TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

Indirect gasification

Workshop at IEA Bioenergy Task32 and Task33 Meeting, October 2010

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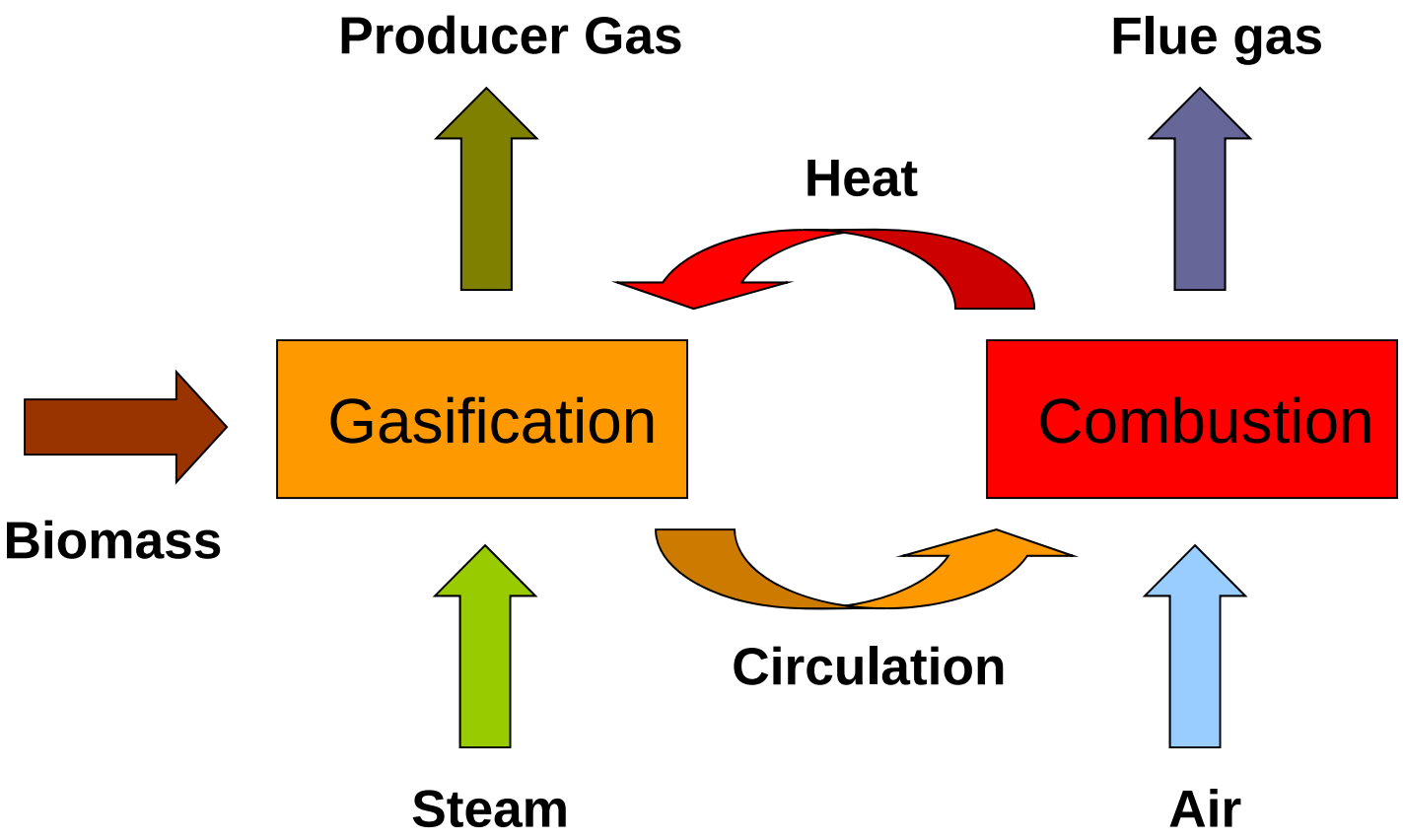
Content

- Technology
- Operational status
- Efficiencies
- Investment costs
- Fuels and specifications

