

A large, light-colored stone statue of a figure with an owl on its head, set against a background of a building's facade. The figure has its arms outstretched and is wearing a long, flowing robe. The owl is perched on the figure's head, facing forward. The background shows the architectural details of a building, including a triangular pediment and columns.

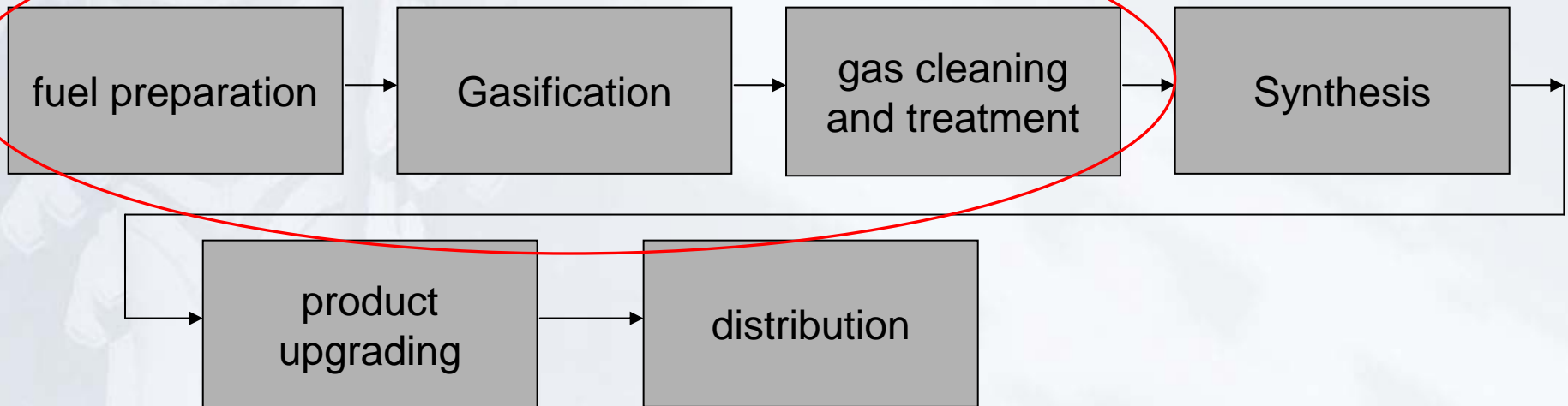
## **2nd generation biofuels Güssing demo plant**

**Dr. Reinhard Rauch**  
**Institute for Chemical Engineering**  
**Vienna, University of Technology**

- IEA Bioenergy Task33 “Thermal Gasification of Biomass
- Overview about research in 2nd generation biofuels
- Results from biomass CHP Güssing

- Synthetic fuels produced from synthesis gas (Fischer Tropsch Fuels, DME, etc.)
- Ethanol from lignocellulosic biomasses via fermentation

Focus of IEA Bioenergy Task33



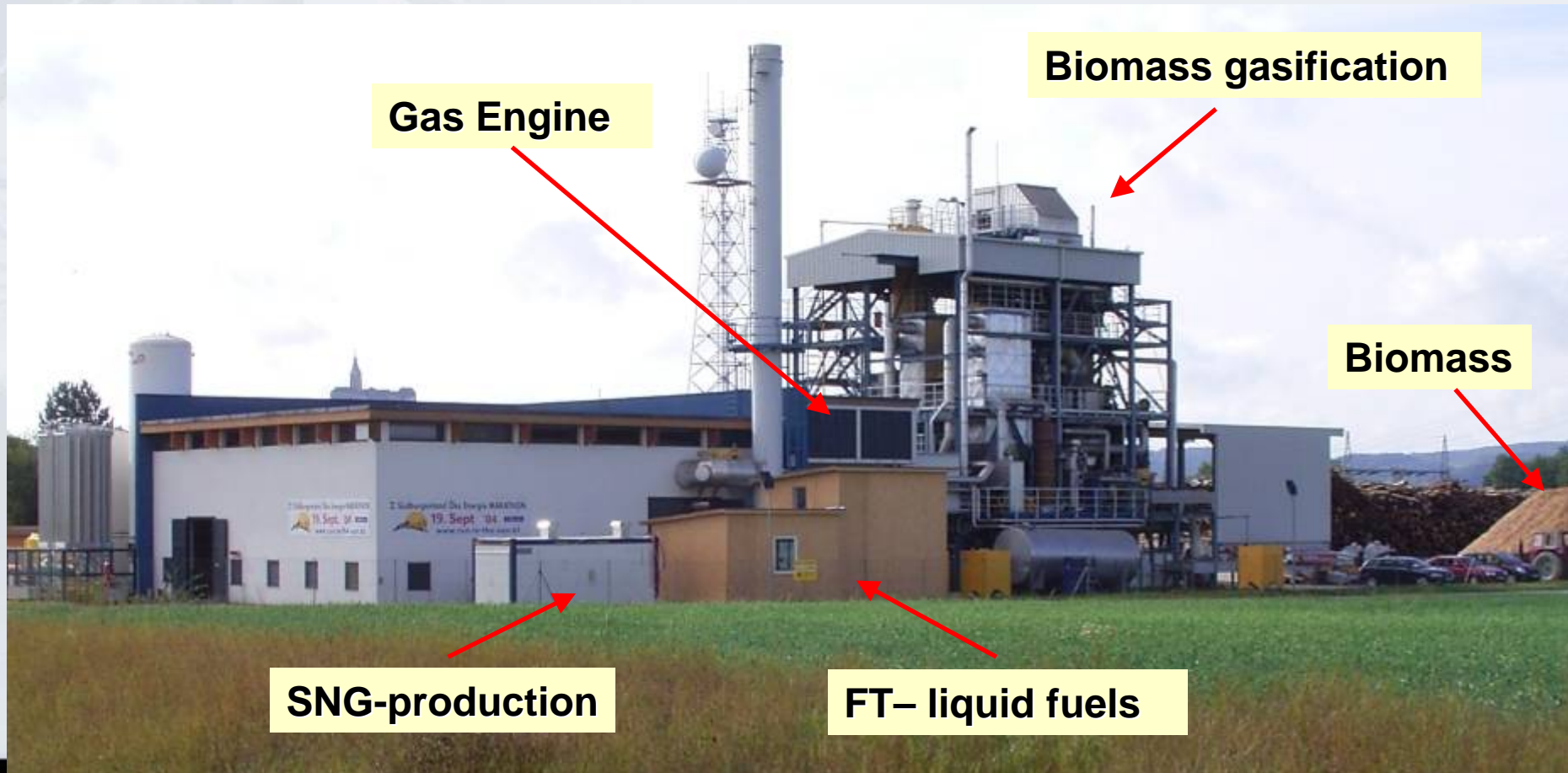
- The objectives of Task 33 are to review and exchange information on biomass gasification (BMG) research, development, demonstration, and commercialization
- Participating countries (12): Austria, Canada, Denmark, European Commission, Finland, Germany, Italy, The Netherlands, New Zealand, Sweden, Switzerland, and the USA
- Task Leader: Dr. Suresh P. Babu, Gas Technology Institute, Des Plaines, IL., USA.
- More details at <http://www.ieatask33.org>

