

HYDROGEN FROM SUPERCRITICAL WATER GASIFICATION OF RESIDUES FROM WINE GRAPES AND GREENHOUSE BIOMASS

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**BIO-ENERGY
ENLARGED PERSPECTIVES**

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OBJECTIVES

- **BIOSLURRY FEED PREPARATION**
- **HIGH PRESSURE PUMPING TO 350 BAR**
- **SUPERCRITICAL WATER GASIFICATION OF BIOSLURRY AT 350 BAR AND 600 °C IN 10-30 L/HR BENCH SCALE UNIT (20 kW_{th})**
- **VALIDATION IN 100 L/HR PILOT UNIT**
- **DESIGN OF 1 MW DEMO UNIT**

OVERALL PURPOSE: CONVERT BIOMASS WASTE TO HYDROGEN FOR ELECTRICITY AND HEAT

CONVERSIONS

GLYCEROL: WATER IS FORMED (1:1,1)

HYDROGEN FROM GLYCEROL (1:0,8)

GLUCOSE: WATER IS NEEDED (1:3,4)

HYDROGEN PRODUCTION (1:7,1)

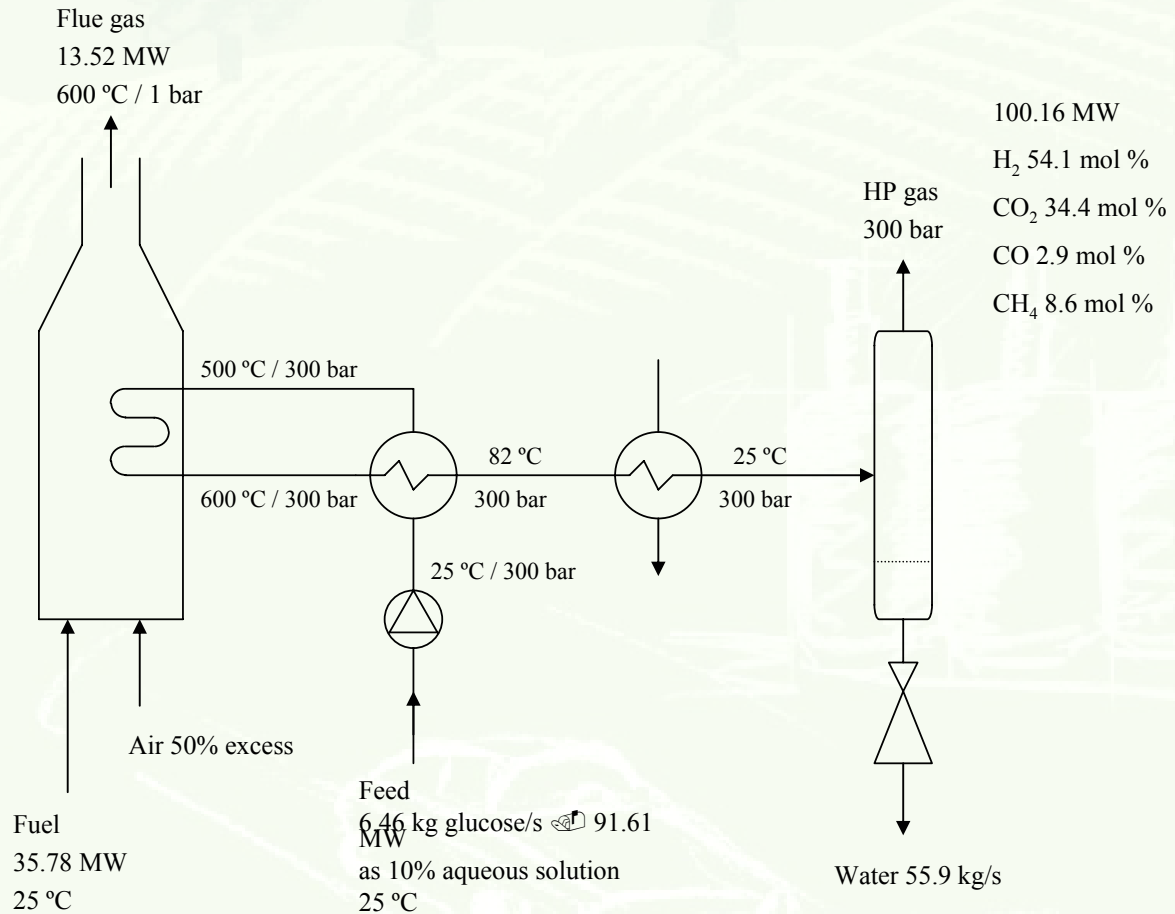
36% OF H₂ FROM WATER

TRESTER: WATER IS NEEDED (1:1,3)

