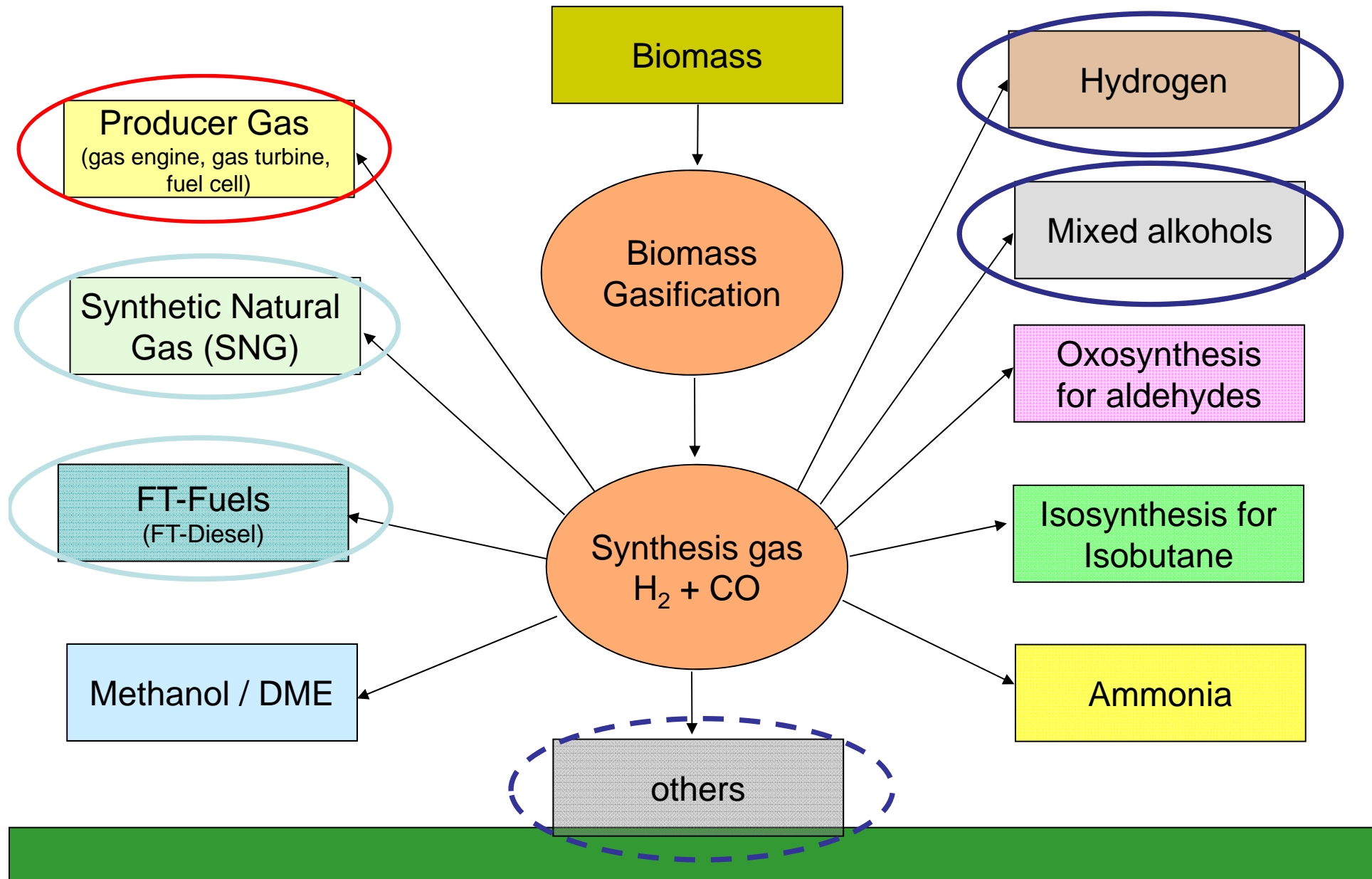


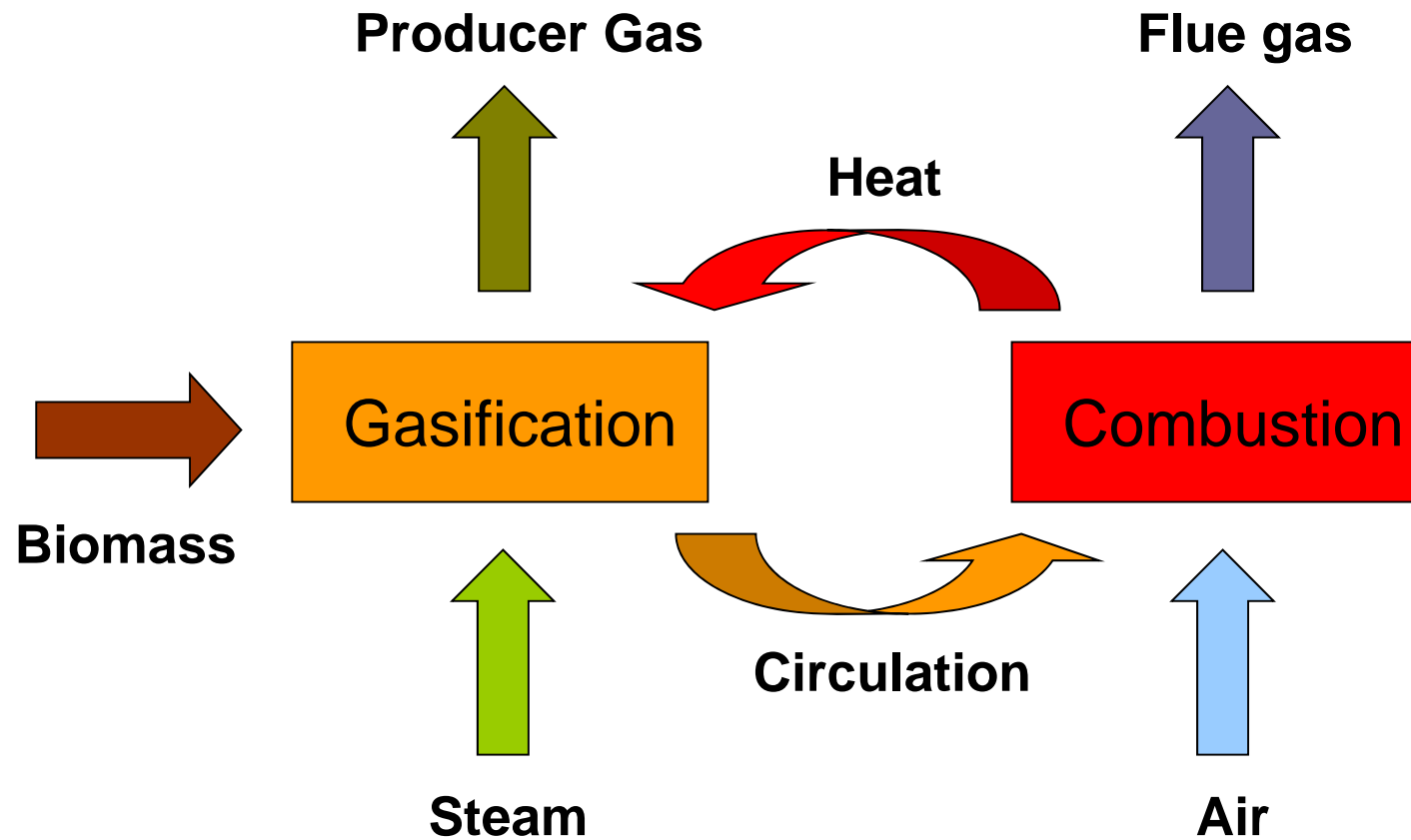
Dual fluidized bed gasification for CHP and production of advanced biofuels