- Abengoa (Ethanol)
- Chemrec (DME)
- Choren (Fischer Tropsch Diesel)
- Cutec (Fischer Tropsch Diesel)
- ECN (Fischer Tropsch Diesel, BioSNG)
- Forschungszentrum Karlsruhe (Fischer Tropsch Diesel, Methanol)
- Institute of Gas Technology (Fischer Tropsch Diesel)
- Institut Francais du Petrole (Fischer Tropsch Diesel)
- Sasol (Fischer Tropsch Diesel) largest producer of FT products worldwide
- Technical University of Karlsruhe (Fischer Tropsch Diesel)
- Vienna, University of Technology (Fischer Tropsch Diesel, BioSNG)
- VTT (Fischer Tropsch Diesel)
- All Oil companies, like Shell, Total, Chevron ... ! (but only for non renewable sources like coal and natural gas)

More info in the country report of IEA Bioenergy Task33

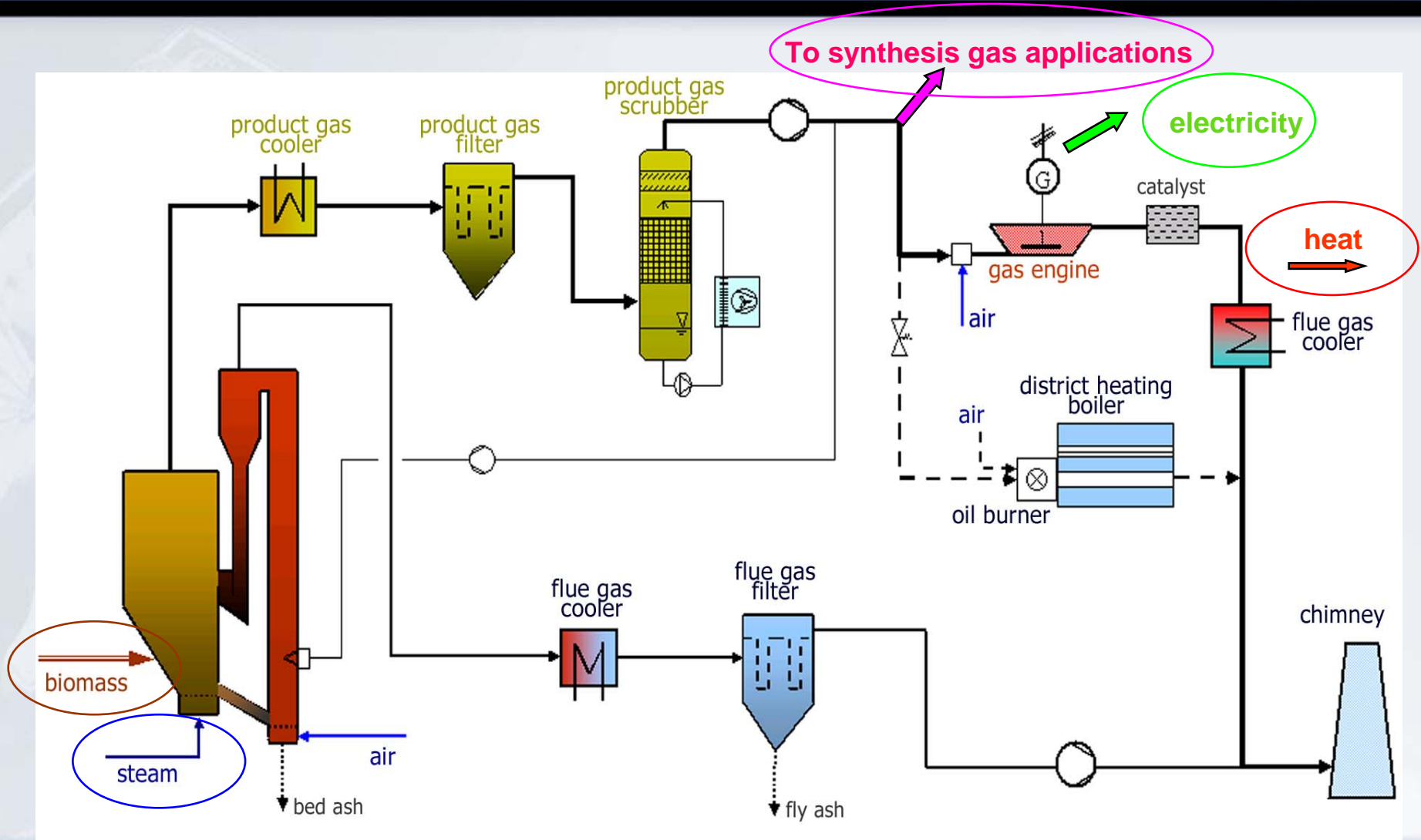
This list is not complete!!!

