



Efficient Syngas Fermentation of Gasified Woody Biomass

Techno-economic analysis and overall results

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Results from tests with real-life syngas

Only syngas: Unstable biological process, high CO content in outgoing gas, increase in pH.

Syngas + CO₂: 23.13 L/min syngas + 4.47 L/min CO₂ resulted in residual levels of 0.75% CO and 3.71% H₂ with 10.5 L of CH₄ leaving the reactor per L reactor volume and day.

Syngas + H₂: Low CO (0,06%) and H₂ (0,20%) content in outgoing gas plus gas conditioning with recycling of CO and H₂ to gas feed = no CO leaving the system

TEA - commercial scale

Capacity: 7.5 MW_{th} wood chips (35% water content), 6 MW syngas and 4.8 MW biomethane

Gas composition: 58% H₂, 30% CO, 10% CO₂, 2% CH₄

Process parameters: Non-pressurised biological methanation, mixed culture

Gas conditioning: Membrane separation, recycling of residual H₂ and CO to gas feed. End product meeting grid specifications and delivered at 10 barg.

Operational hours: 8,000 h/a

TEA - parameters

Annuity method, interal interest rate 7% and 20 year economic life time.

CAPEX: WoodRoll® gasification system, delivery pressure 250 mbar, Solid-state biological methanation, gas conditioning and upgrading incl. compression to 10 barg. Start-up cost is set to 5% of investment cost.

OPEX: Electricity, water, nutrients, staff cost, maintenance cost

Feedstock: Wood chips (300 SEK/MWh, ~27.4 EUR/MWh)

Production: 4.8 MW – 50 kW (flare) biomethane

Other revenues: Heat (4,000 h/a), carbon containing ash (metallurgic industry)

TEA – production cost

Two cases have been calculated, with and without investment support via Klimatklivet. 45% of the investment cost can be covered by Klimatklivet.

	No investment support	Investment support
Production cost [SEK/MWh CH ₄]	1 812 (~165 EUR)	1362 (~124 EUR)
Production cost [SEK/Nm ³ @97% CH ₄]	17,58 (~1.6 EUR)	13,21 (~1,2 EUR)

Business case

- Include a sorting machine to allow the use of low quality biomass (park and garden waste, demolition wood, recycled wood).
 - Co-production of biochar and biomethane.
 - Larger dryer and pyrolysis reactor, modification of the steam system.
 - Increased personnel and maintenance cost.
 - Reduction of annual operational hours (8,000 -> 7,800).
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- 1,100 kg/h extra of wood chips to produce 200 kg/h extra of biochar
 - Biochar sold as soil amendment plus carbon credits, (~1,500 EUR/ton)

Business case

Two cases have been calculated, with and without 45% investment support via Klimatklivet.

	No investment support	Investment support
Production cost [SEK/MWh CH ₄]	1 170 (~107 EUR)	687 (~63 EUR)
Production cost [SEK/Nm ³ @97% CH ₄]	11.35 (~1.03 EUR)	6.70 (~0,61 EUR)





**Thank you for your
attention!**



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