Fluidized bed gasification of biomass: the yield of hydrogen under different operating conditions.

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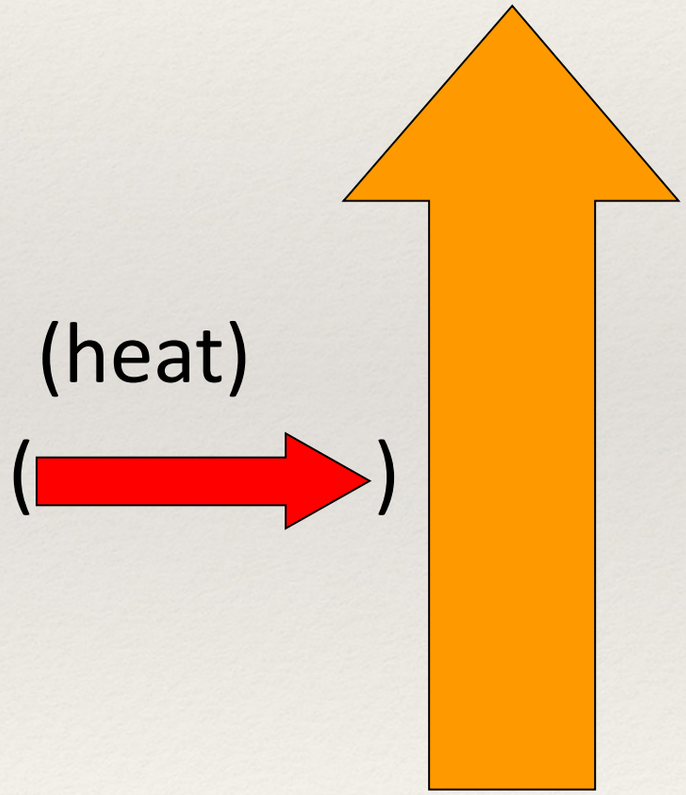
Gasification principles

$H_2 + CO + C_xH_y + CO_2 + H_2O + (N_2)$

+ impurities (tars, solid particles, sulphur-, chlorine-, nitrogen-compounds etc.)



fuel + gasifying agent (air, O_2, steam, CO_2)