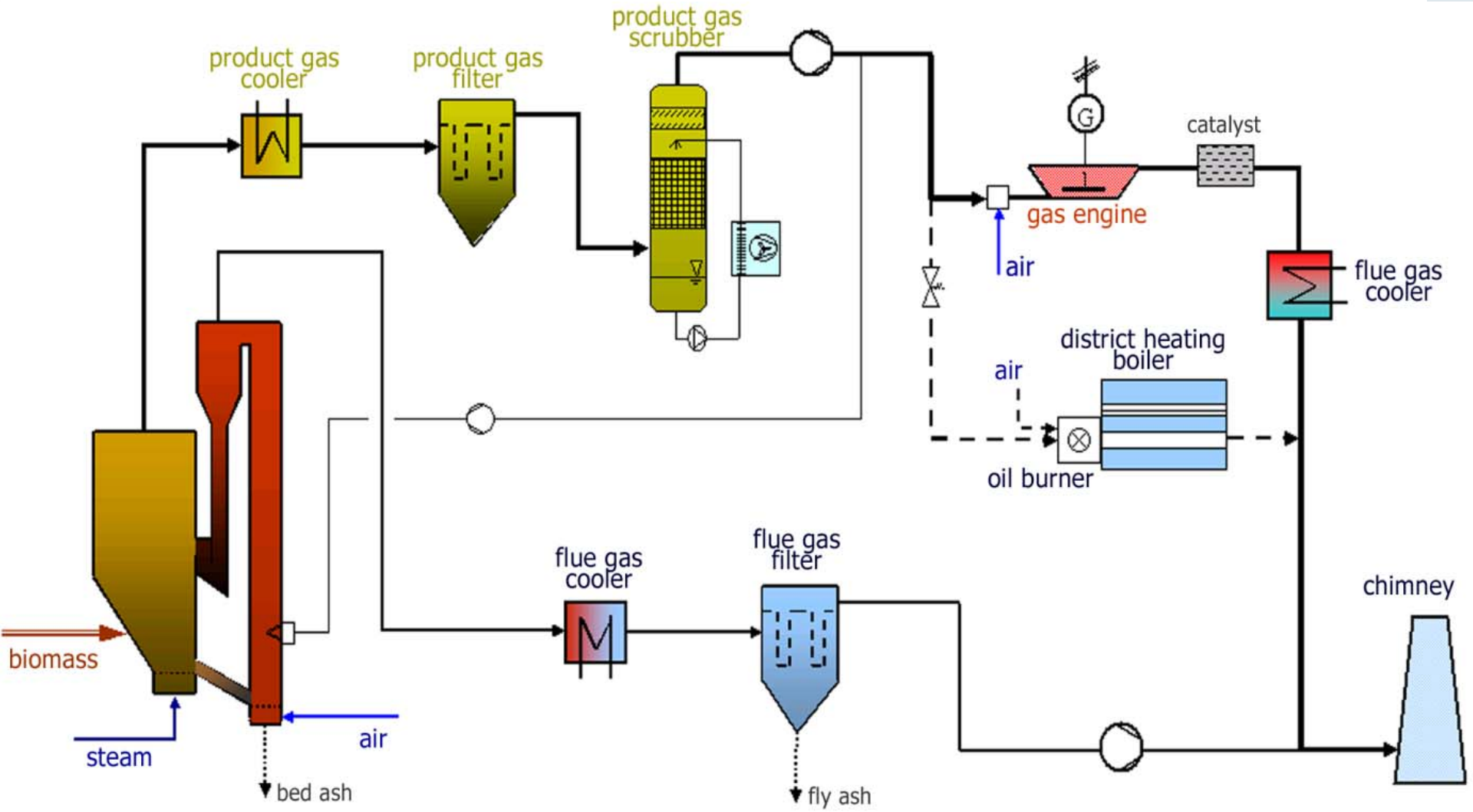
Gasification Concept



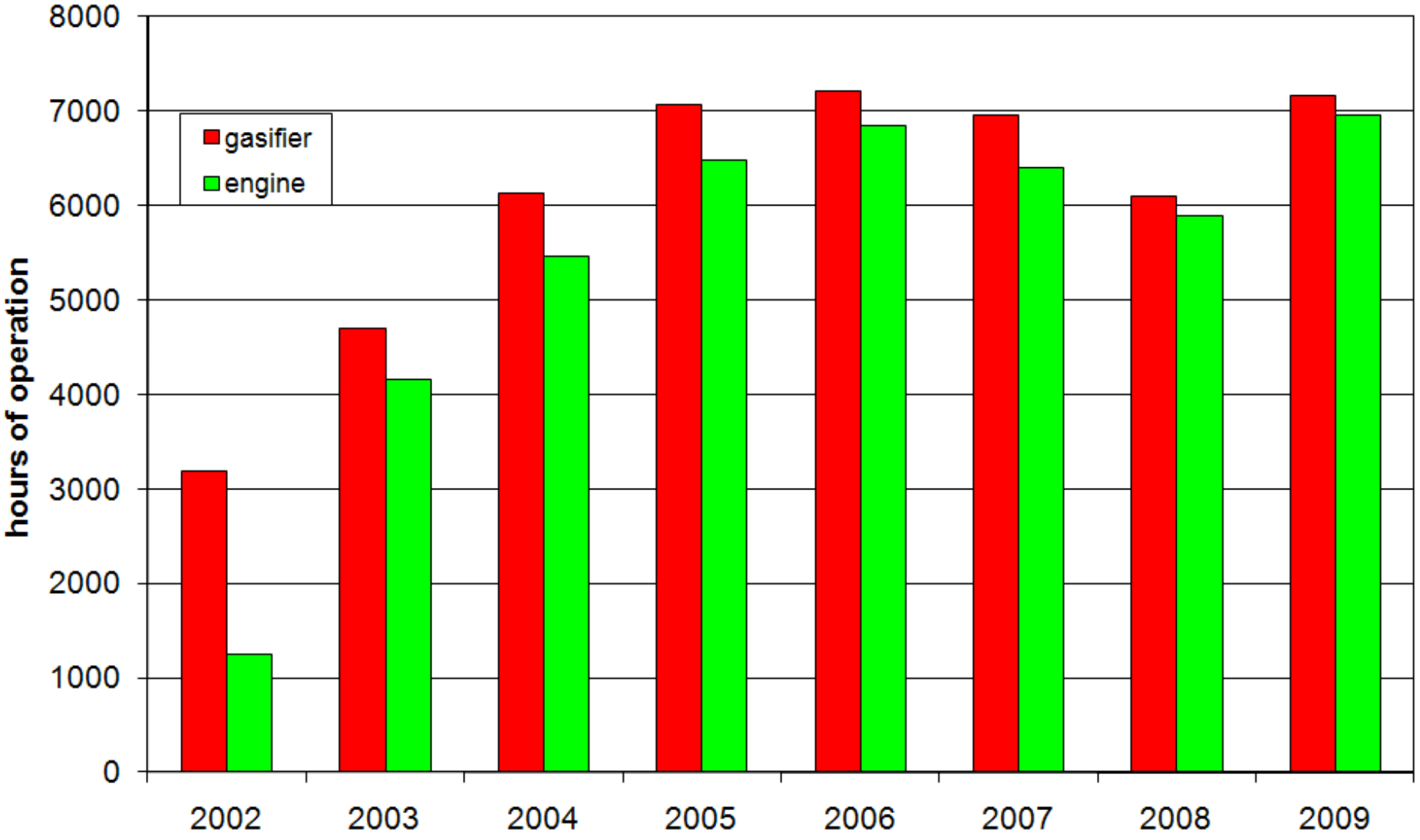
Data CHP Güssing

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	Güssing Biomass Power Station Association		

