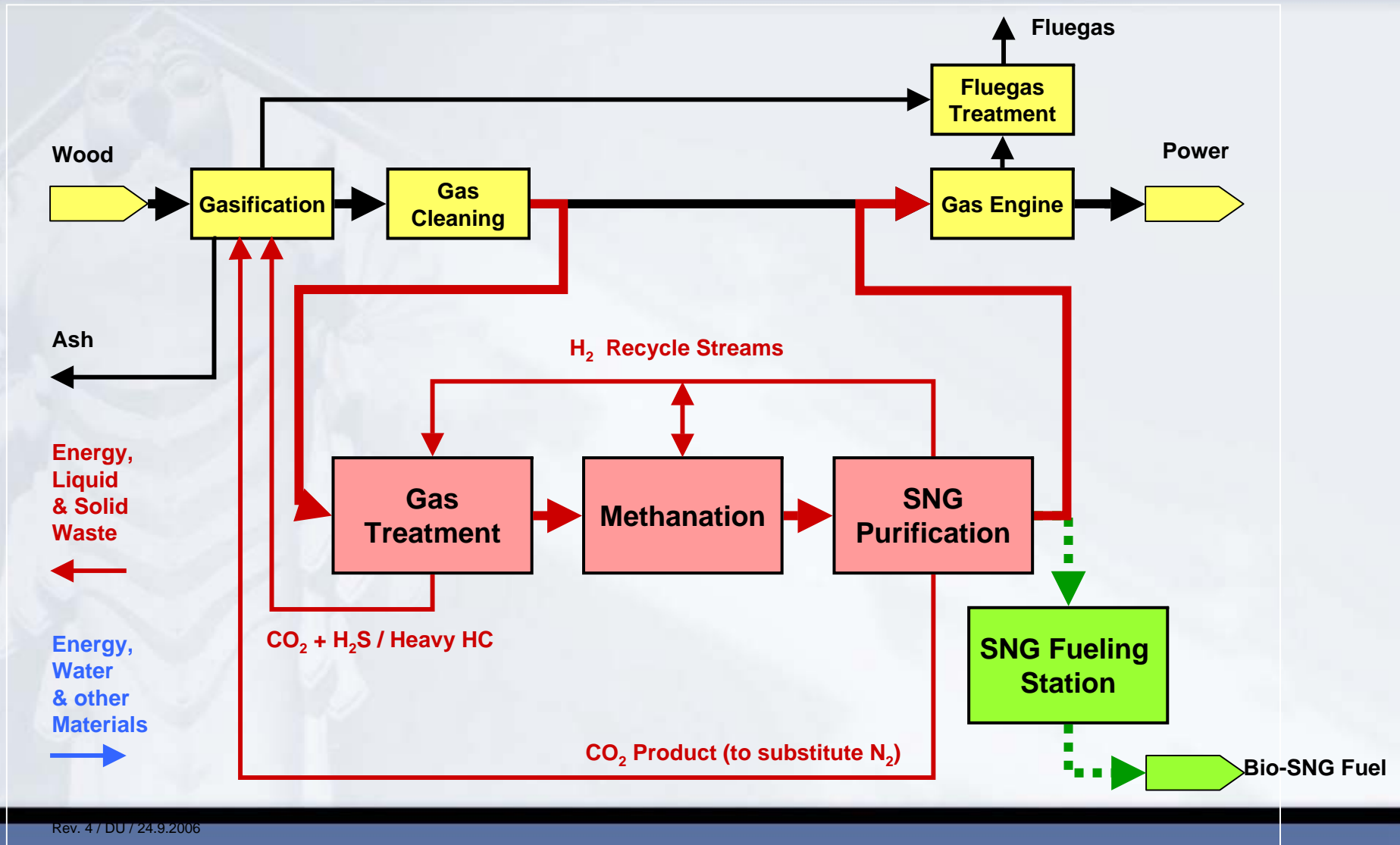


# Schema BioSNG demonstration



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# 1MW BioSNG demonstration plant



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- 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



# Results BioSNG



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	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

# Information



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<http://www.ficfb.at>

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