Use of the gas in a gas engine

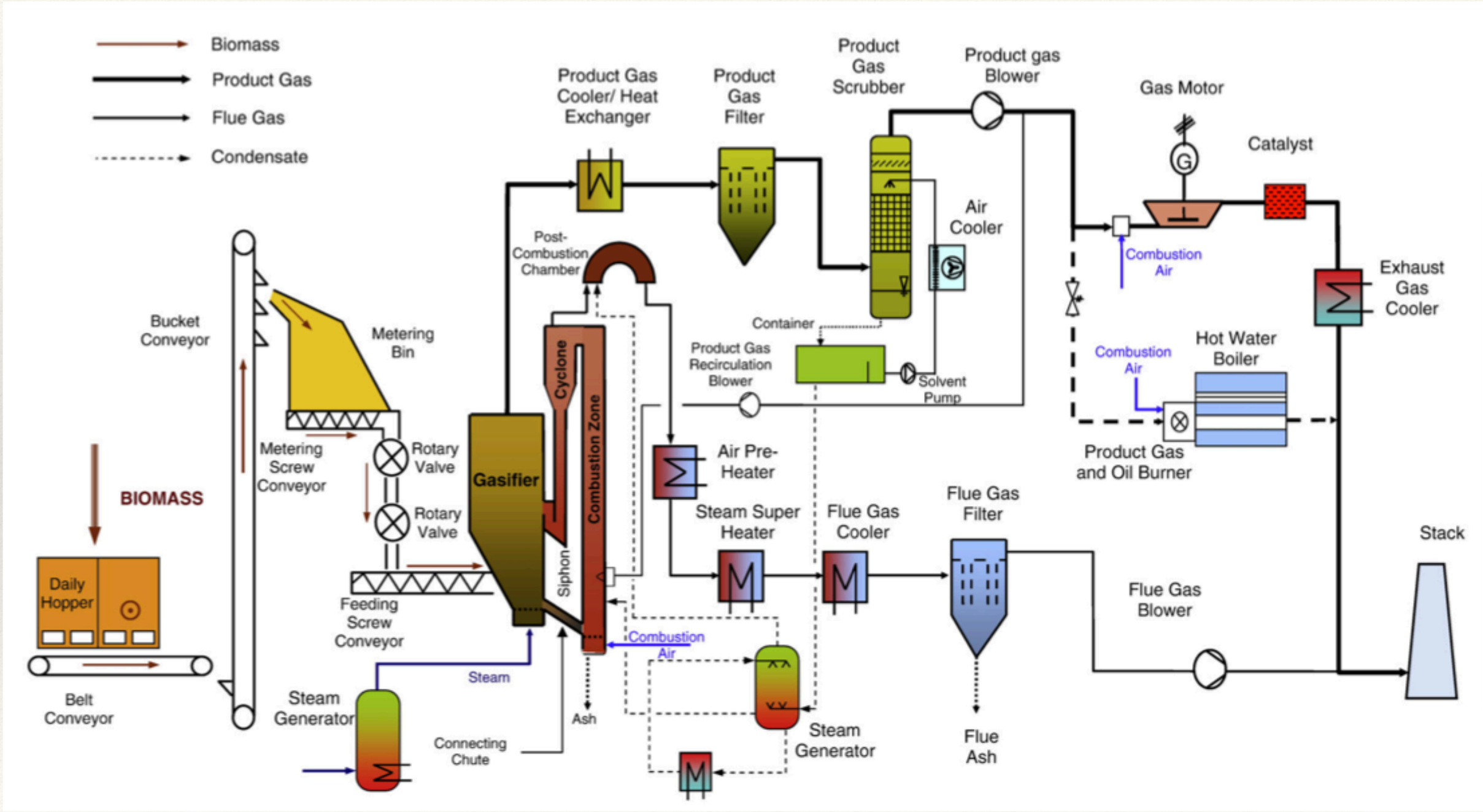
