

requisimus & SST

pollution²power

At a Glance



- Economic way to reduce environment pollution & carbon footprint
- Converting forming gas carbon (CO, CO₂) into methanol (CH₃OH)
- Creating value from waste efficiently by using microwave technology
- Target: Generating profit by saving the environment

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Concept

Methanol Synthese from CO₂

- Protection of natural resources and living environments by reducing emissions
- CO₂ as waste product gains in value, costs and energy required for storing are eliminated
- Methanol is a core compound serving as a precursor in the production of intermediates, synthetic hydrocarbons, solvents, energy storage and fuel
- Methanol, produced with renewable energies, has great application potential as an alternative fuel
- Methanol production and use are essentially carbon neutral without harmful emissions



Technology

➤ Input

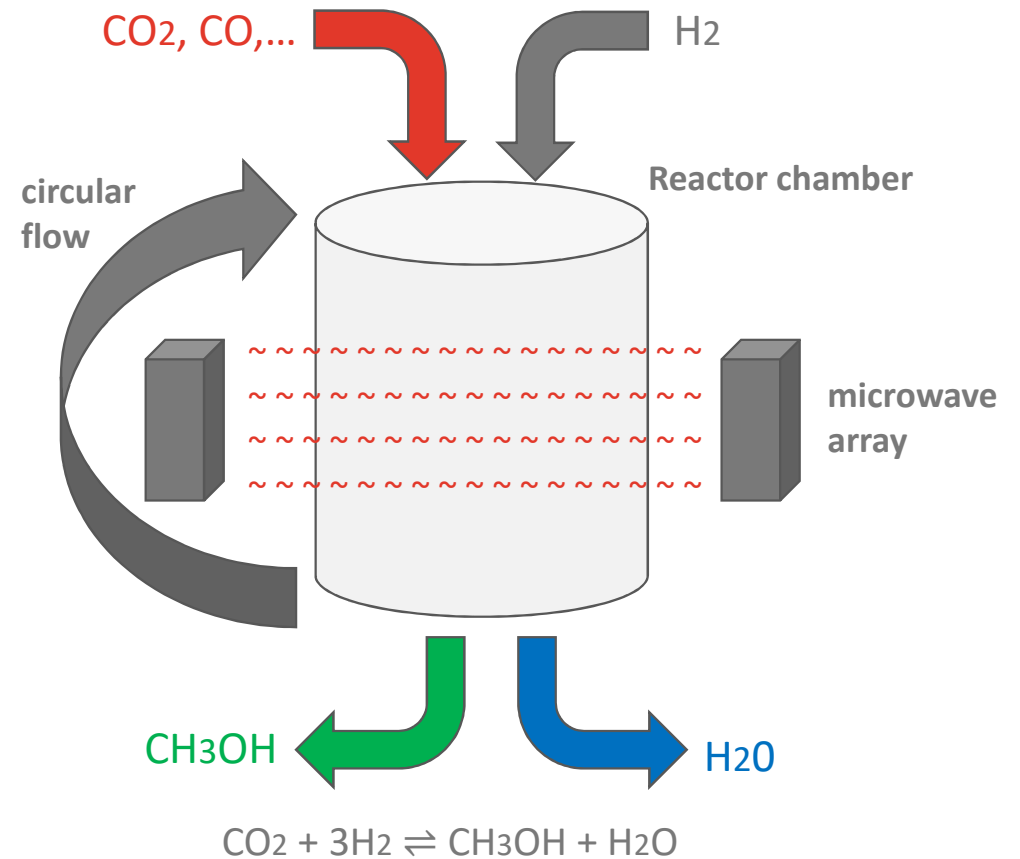
- CO, CO₂ (gas)
- H₂ gas
- Electrical energy

➤ Equipment

- Reactor chamber at definite pressure & temperature range
- Exposed to microwave field
- $\text{CO}_2 + 3\text{H}_2 \rightleftharpoons \text{CH}_3\text{OH} + \text{H}_2\text{O}$