CHP-Plant Güssing



Availability



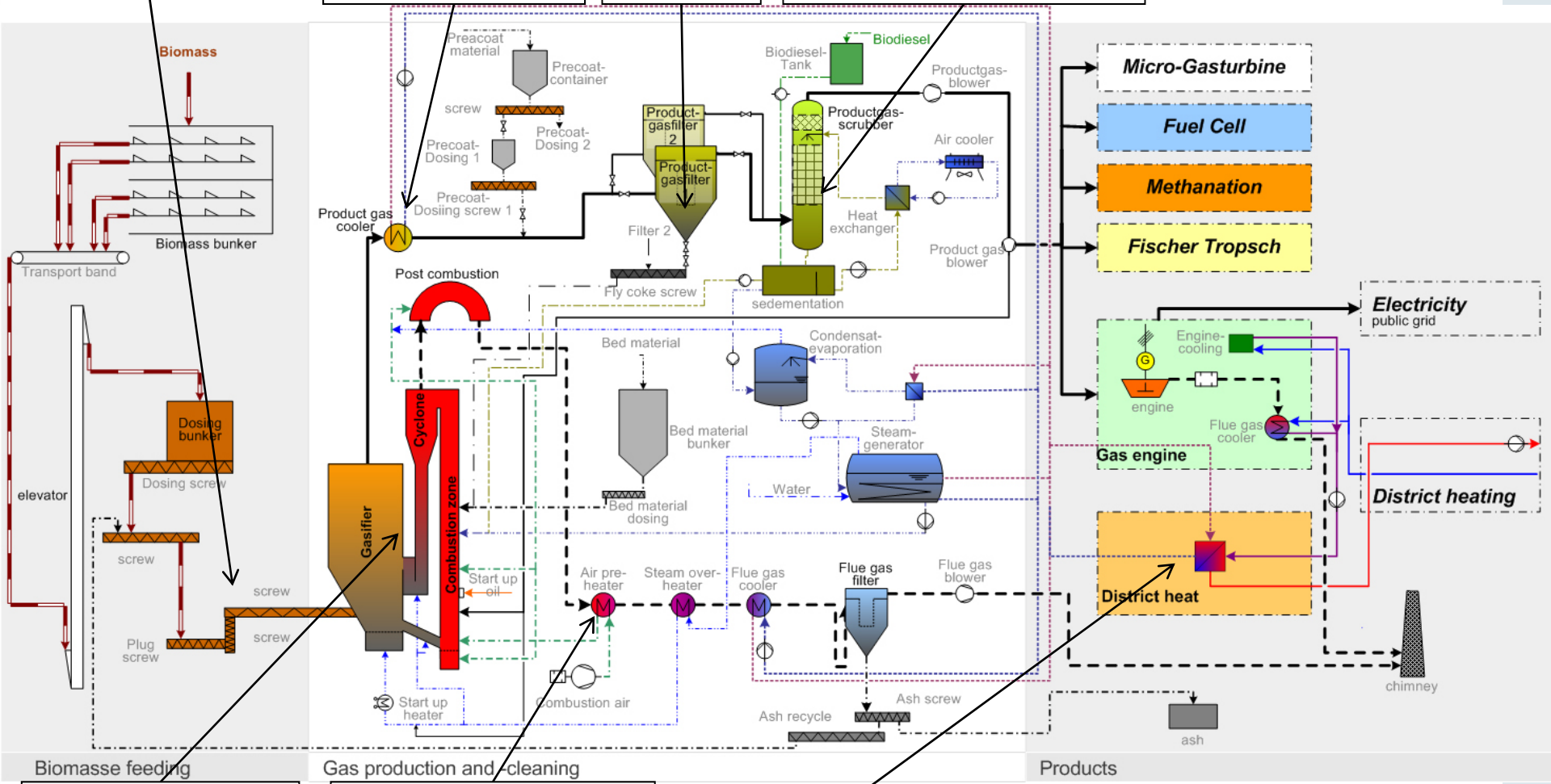
Optimisation of Availability

Biomass feeding

PG cooler
Cleaning >4000h

PG filter
>20 000h

PG scrubber
Consumption: ~1l/MW_{fuel}



Refractory gasifier
repaired 2-3 years