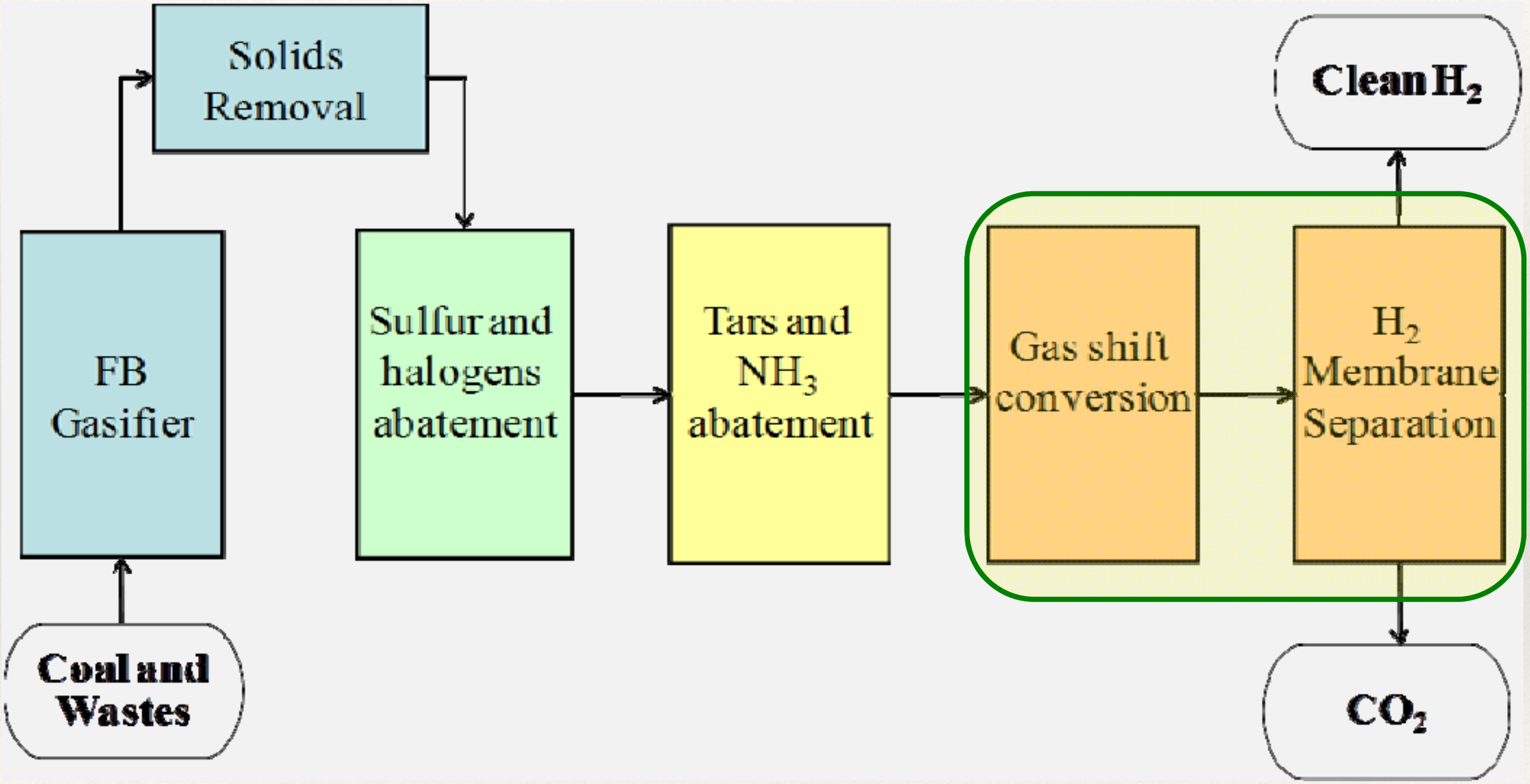
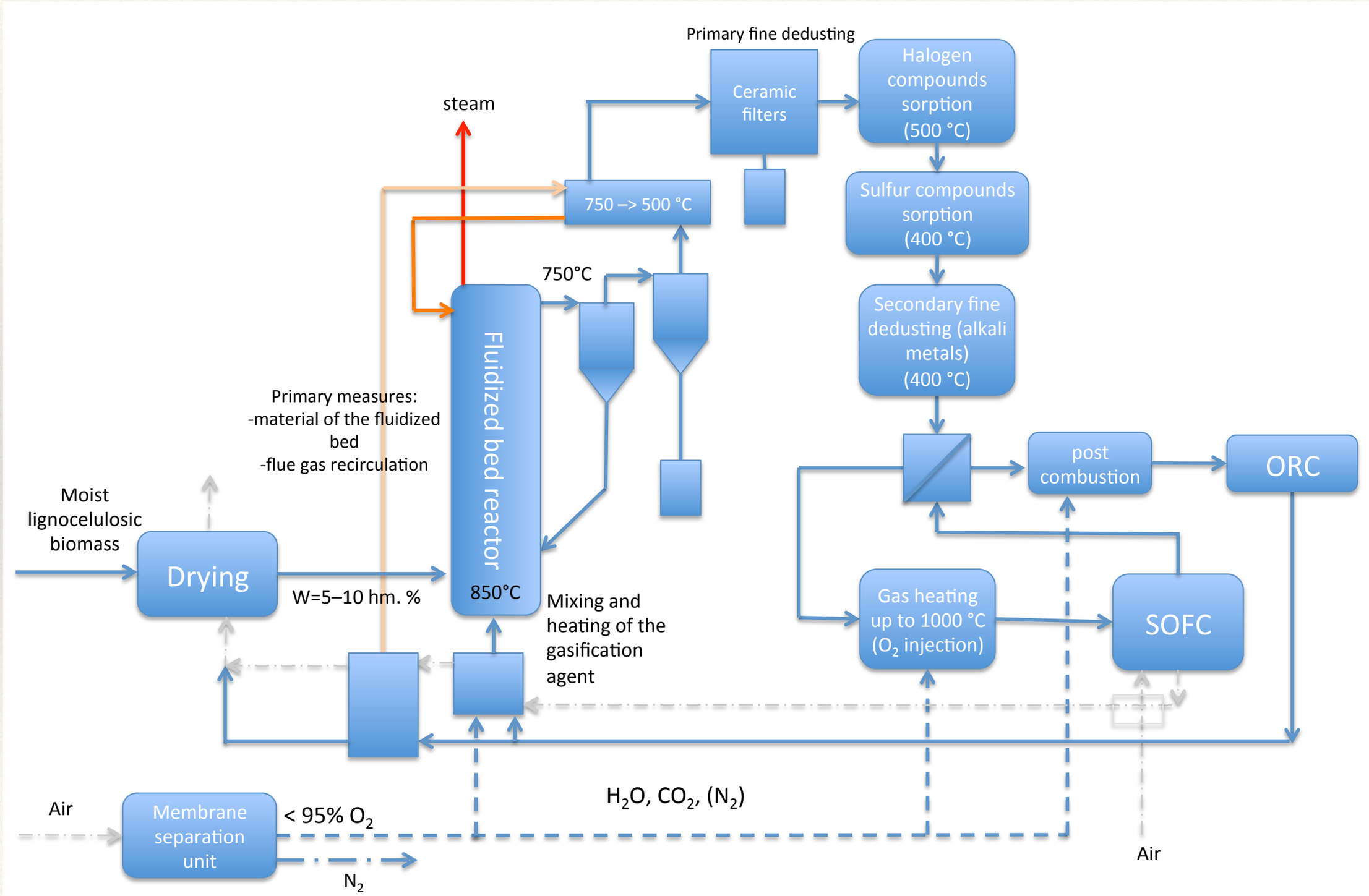