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Bioenergy 2020+



Gasification Concept of Dual Fluid (FICFB)



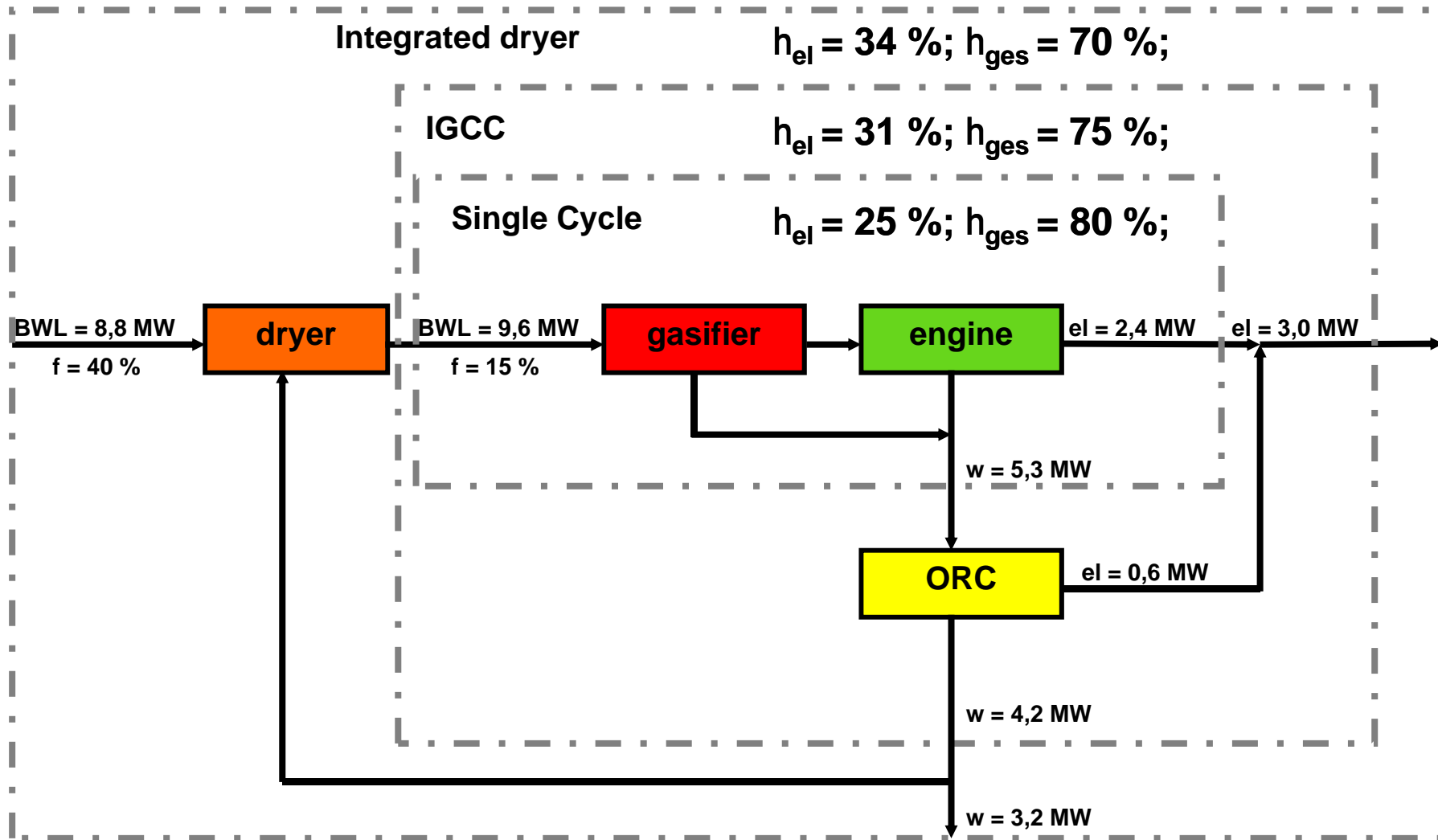
| Location | Usage / Product | Fuel / Product MW, MW | Start up | Supplier | Status |
|---------------------|---------------------|---|----------|----------------------|---------------|
| Güssing, AT | Gas engine | 8.0 _{fuel} / 2.0 _{el} | 2002 | AE&E, Repotec | Operational |
| Oberwart, AT | Gas engine / ORC | 8.5 _{fuel} / 2.8 _{el} | 2008 | Ortner Anlagenbau | Operational |
| Villach, AT | Gas engine | 15 _{fuel} / 3.7 _{el} | 2010 | Ortner Anlagenbau | On hold |
| Senden/Ulm DE | Gas engine / ORC | 14.7 _{fuel} / 5 _{el} | 2011 | Repotec | Operational |
| Burgeis, IT | Gas engine | 2 _{fuel} / 0.5 _{el} | 2012 | Repotec | Commissioning |
| Göteborg, Sweden | BioSNG | 32 _{fuel} / 20 _{BioSNG} | 2013 | Metso/ Repotec | Commissioning |

Biomasses tested in the pilot scale FICFB gasifier

- Wood chips
- Wood pellets
- Saw dust (particle size)
- Coal (fixed carbon)
- Sewage sludge pellets (ash content)
- Animal residue (impurities)
- Straw (ash melting)
- Willow (energy crop)

All fuels can be used, if the ash melting point is above 1000°C as pure fuel and fixed carbon below 25%.