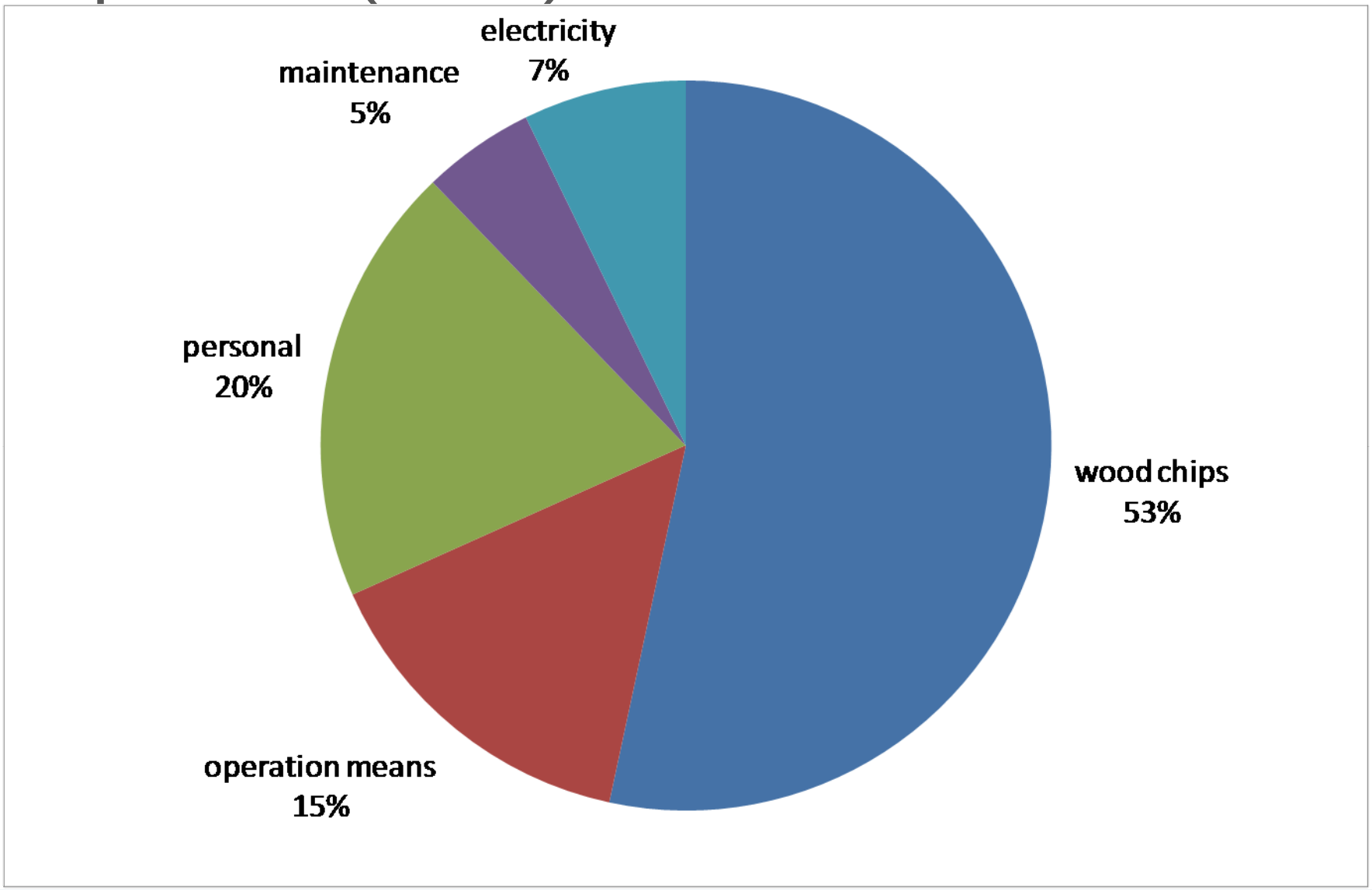
Air preheater
Cleaning: 500-1000 h

Control of district heat

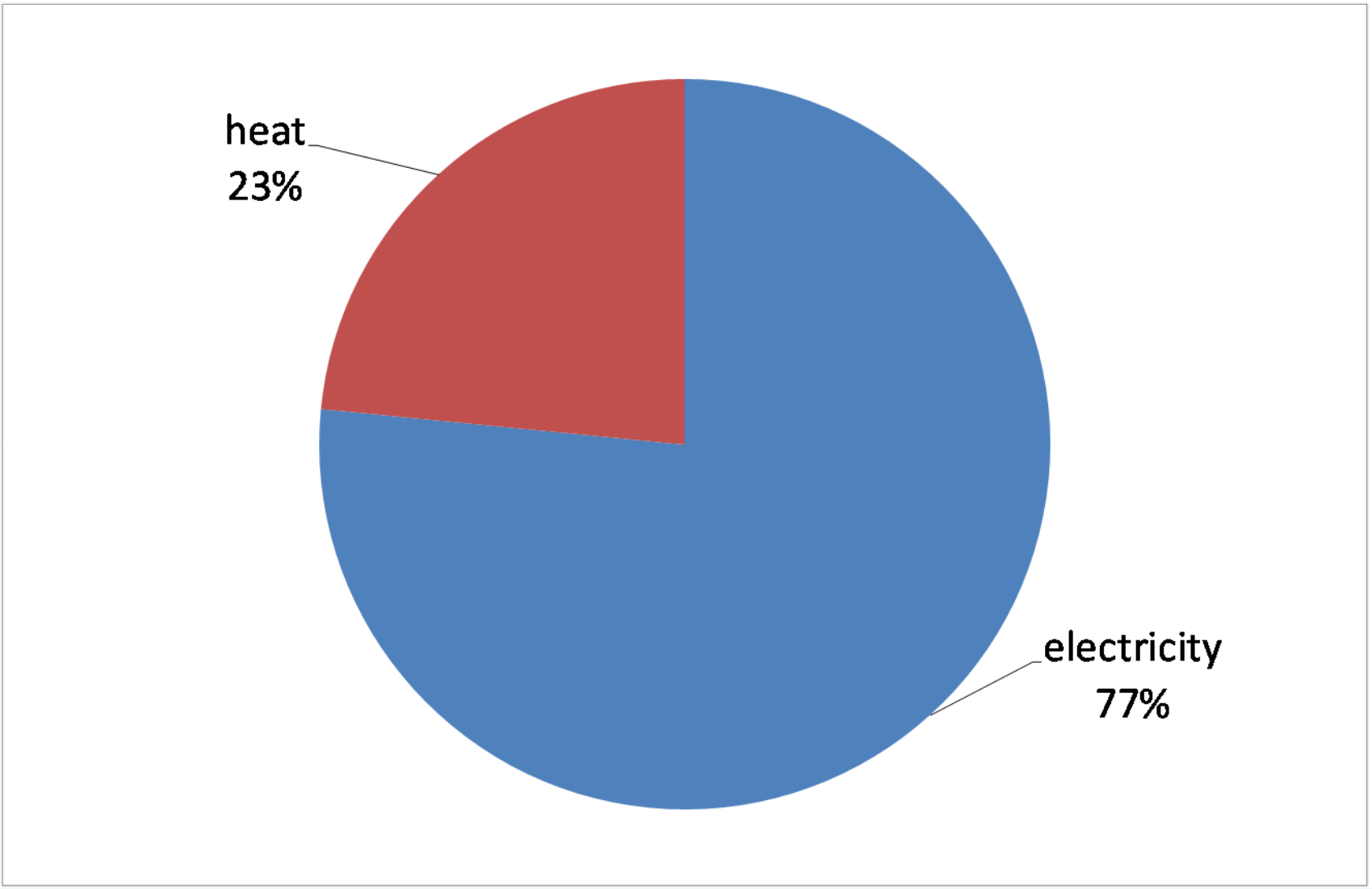
Economic frame conditions

- Biomass costs: 1.8-1.9 c€/kWh (80-90 €/t_{dry})
- Feed in rate for electricity: 16 c€/kWh
  for electricity from forest wood chips, <2MW_{el},
  independent on technology
- Price of heat: 2.5-3.0 c€/kWh, depends on average biomass price and light heating oil price
- Funding of investment costs, due to demonstration plant

Expenses (2009)



Income (2009)