➤ Output

- Methanol (liquid)
- Water (liquid)



Sustainability

➤ Renewable driven

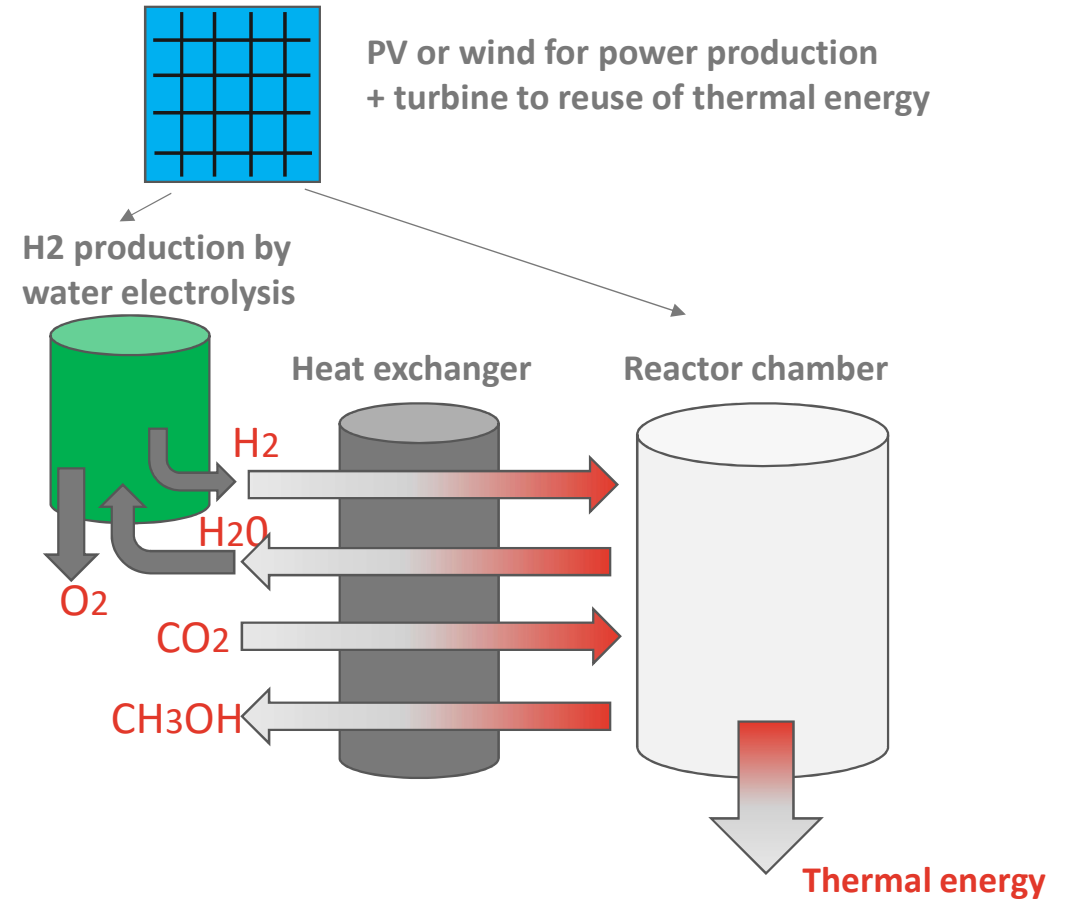
- Use heat exchanger to minimize energy
- Turbine use of thermal energy recovery
- Additional power demand covered by PV or wind energy

➤ Zero waste

- Recycling of H₂O to minimize water consumption and to avoid waste
- Circular gas flow within reactor chamber to increase yield
- Output O₂, CH₃OH. No further residuals