Fig. 1.16 Gasification in Güssing (Austria) [24]

Hydrogen production via gasification



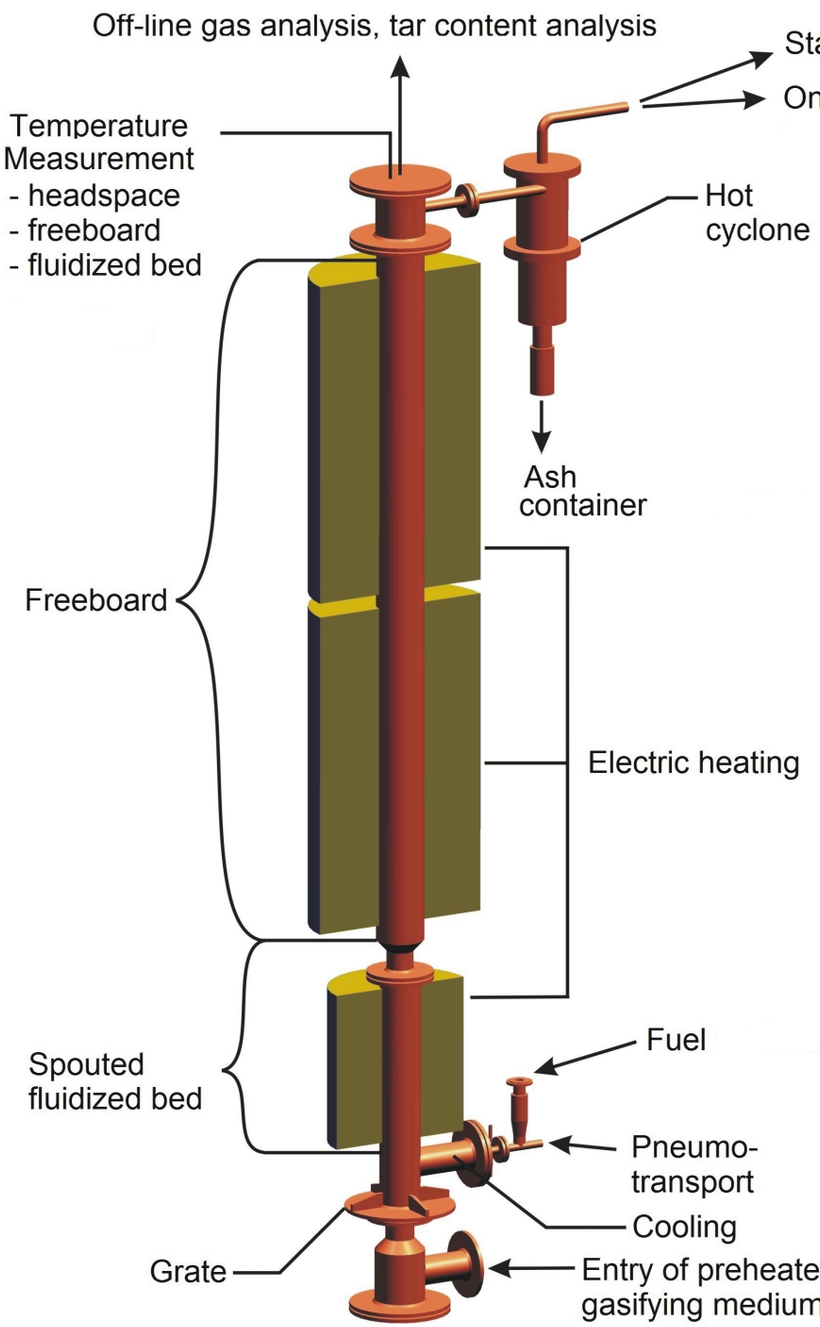
Gasification + SOFC concept



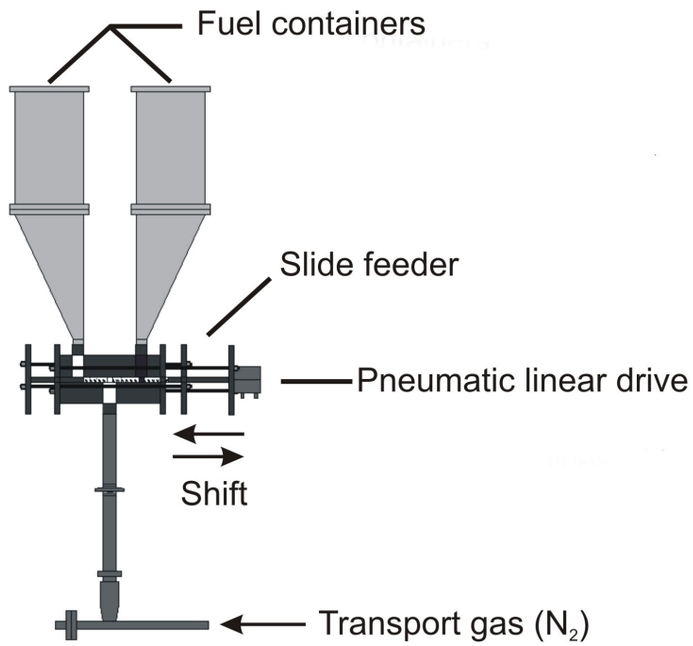
Aim

- To determine optimal concentration of dolomitic limestone in the fluidized bed.