Fuels with lower ash melting point or higher fixed carbon have to be used as mixture (e.g. 15% straw works well)



BioH₂

Biomass *to Hydrogen*

BioH₂-4Refineries

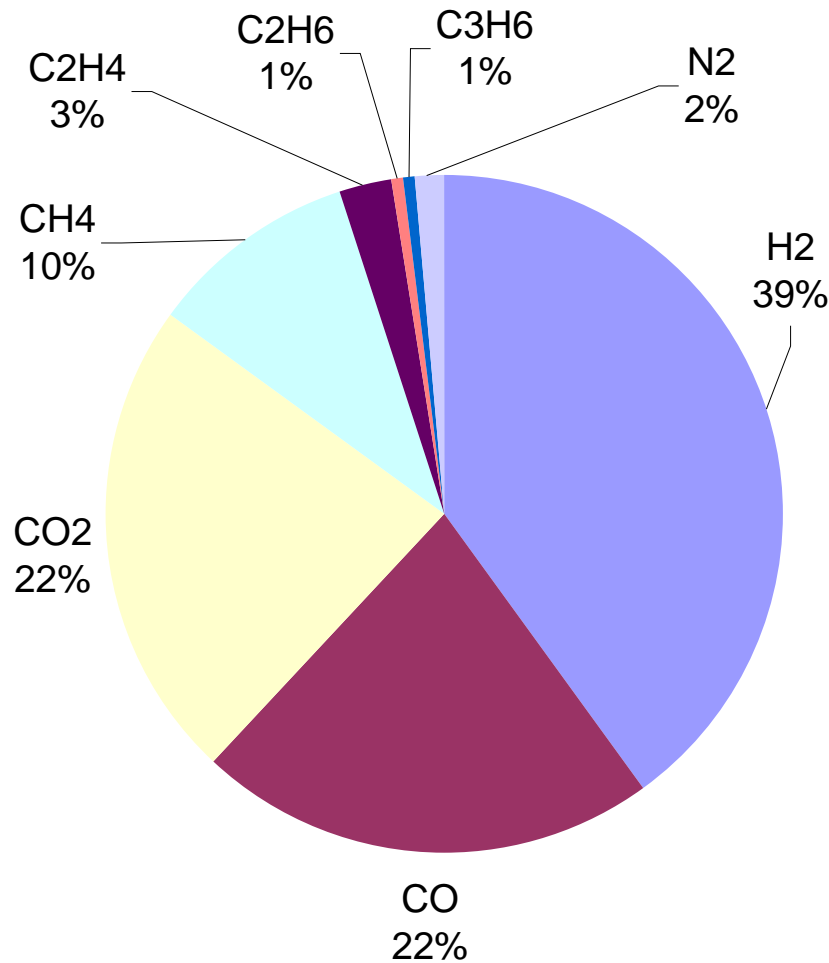
Economic evaluation of production of hydrogen for a refinery