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



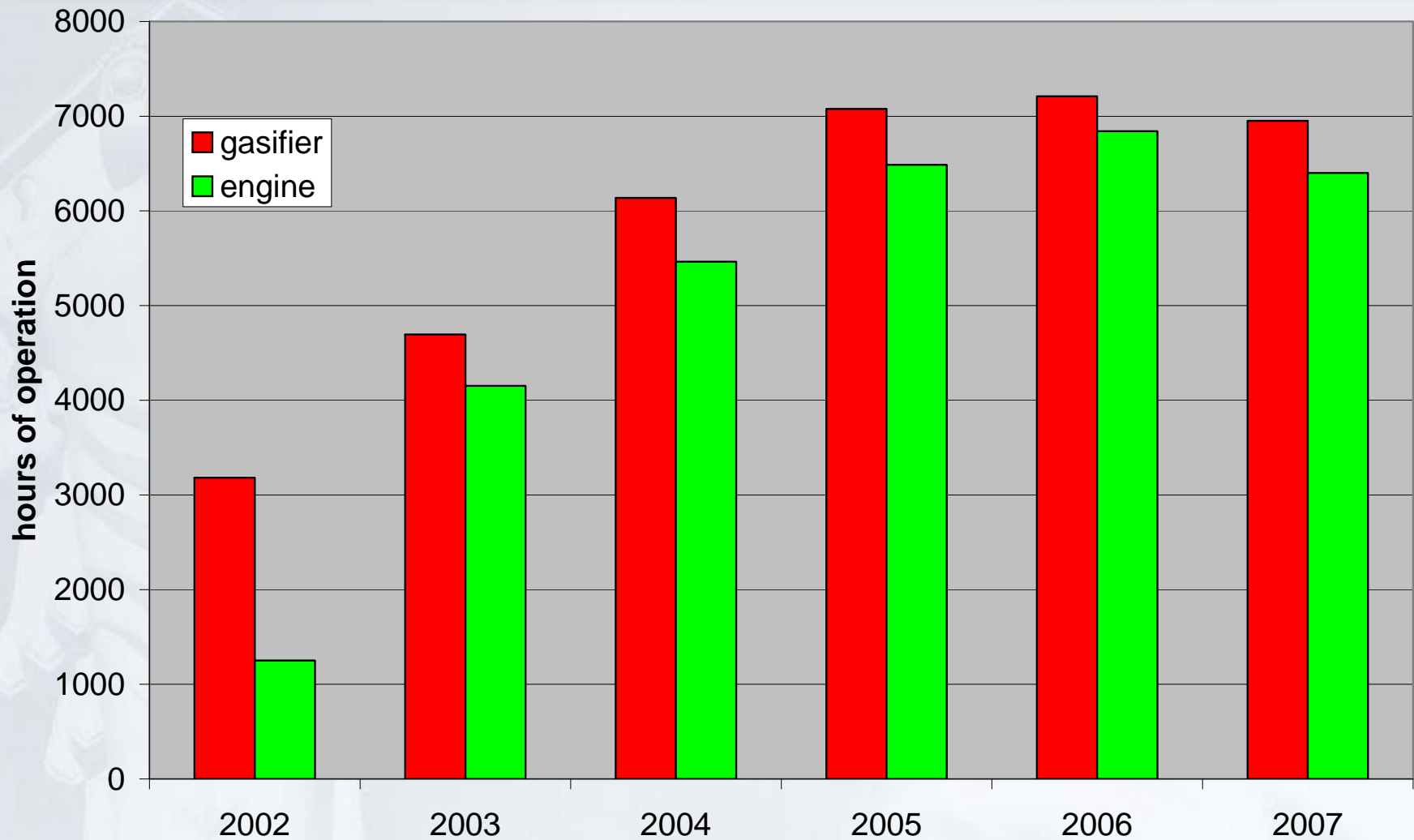
- Start of construction September 2000
- Start up January 2002
- Fuel 2,2 to/h (Wood chips)
- Water content 15 % (35 %)
- Fuel power 8 MW
- Electrical power 2 MW
- Thermal power 4,5 MW
- Electrical efficiency 25 % (20%)
- Total efficiency 80 %
- Owner and operator Biomass Power Station  
Güssing Association