- (dolomitic limestone has catalytic effect on gasification, but it is prone to attrition)
- (silica sand has good mechanical properties for fluidized bed)

Experimental reactor



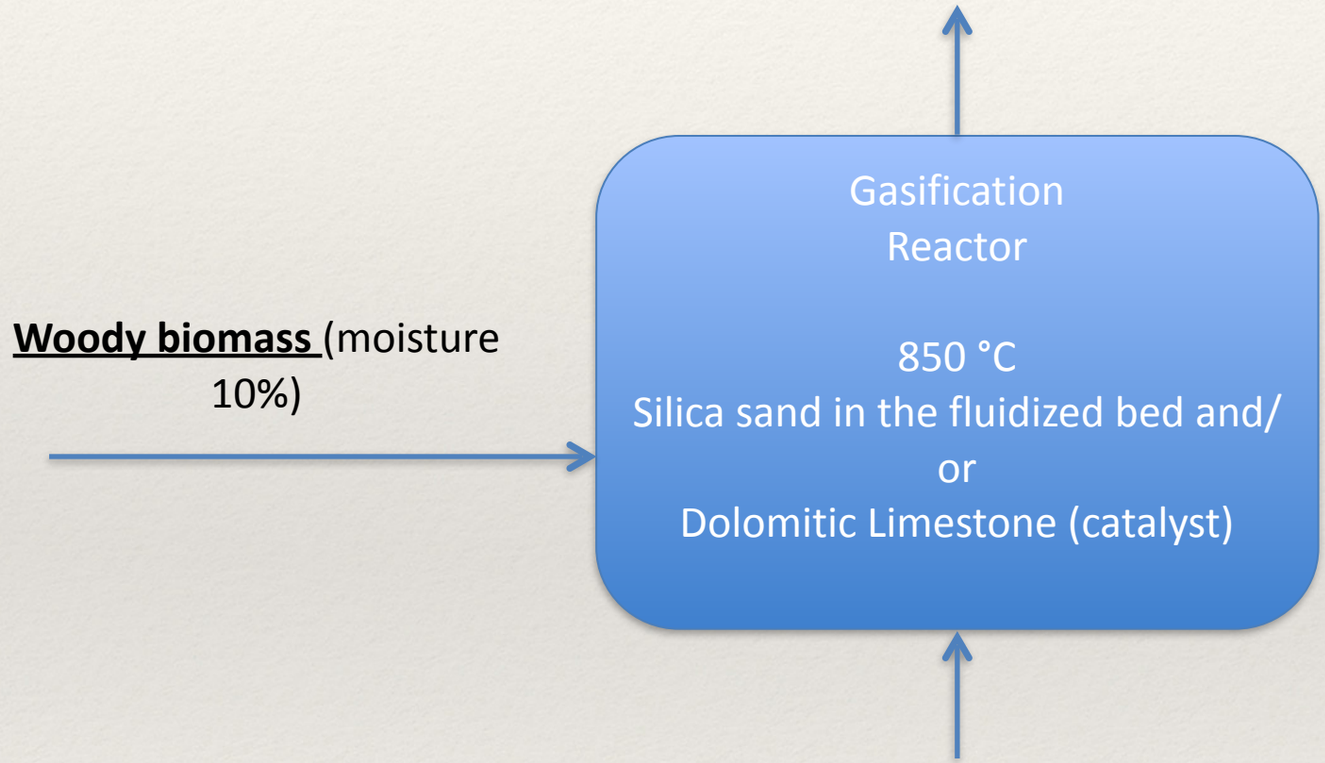
Reactor diameter	51 mm in lower section 99 mm in upper section
Height	2200 mm
Power	~10 kW