- 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

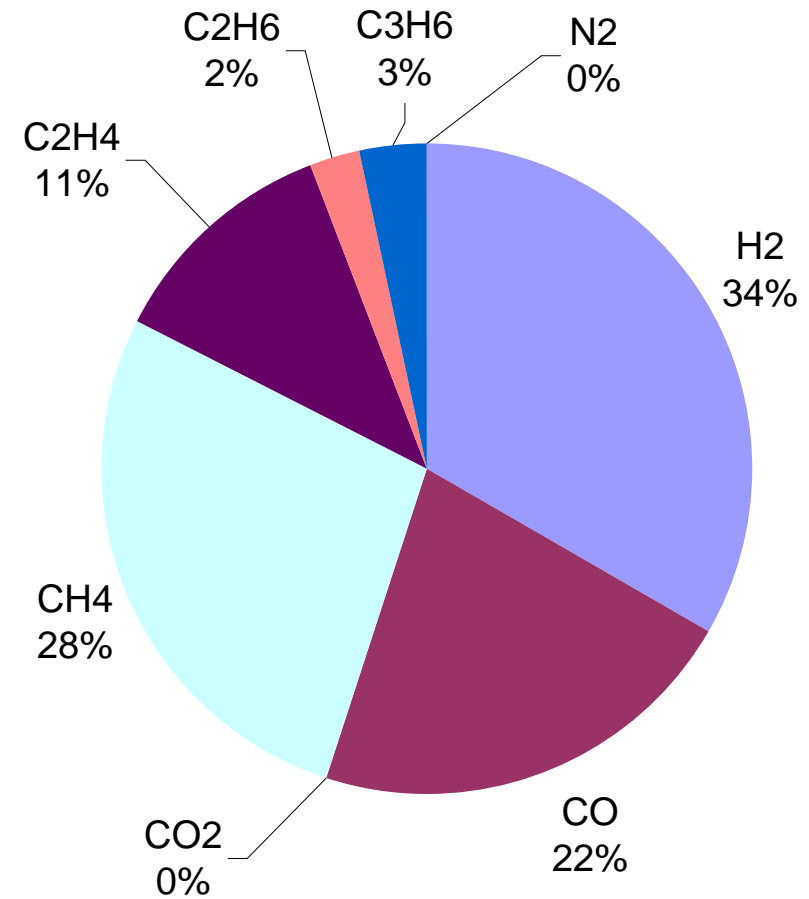


Gas composition at CHP Güssing

On volume basis



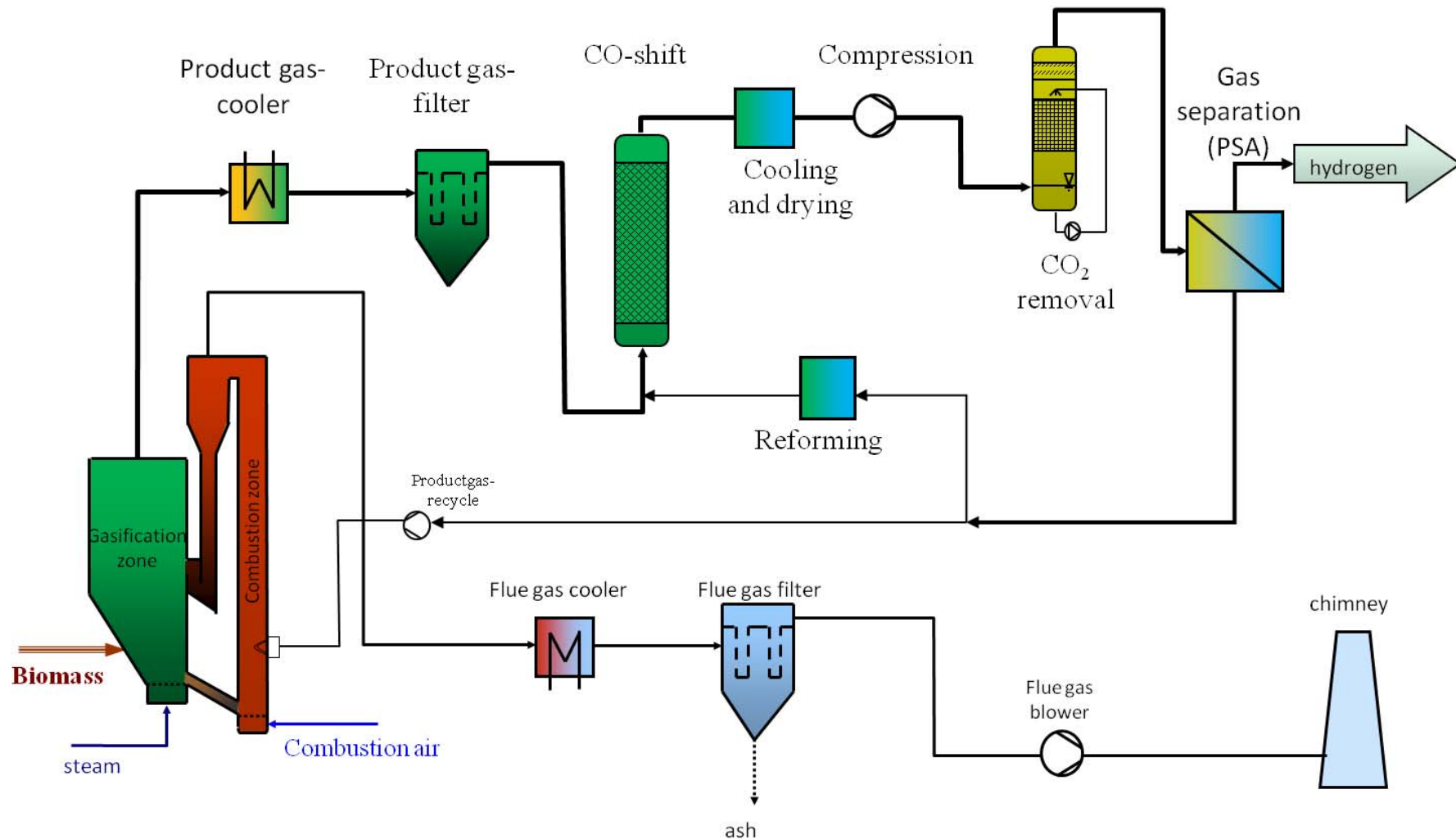
On energy basis



Options for gas conversions

- CO-shift
- Conversion of hydrocarbons
 - Reforming to H₂ and CO and recycle
 - Conversion to SNG
 - Conversion to electricity and heat
- Mass and Energy balances for all 3 cases were calculated
- Economics show, that reforming gives the highest overall value (at the frame conditions in Austria)