HYDROGEN PRODUCTION (1:2,9)

17% OF H₂ FROM WATER

Conceptual process configuration SWG/SWS process - based on glucose / SCW chemistry



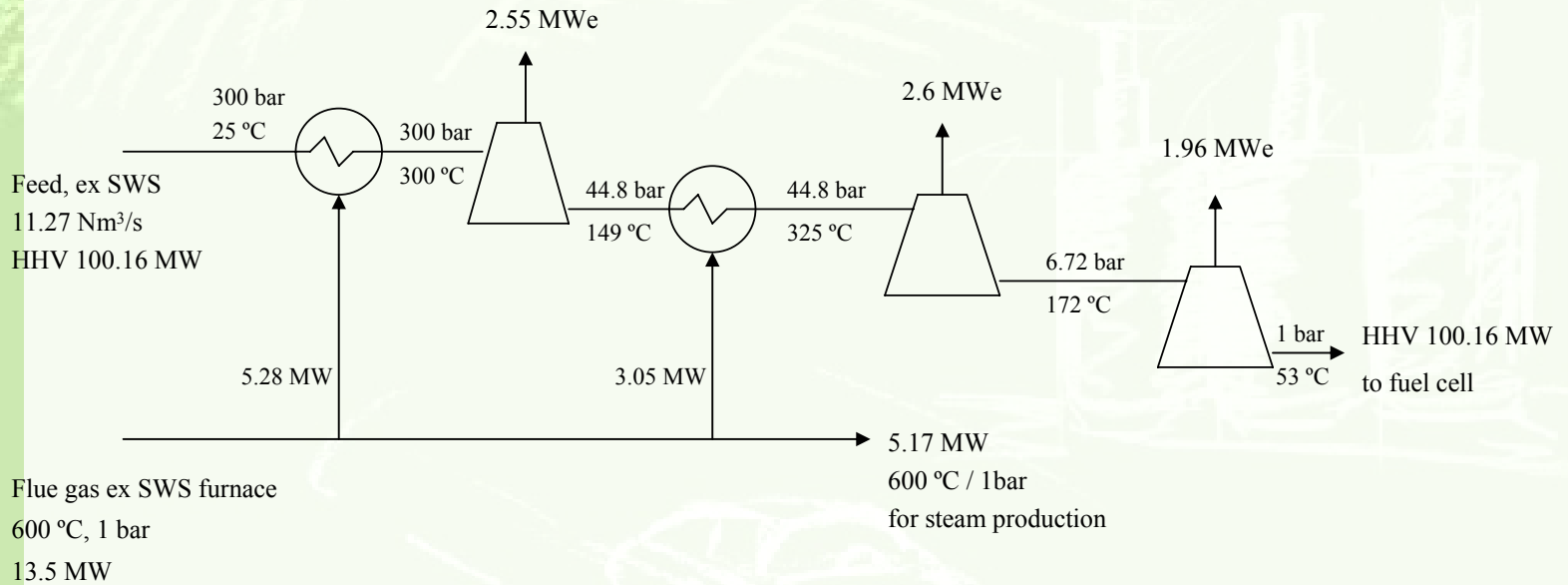
Thermal efficiency η of SWS process - 100.16 MWth product gas / 300 bar

feed wt %	glucose feed rate	furnace fuel	hp pump*	η
10	91.61 MWth	35.78 MWth	3.58 MWth	0.767
20	91.61	24.90	1.98	0.846
30	91.61	21.10	1.28	0.882

* fuel demand for electric power, 50 % efficiency

Expansion to atmospheric pressure for maximum power

expansion ratio: 6.7 $\eta = 0.72$



SWS vs. Electrolysis

	SWS	Electrolysis
Power consumption, MWe	14.04 – 24.09	162 – 191
Biomass consumption, MWth	91.61	zero

SWS costs 91.61 MWth of wet biomass

But saves 138 to 177 MW electric power over electrolysis !

“Power production from wet biomass with thermal efficiency higher than 100 %”

CONCLUSIONS

- **BIOSLURRIES UP TO 35% DS PRETREATED**
- **RAPID CONVERSION AT 300 BAR AND 600 C**
- **SALT FORMATION TO BE REMOVED BEFORE DURING AND AFTER SCWG**
- **THERMAL YIELD ABOVE 70%**
- 5. **25 ct/kg H₂ AT EUR -/- 25/TON GATE COST IN 100 MW_{th} PLANT USING 190 kT/YR BIOMASS**