Experimental conditions

<u>Calorific gas</u>

(mixture of H_2, CO, CH_4, C_xH_y, CO_2, H_2O, N_2+ pollutants [**tars**, particles, S-compounds, Cl^{-1} compounds etc.])



O_2 reactions are exothermic (λ=0.2)

H_2O reactions are endothermic

The effect of material of the FB on major gas yields

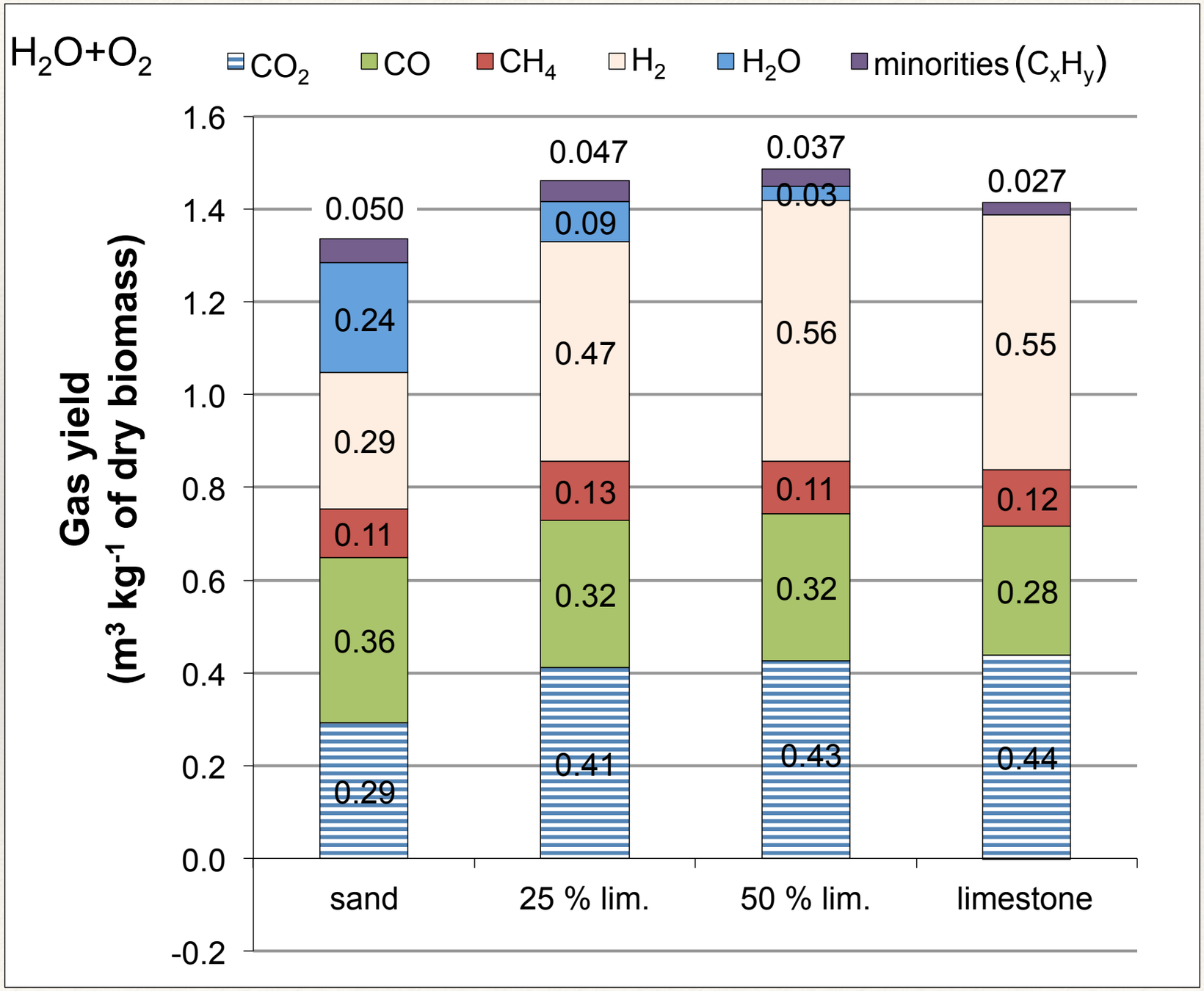


Fig. 4.63 Major gasses yield in the 'H_2O+O_2' steady state. H_2O input in the gasifying agent is subtracted.