Simplified flow chart



- Applied for NER300
- Technical diligence was good
- Economics due to high biomass price (110 €/t_{dry}) were the main reason to be on the 3rd place
- Project is on hold, but pilot plant is realised as slip stream in Güssing
- Future applications are evaluated together with gas industry

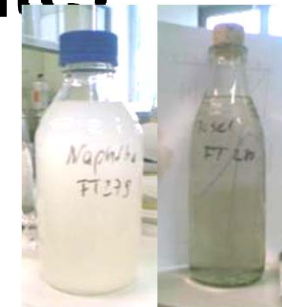
*Bio*FiT

BIOMASS-TO-FISCHER-TROPSCH

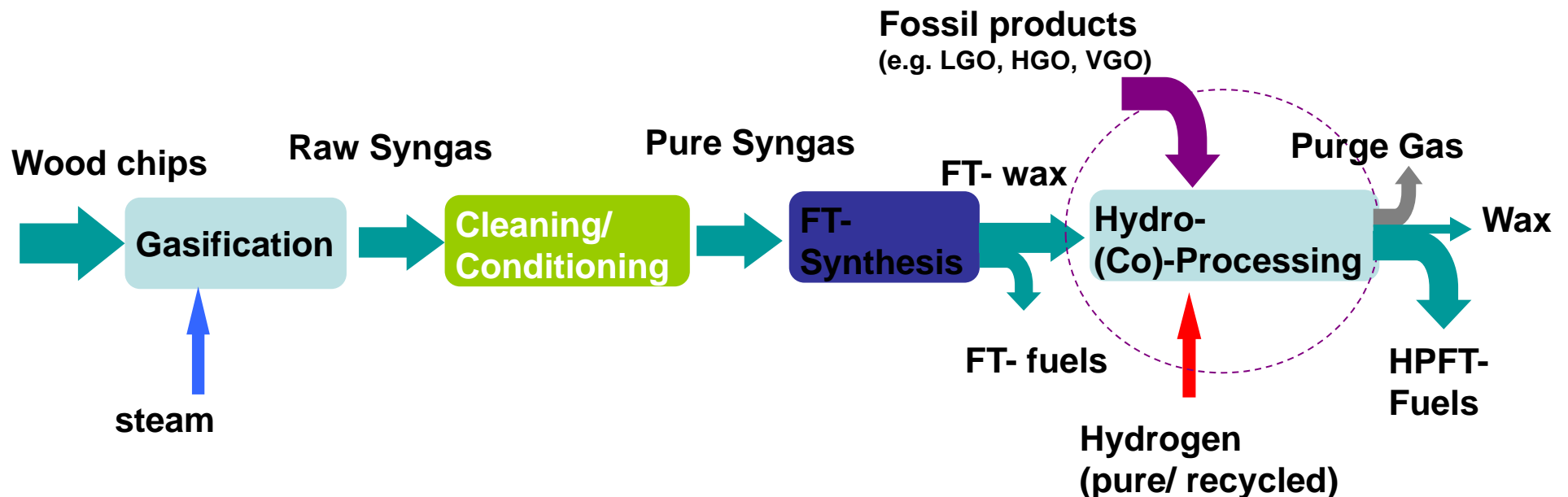
Synthetic biofuels (FT- Route)