# CHP-PLANT GÜSSING

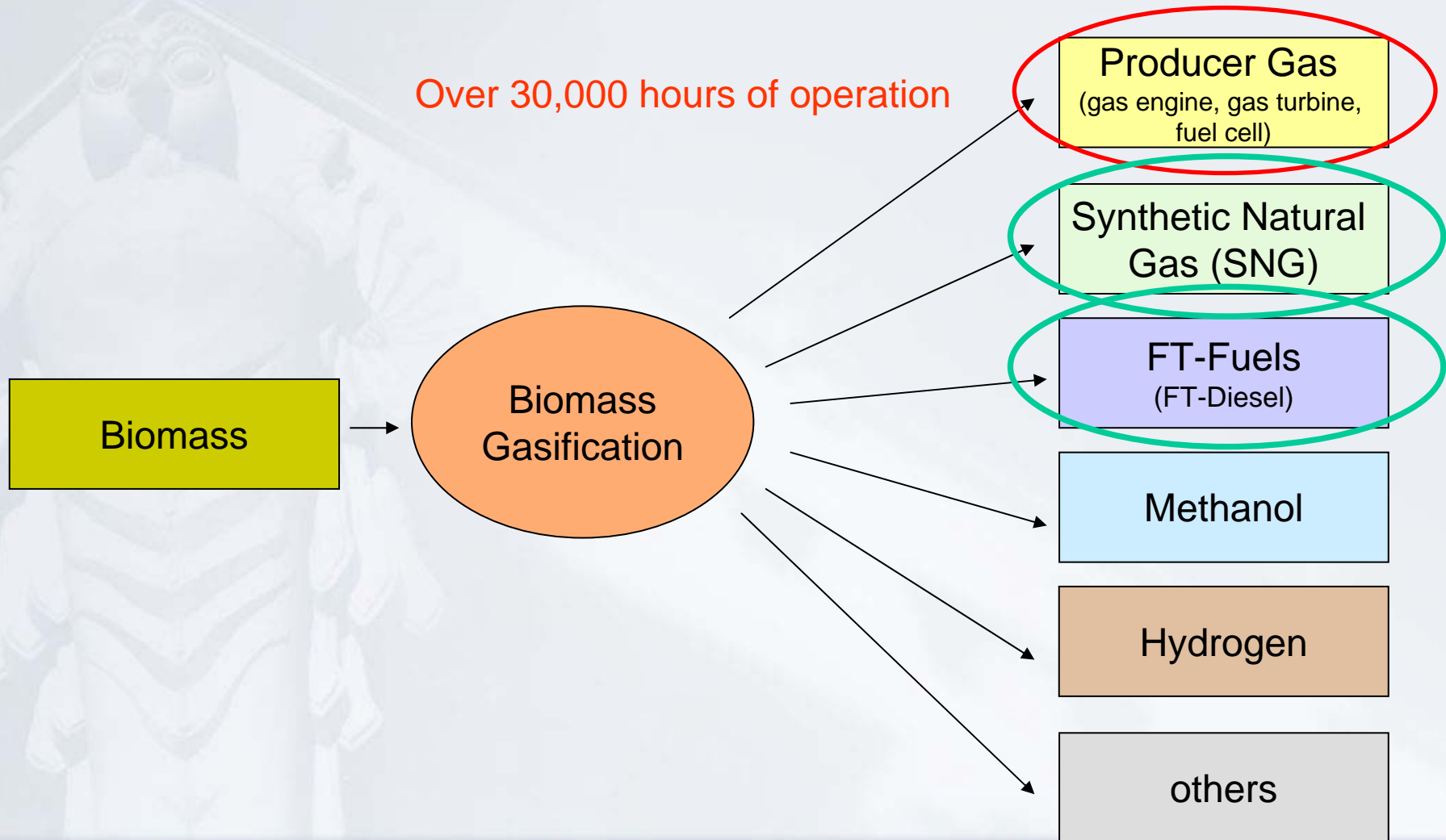




# Increase of Availability of the Plant



# The basic concept – “Green Chemistry”

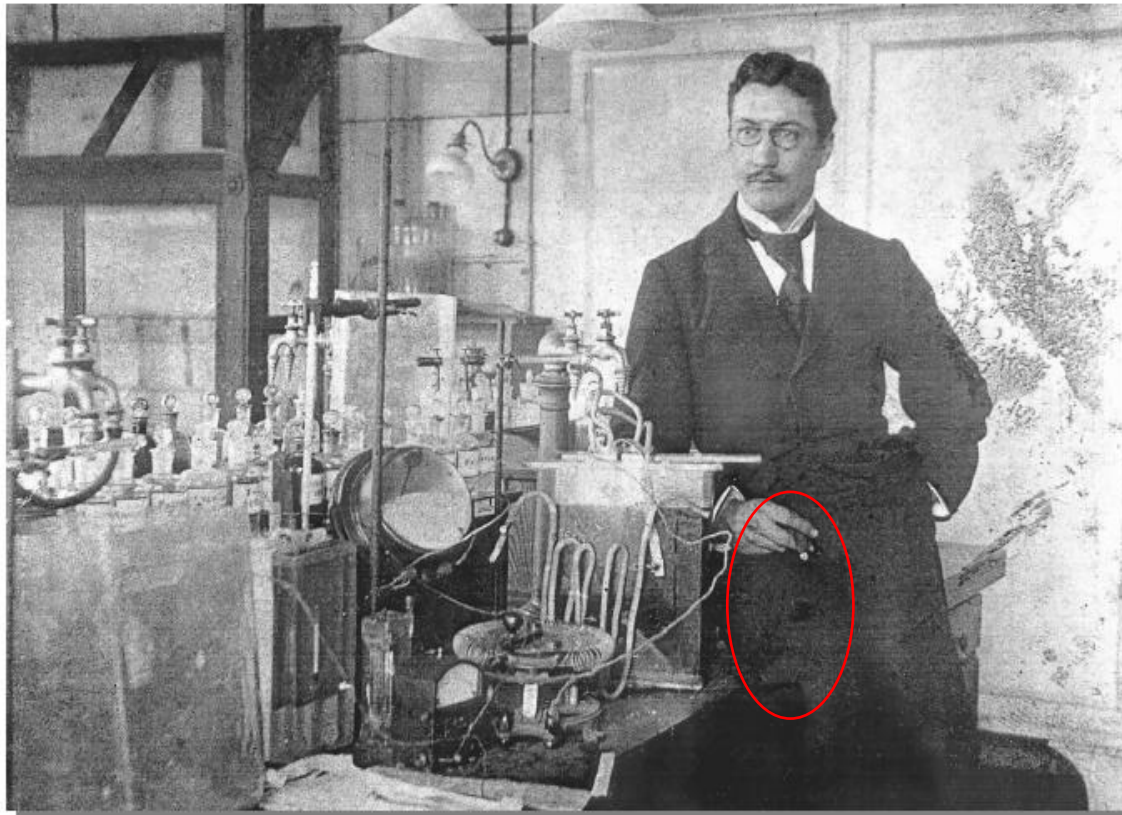


A faded, light-colored background image of a classical statue, possibly a figure with wings or a helmet, positioned on the left side of the slide.