The effect of material of the FB on minor organic gasses and tars

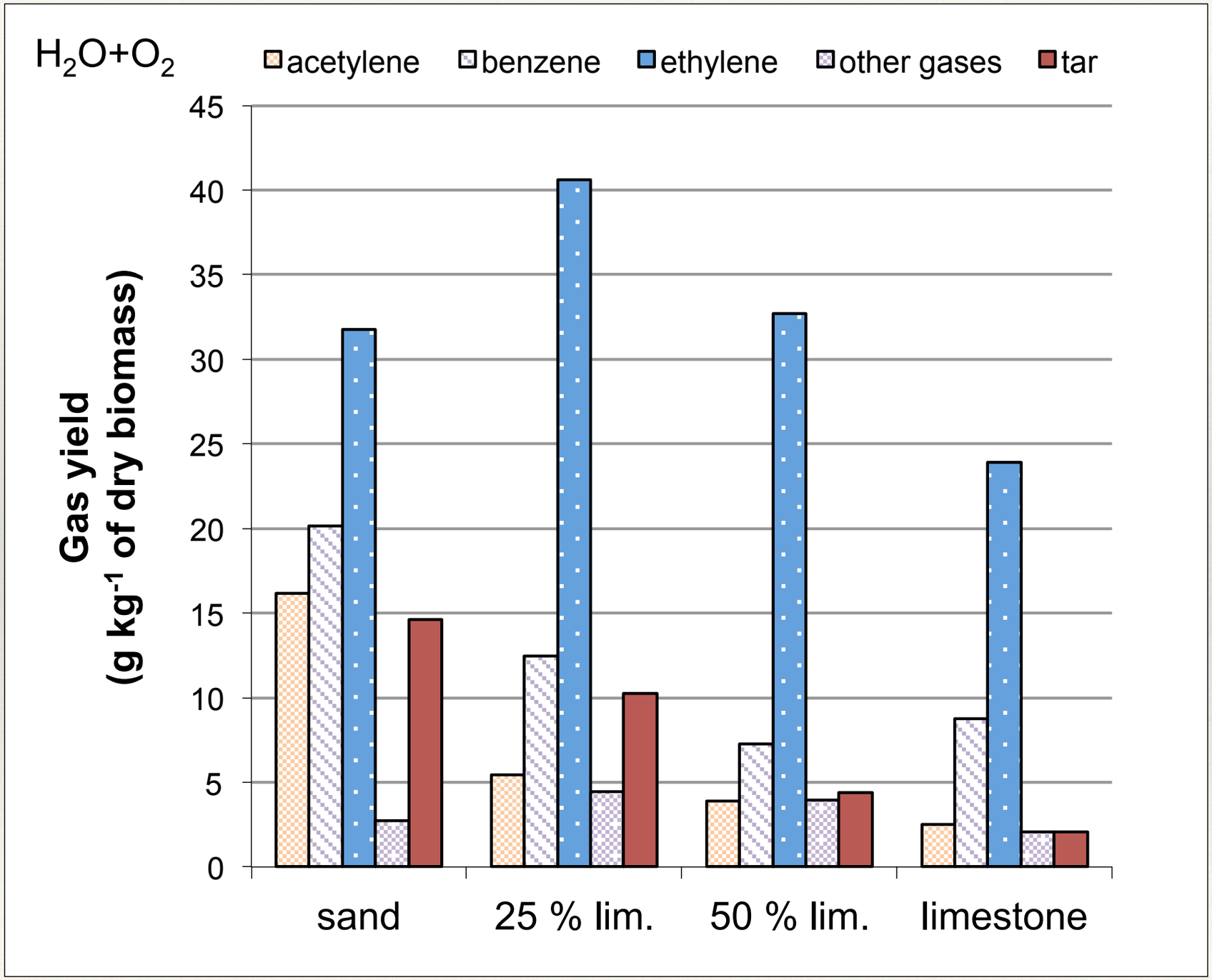


Fig. 4.66 Minor organic gasses and tar

The effect of material of the FB on tar yield and composition