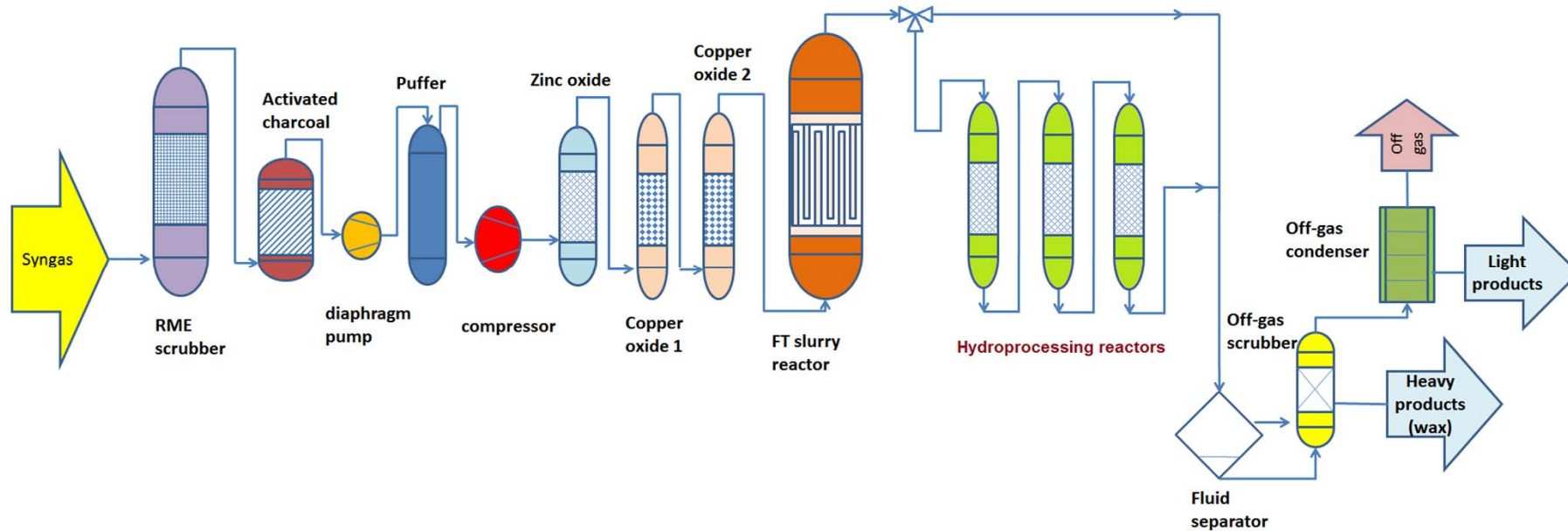


Cellulose, Polyose (Hemicellulose)
Lignin



i/n- paraffins
(hydrocarbons)





5-10kg/day of FT raw product

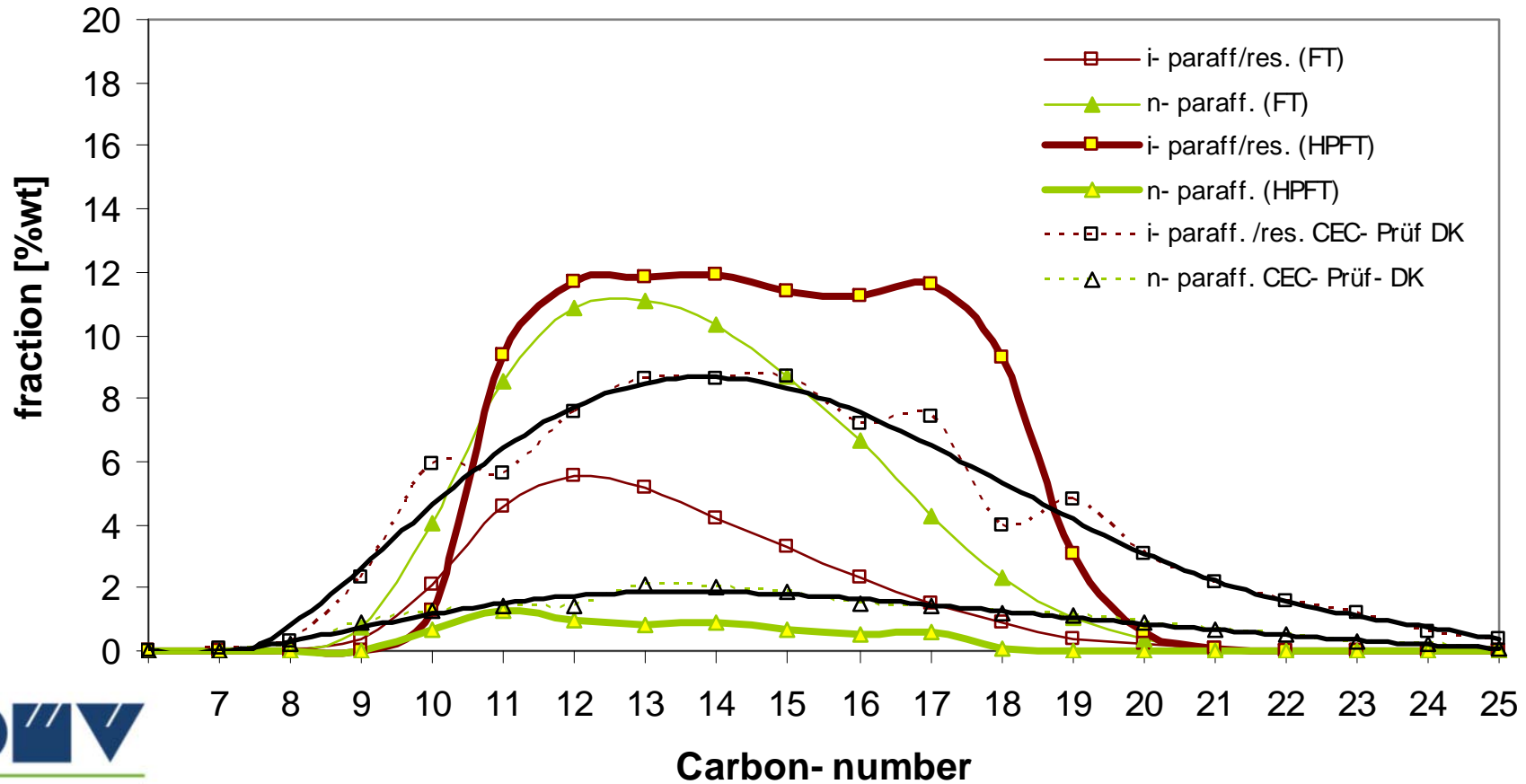
Slurry reactor, because of excellent heat transfer and easy scaling up