**Renewable liquid fuels**

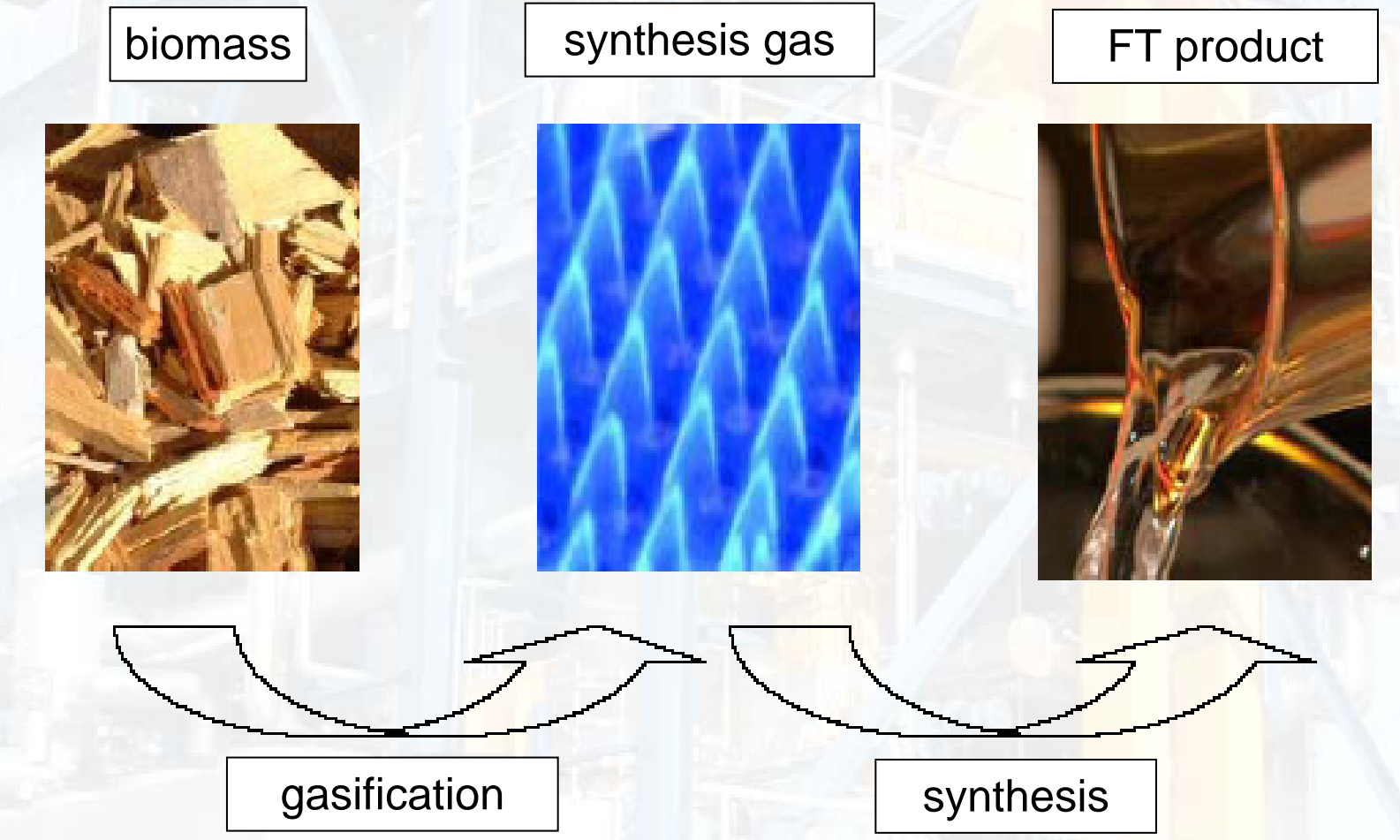
**Fischer-Tropsch Syntheses**

## Franz Fischer at Work in 1918

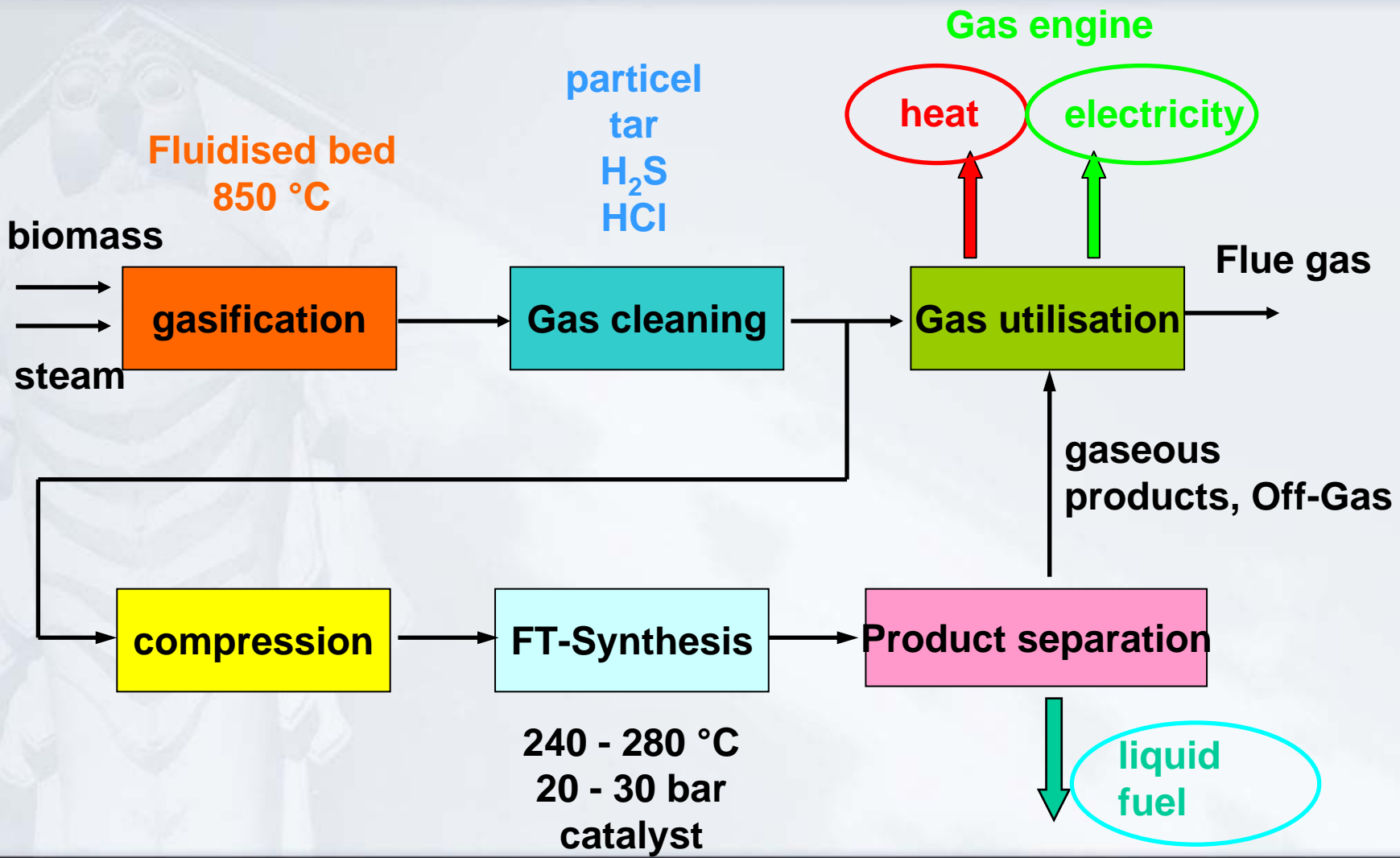


Financial Mail 2000

# Fischer Tropsch Syntheses



# Schema of FT Syntheses



Main gas components		
H <sub>2</sub>	%	35-45
CO	%	22-25
CO <sub>2</sub>	%	20-25
CH <sub>4</sub>	%	~10
C <sub>2</sub> H <sub>4</sub>	%	2-3
tar	mg/m <sup>3</sup>	20-30

Possible poisons		
H <sub>2</sub> S	ppm	~100
Org. S	ppm	~30
HCl	ppm	~3
dust	mg/Nm <sup>3</sup>	< 20

**H<sub>2</sub>:CO      1.5:1 bis 2:1**

**Optimal for synthesis gas  
applications**

# Properties of FT Diesel





Properties	Unit	EN 590:2004		Results of FT Diesel
		min	max	
Cetane number	-	51,0	-	75-85
Density at 15 o C	kg/m <sup>3</sup>	820	845	770-790
Polycyclic aromatic hydrocarbons	%(m/m)	-	11	< 1