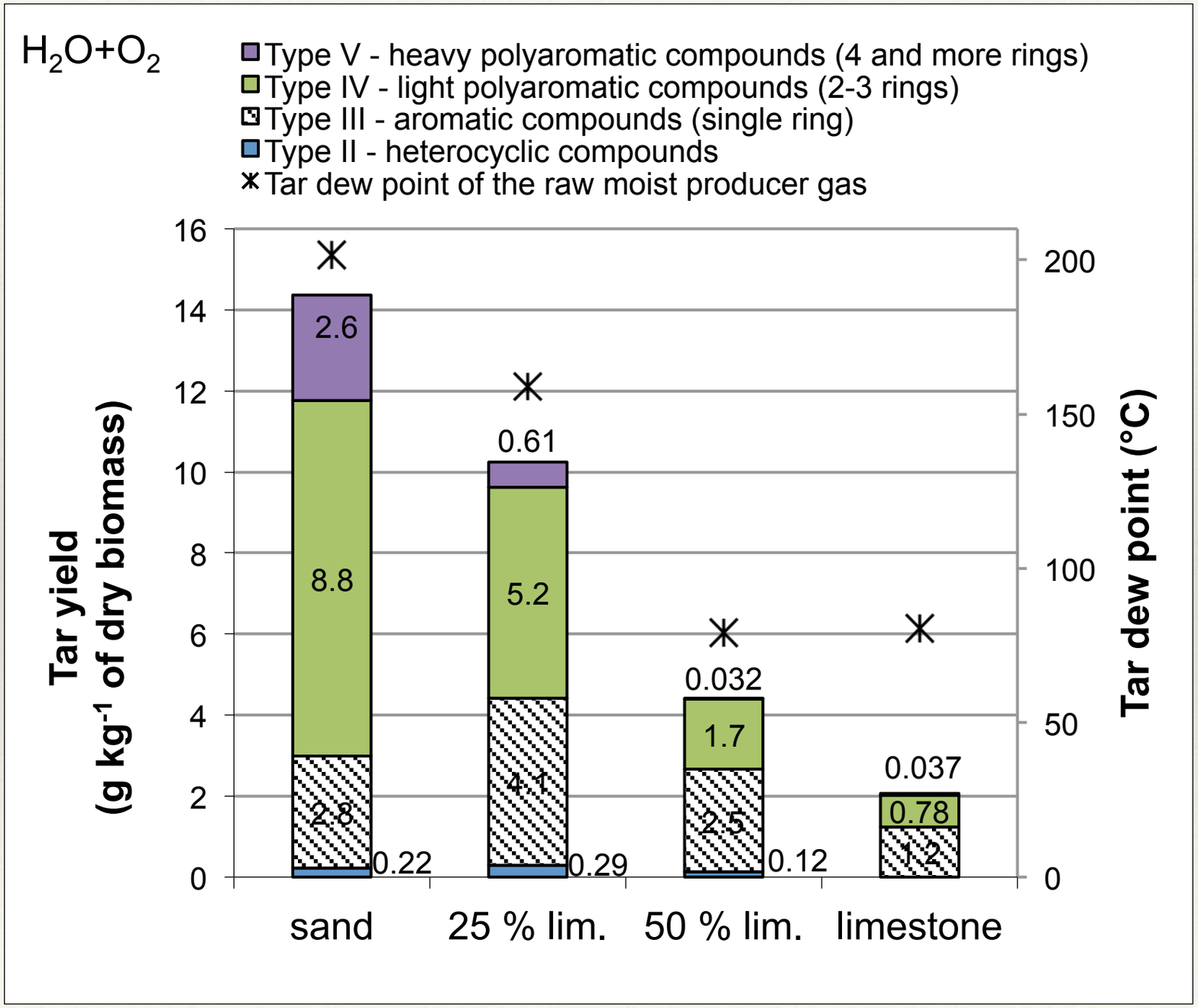


Fig. 4.68 A detailed view of tar classes

Conclusion

- From the point of view of hydrogen yield and producer gas purity, 1:1 mixture of of catalytic dolomitic limestone and sand in FB is an optimal mixture.