Gas treatment removes Sulphur to below 10ppb

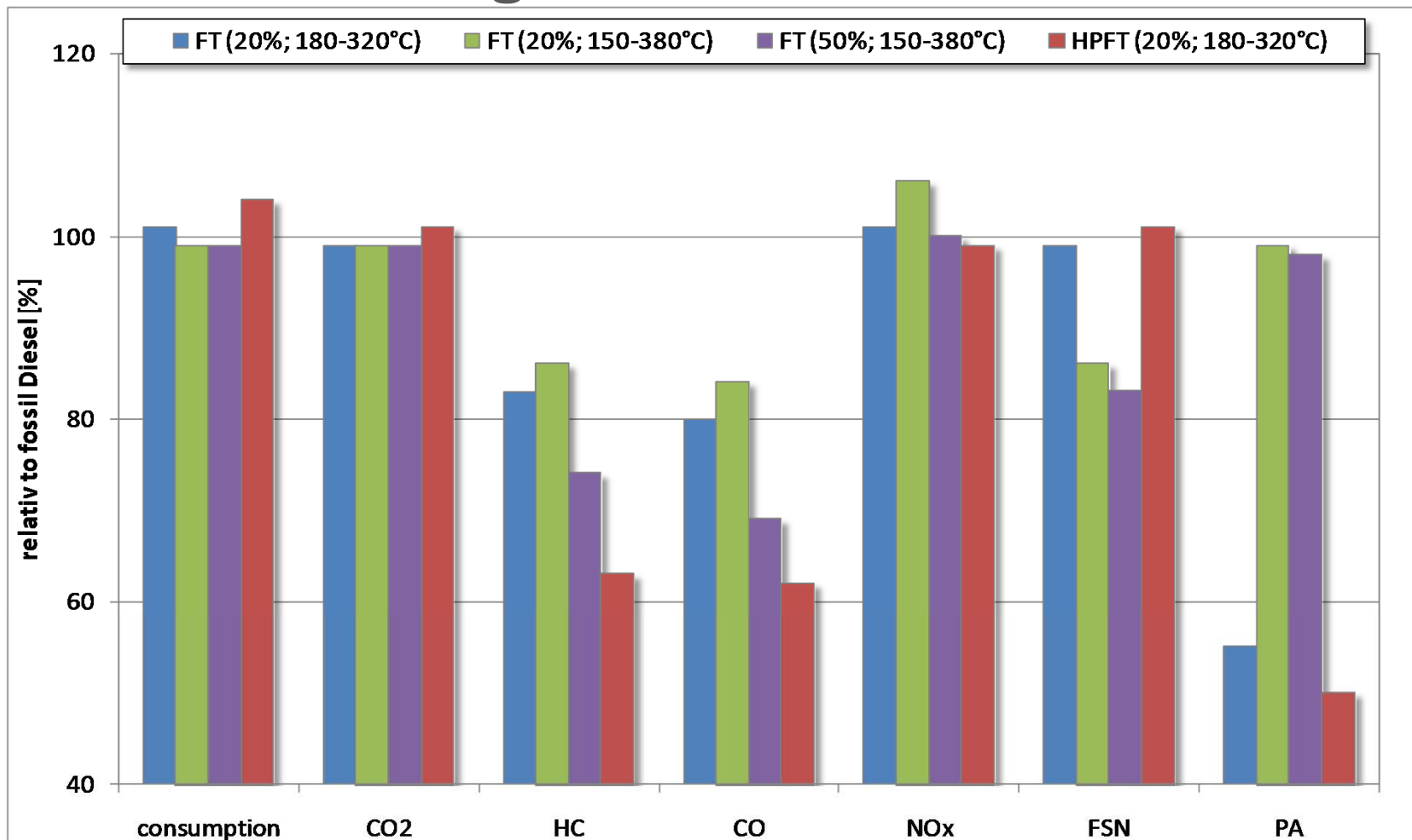
Fully automatic

Comparison of produced FT Fuels

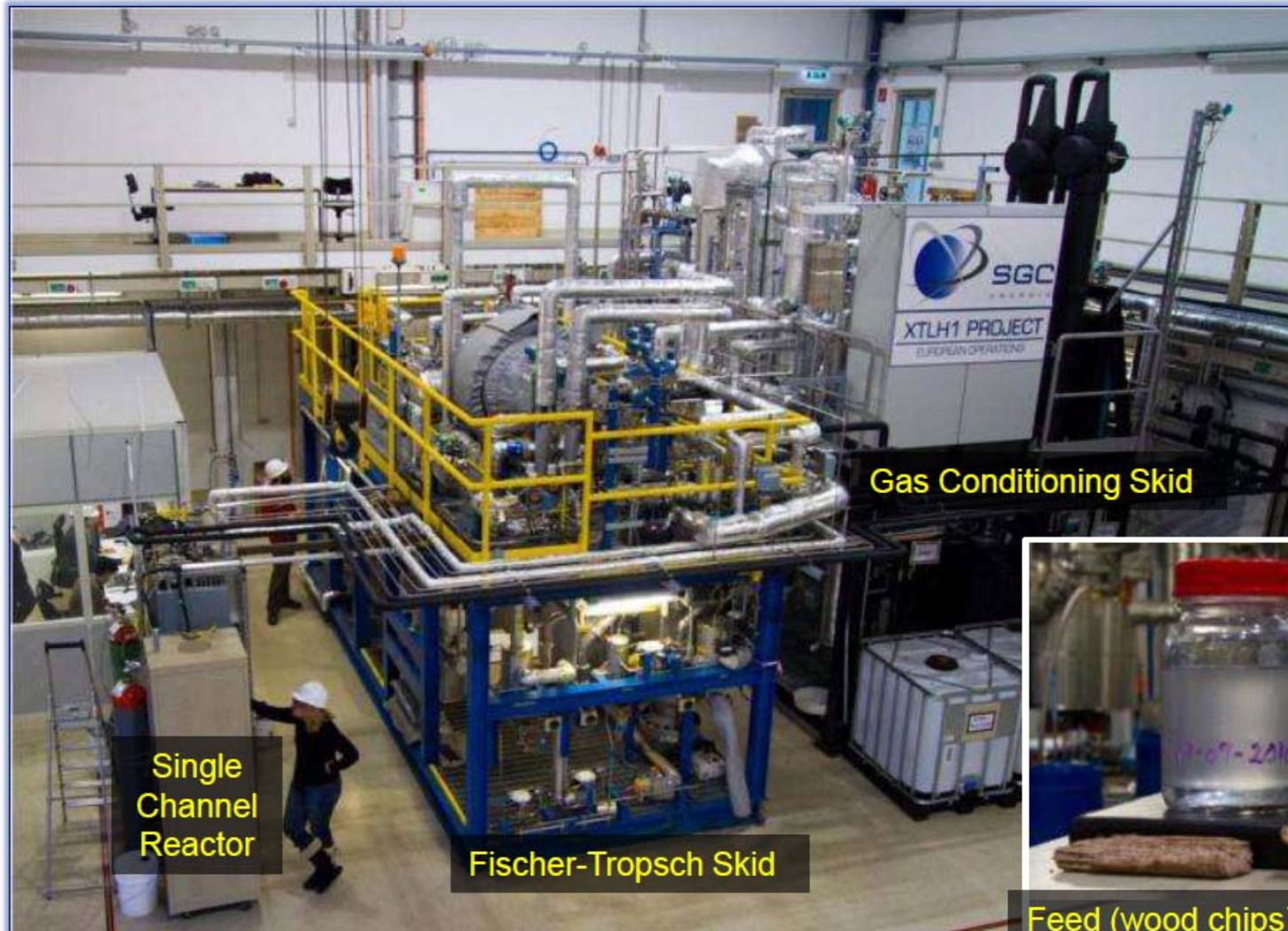
| | FT- Diesel | HPFT- Diesel | CEC- Prüf. |
|-------------|-------------------|---------------------|------------|
| ACN: | >72 $t_d = 2,5$ s | 68,5 $t_d = 2,91$ s | >51,8 / |
| CFPP/CP/FP: | -12/ -9/ - °C | -62/ -60 / -98°C | -18/ -5 °C |