Total aromatics content	%(m/m)	-	-	< 1
Sulphur content	mg/kg	-	50	< 5
Flash point	°C	>55	-	87 to 91
Carbon residue	%(m/m)	-	0,30	< 0,03
Ash content	%(m/m)	-	0,01	< 0,0015
Water content	mg/kg	-	200	200 to 300
Total contamination	mg/kg	-	24	2 to 4
Copper strip corrosion (3h at 50 °C)	rating	class 1		class 1 a
Oxidation stability	g/m <sup>3</sup>	-	25	< 5
Lubricity, corrected wear scar diameter	m m	-	460	340 to 360
Viscosity at 40oC	mm <sup>2</sup> /s	2,00	4,50	2.3 to 2.5
Oxidation stability	g/m <sup>3</sup>	-	25	< 12
Cold Filter Plugging Point, (CFPP)	°C	-	-20	-5 to 0



- renewable
- Minor additional CO<sub>2</sub> emissions
- Lower emissions from combustion
- Better behaviour in engine (Centane number above 70)
- No adaptation of engine necessary

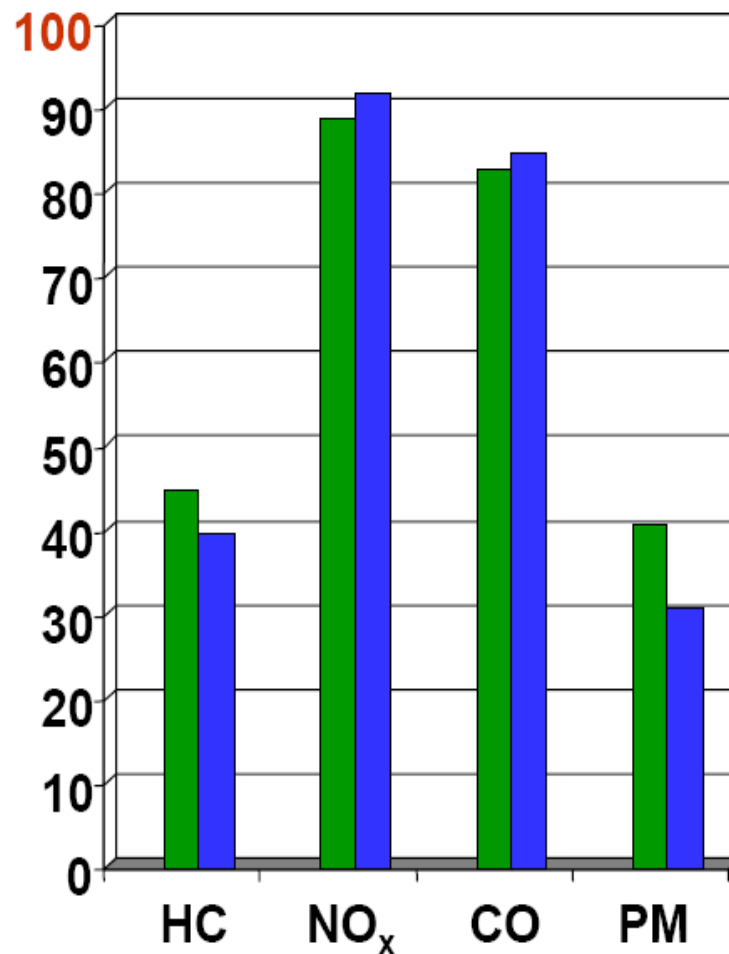
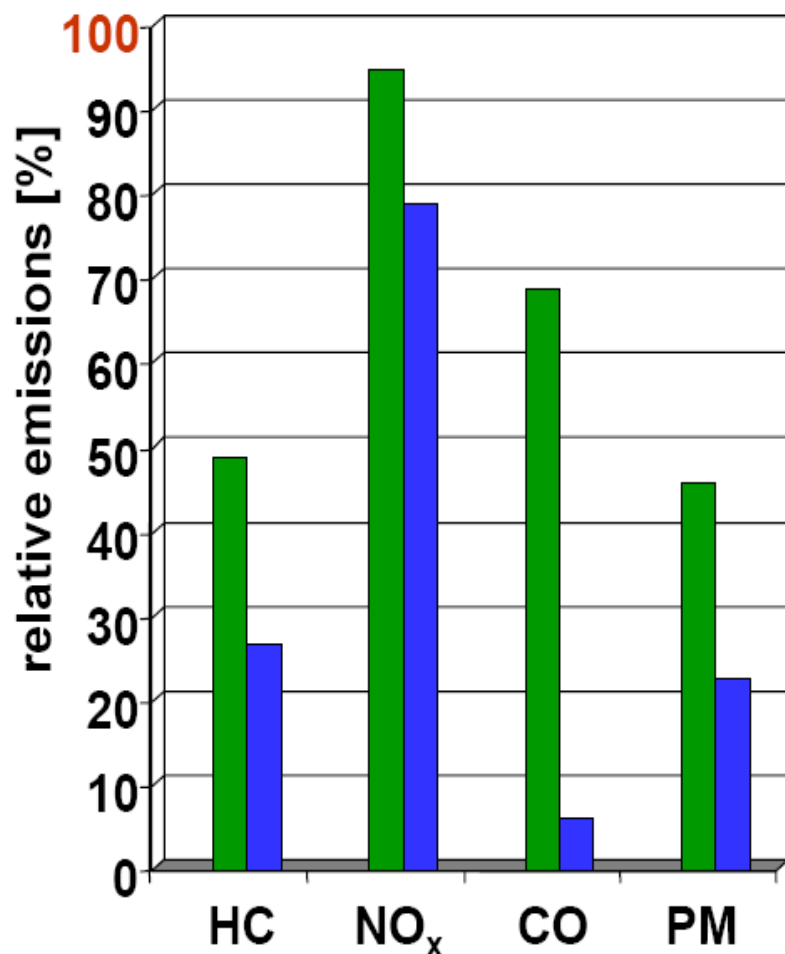
# Emissions from FT Diesel