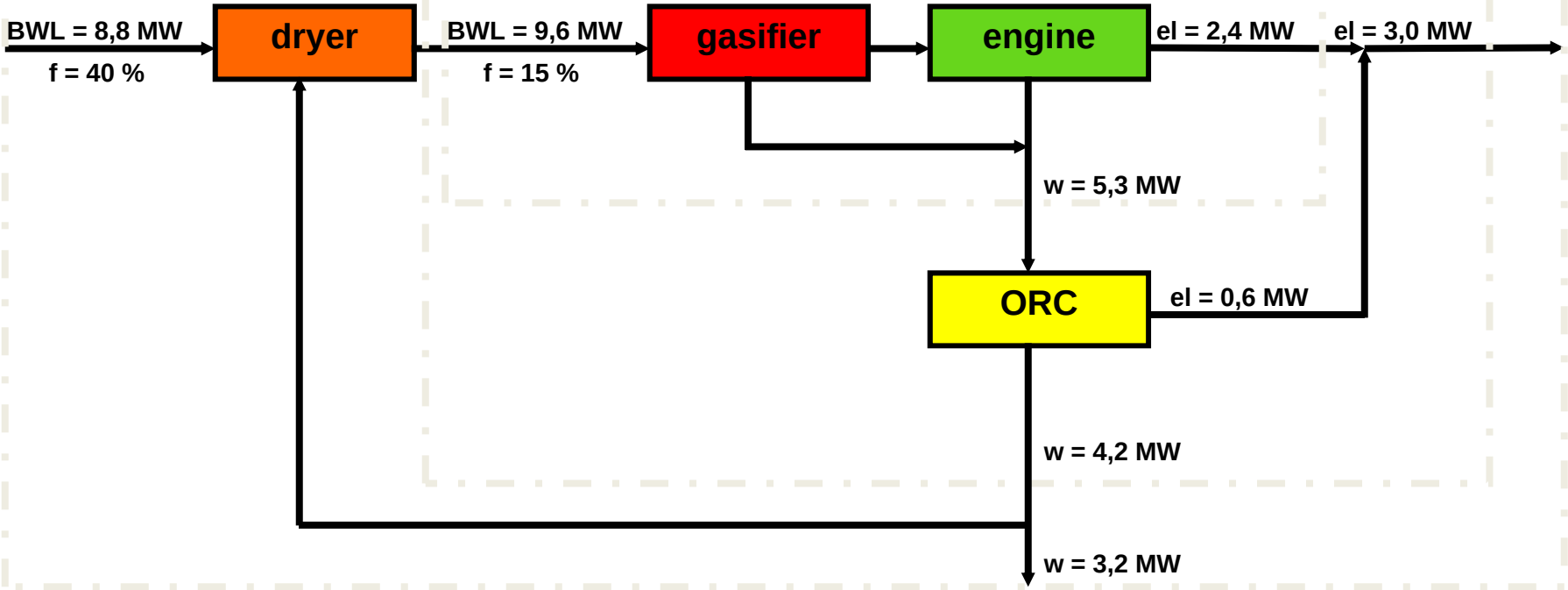


Optimisation of Efficiency

Integrated dryer $h_{el} = 34\ \%;\ h_{ges} = 70\ \%;$

IGCC $h_{el} = 31\ \%;\ h_{ges} = 75\ \%;$

Single Cycle $h_{el} = 25\ \%;\ h_{ges} = 80\ \%;$



Commercial FICFB gasifiers

Location	Electricity production	Fuel / electr. MW, MWel	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	In commissioning
Klagenfurt, AT	Gas engine	25 / 5.5	2011	Detailed engineering
Ulm, DE	Gas engine / ORC	15 / 5.3	2010	Under construction
Geislingen, DE	AER-process / Gas engine / ORC	10 / 3.3	2010	Detailed engineering

Commercial FICFB gasifiers

Location	Electricity production	Fuel / electr. MW, MWel	Supplier	Investment costs (M€)
Güssing, AT	Gas engine	8.0 / 2.0	Austrian Energy / Repotec	10.7
Oberwart, AT	Gas engine / ORC	8.5 / 2.8	Ortner Anlagenbau	16
Villach, AT	Gas engine	15 / 3.7	Ortner Anlagenbau	?
Klagenfurt, AT	Gas engine	25 / 5.5	Ortner Anlagenbau	?
Ulm, DE	Gas engine / ORC	15 / 5.3	Repotec	?
Geislingen, DE	AER-process / Gas engine / ORC	10 / 3.3	Repotec	?

FICFB Ulm, Germany

http://www.swu.de/index.php?eID=z7_swuwebcam_popup

Biomasses tested in the 100kW pilot scale FICFB gasifier

- Wood pellets
- Water content (Wood chips)
- Particle size (Saw dust)
- Fixed carbon (Coal)
- Waste wood
- Ash content (Sewage sludge pellets)
- Impurities (Animal residue)
- Ash melting (Straw)
- SRC (Willow)
- Waste

All fuels can be used, if the ash melting point is above 1000°C as pure fuel.
Fuels with lower ash melting point have to be used as mixture (e.g. 15% straw works well)

Current Status and Outlook

Successful scale up of a dual fluidized bed steam gasification system from laboratory to industrial scale **(within 10 years)**