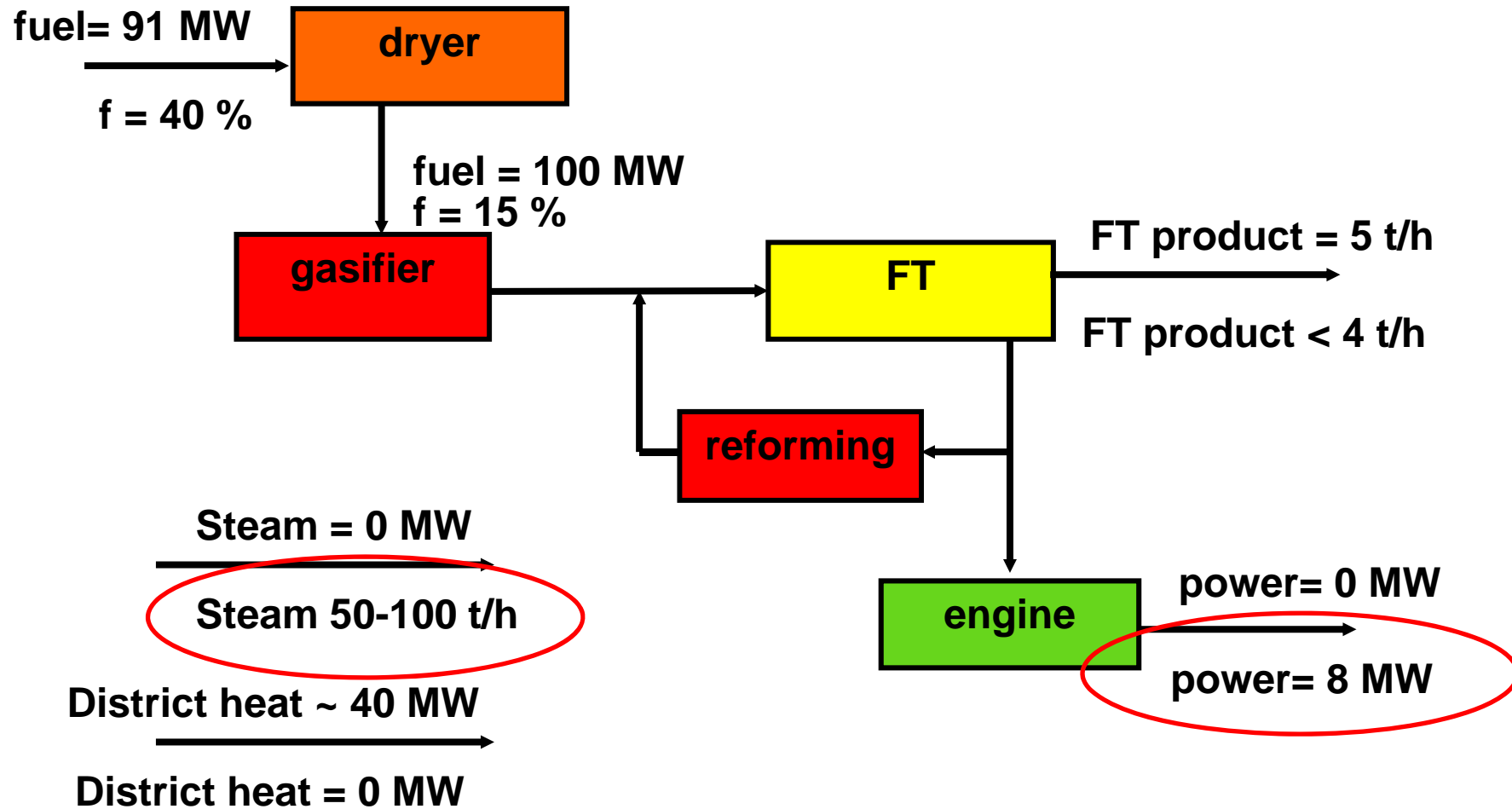
Results on engine tests with blends

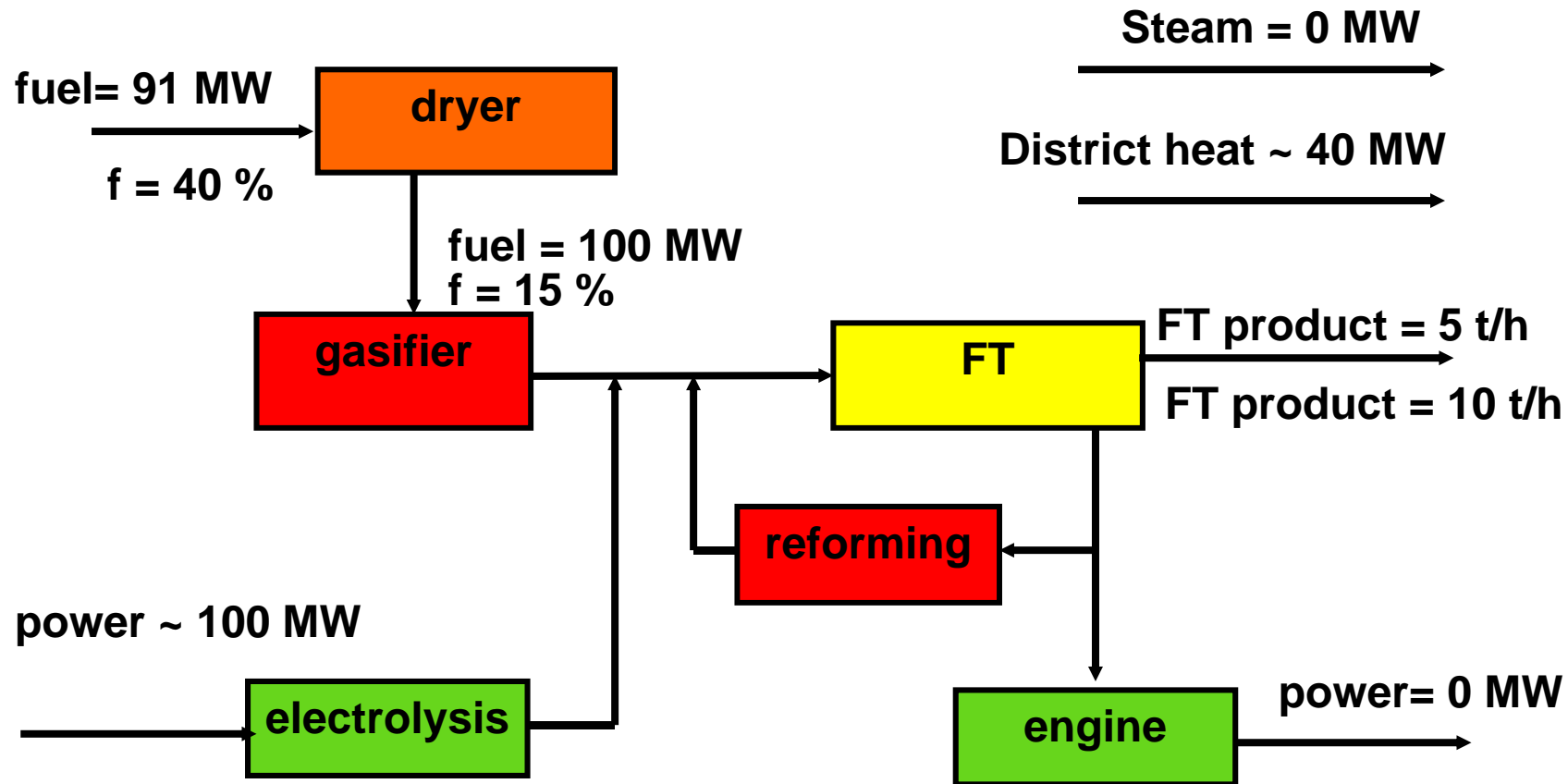


SGC Energia finished successfully their 1bpd demo



Feed (wood chips) and FT Product





- Successful scale up of a dual fluidized bed steam gasification system from laboratory to industrial scale (**within 10 years**)
- Several industrial plants available with
 - High electrical efficiency (> 30 % with combined gas engine and ORC-process)
 - No solid residues (only ash, carbon content <0,5 %)
 - No liquid condensates
 - European emission requirements are met
 - High availabilities (>90 %)
 - Three plants are already in operation (8-15 MW_{fuel})
- High potential for biofuels (BioSNG, BioFiT)
 - BioSNG, most suitable,
 - BioFiT, research ongoing, scale up to 1 bpd is ongoing
- Biomass CHP Güssing and now also Oberwart is optimal for research, as synthesis gas is available for 7000 hours per year

Information

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<http://www.bioenergy2020.eu>