100% reference: diesel  
common rail, EU 3

 SynFuel A  
 SynFuel B

1500 rpm / 22 Nm

2000 rpm / 94 Nm



- Tons of biomass (d.m.) per ton of fuel

fuel oriented:	4.0 - 5.0	to/to
Polygeneration:	9.0 - 10.0	to/to
- efficiency (on lower heating value)

fuel oriented:	55 – 60 %
Polygeneration:	35 – 45 %
- arable farm land:

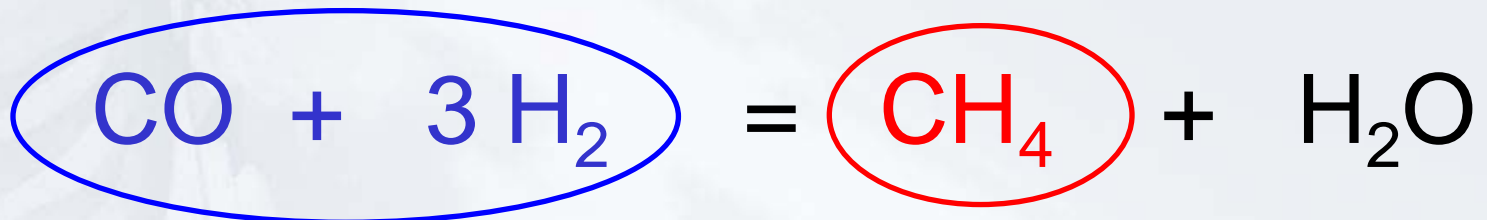
10-20	toTS / ha a	(short rotation coppice, Miscanthus)
3.500	lit / ha a	BioFIT-Treibstoff
- for comparison: 1.500 lit / ha a Biodiesel

A faded, light-colored background image of a classical building facade, featuring a large central archway and ornate architectural details.

**Renewable natural gas**

**Synthetic natural gas (BioSNG)**

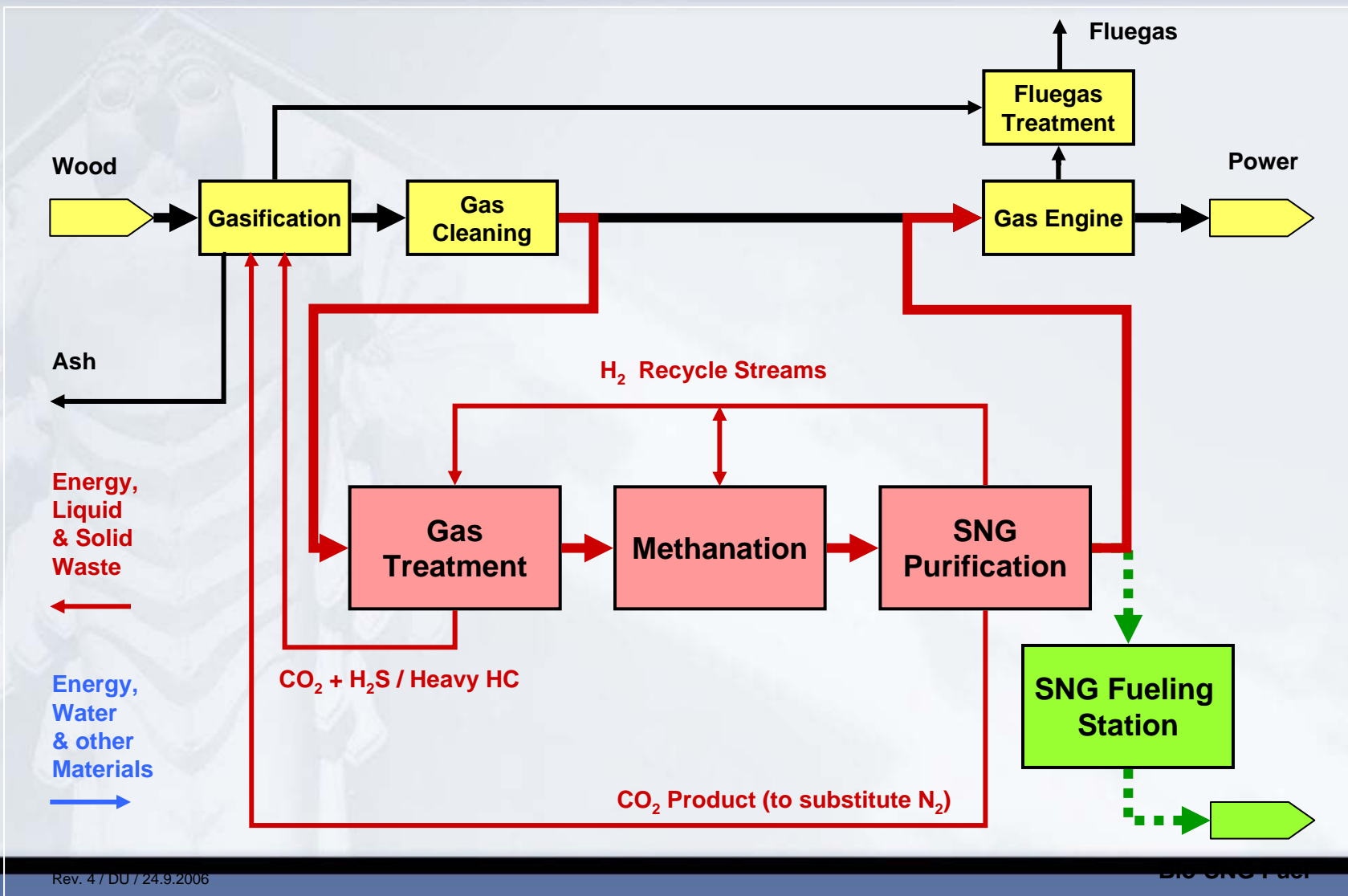
# renewable natural gas (BioSNG)