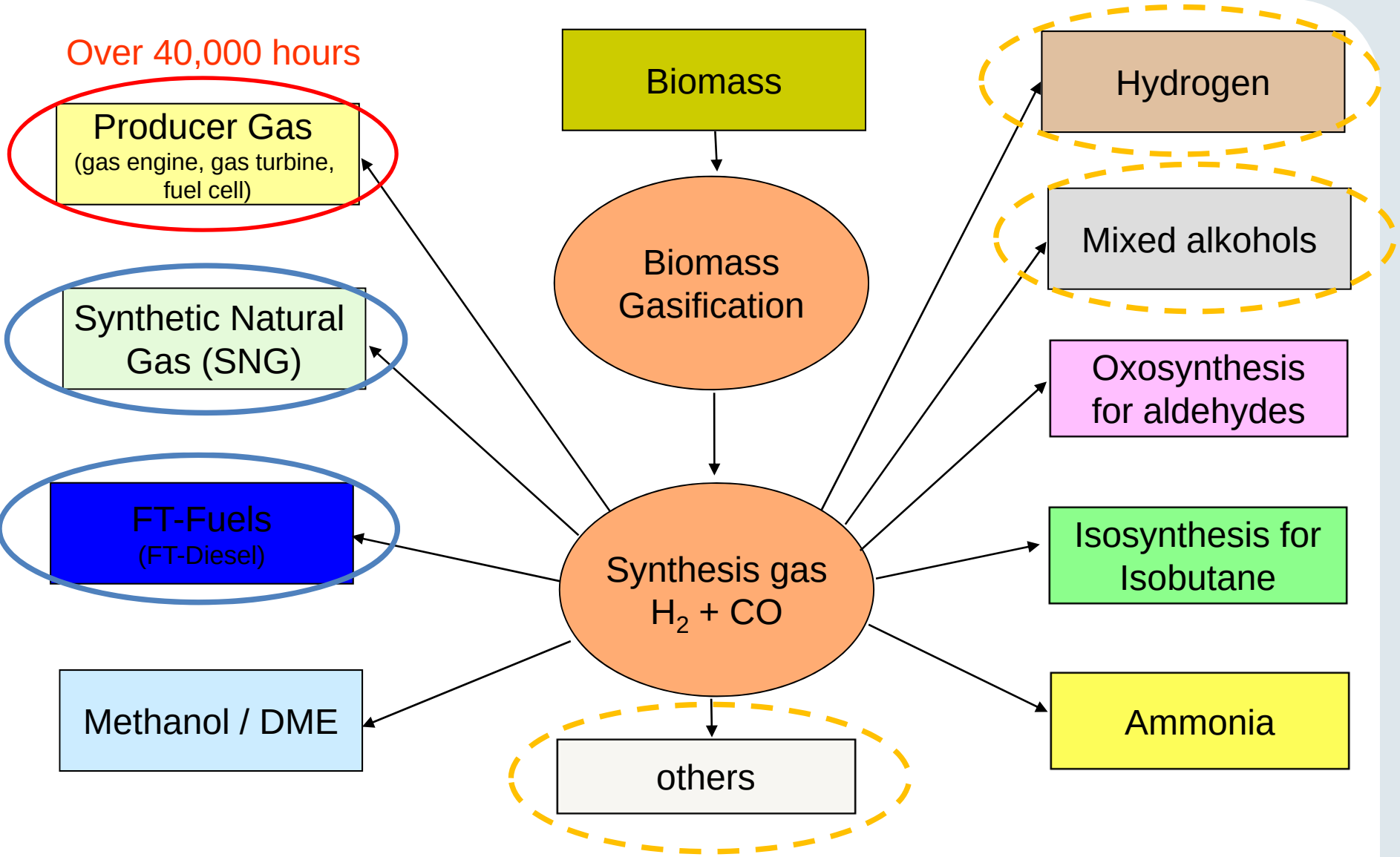
Industrial plant available with

- High electrical efficiency (> 30 % with combined gas engine and ORC-process)
- No solid residues (without ash, carbon content <0,5 %)
- No liquid condensates
- European emission requirements are met
- High availabilities (>90 %)
- Second plant is already in operation (~10 MW_{fuel})

High potential for biofuels (BioSNG, BioFiT)

- BioSNG, most suitable, 1 MW (100 m^3/h BioSNG) was demonstrated from wood chips, till using the BioSNG in cars
- Fischer Tropsch, research ongoing, scale up to 1 bpd is ongoing

The basic concept – "Green Chemistry"



Outlook: usage as synthesis gas

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Thank you for your attention

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