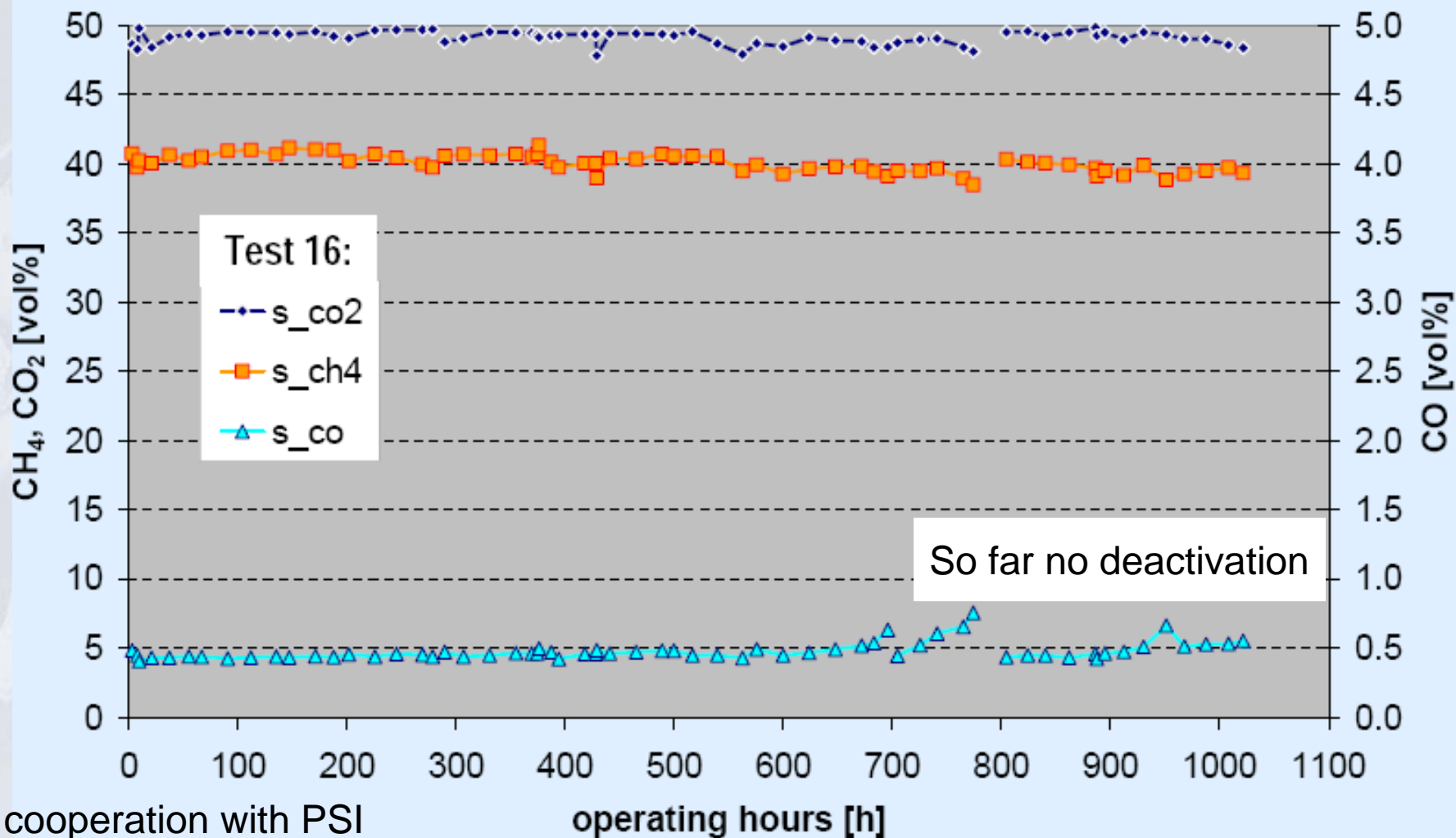
Synthesis gas

Renewable natural gas (BioSNG)

# Schema BioSNG demonstration



# Results BioSNG lab scale



In cooperation with PSI

# 1MW BioSNG demonstration plant



Institute of Chemical  
Engineering

Working group: Zero Emission  
Energy Technology





- size of plant: 50 MW fuel input
  - Biomass prize 16 €/MWh (1,6 cent/kWh, 70 €/to)
  - Consideration period 15 Jahre
  - Interest rate 5 %
  - Prize for heat 20 €/MWh (2,0 cent/kWh,
  - Prize for electricity 130-160 €/MWh
- BioFiT (FT-fuel from biomass) **0,85 €/Liter**
  - BioSNG (Synthetisches natural gas) **0,6 €/m<sup>3</sup>**

# Information



Institute of Chemical Engineering

Working group: Zero Emission Energy Technology

<http://www.renet.at>

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Industrielle  
Kompetenzzentren und Netzwerke

EIN PROGRAMM DES BMWA