➤ Climate-neutral

- Reducing carbon footprint without negative side effects



Profitability

➤ For equipment size of 500 tons / year CH₃OH

- 1.635 tons / year reduced CO₂ emission, worth ~ 98.000 € compensation for CO₂ emission reduction - strongly increasing in the future
- 500 tons / year production of green fuel CH₃OH, worth ~ 1.250.000 € sales volume
- Contribution to the environment protection
- Byproduct O₂ from electrolysis process can be sold additionally

➤ Efficient

- Closed loop system – non-reacted off-gases return into production cycle
- Microwave technology ensures efficient initiation and maintaining of methanol synthesis in the reactor and saves energy costs
- Cost-saving and environmentally friendly renewable hydrogen production
- Closed loop water cycle reduces water consumption

Current status & next steps

Step 1a: Ideal Case		
	Power: 5 kW	
Input	Reactor	Output
H ₂ : 1,89 to/Y = 0,236 kg/h	10 to/Y CH ₃ OH synthesis, p = 60.....150 bar, T = 250.....350 °C	H ₂ O: 5,62 to/Y = 0,70 kg/h
CO ₂ : 13,74 to/Y = 1,72 kg/h		CH ₃ OH: 10 to/Y = 1,25 kg/h

Step 1b: Real Case		
	Power: 7 kW	
Input	Reactor	Output
H ₂ : < 6 to/Y = 0,75 kg/h	10 to/Y CH ₃ OH synthesis, p = 60.....150 bar, T = 250.....350 °C	H ₂ O: 5,62 to/Y = 0,70 kg/h
CO ₂ : < 32,70 to/Y = 4,10 kg/h		ret H ₂ : < 4,10to/Y=0,513 kg/h ret CO ₂ : < 18,97to/Y=2,37 kg/h
		CH ₃ OH: 10 to/Y = 1,25 kg/h

Perspective

Step 2: + Electrolysis		
ideal H ₂ : 1,89 to/Y = 0,236 kg/h = 2,62 Nm ³ /h = 12,36 kW real H ₂ : <6,0 to/Y = 0,75 kg/h = 8,29 Nm ³ /h = 39,13 kW Power 7 kW		
Input	Reactor	Output
Photovoltaic Solar Panels P = 20...50 kW (H ₂ < 0,75 kg/h) incl < 40 kW H ₂ O Electrolyser	10 to/Y CH ₃ OH synthesis, p = 60.....150 bar, T = 250.....350 °C	H ₂ O: 5,62 to/Y = 0,70 kg/h ret H ₂ : < 4,10to/Y=0,513 kg/h ret CO ₂ : < 18,97to/Y=2,38 kg/h
CO ₂ : < 32,70 to/Y = 4,10 kg/h		CH ₃ OH: 10 to/Y = 1,25 kg/h

Step 3: + Using Flue Gas (Rauchgas) (5.....15% Vol - CO₂)		
Initial Flue Gas: 40,88 kg/h; 10% CO ₂ =4,088 kg/h Power: 7 kW		
Input	Reactor	Output
Photovoltaic Solar Panels P = 20...50 kW (H ₂ < 0,75 kg/h) incl < 40 kW H ₂ O Electrolyser Flue Gas OASE Blue CO ₂ Washer RWE-Linde-BASF	10 to/Y CH ₃ OH synthesis, p = 60.....150 bar, T = 250.....350 °C	H ₂ O: 5,62 to/Y = 0,70 kg/h ret H ₂ : < 4,10to/Y=0,513 kg/h ret CO ₂ : < 18,97to/Y=2,36 kg/h CH ₃ OH: 10 to/Y = 1,25 kg/h

Rollout

<u>Step 4: + Scale up to 500 to/Y</u>		<u>Power:</u>
Input	Reactor	Output
Photovoltaic Solar Panels Initial Flue-Gas: 2.043,9 kg/h=16.351,17 to/Y OASE Blue CO2 Washer RWE-Linde-BASF	500to/Y CH3OH Synthesis p = 60.....150 bar, T = 250.....350 °C	H2O: 281,19 to/Y= 35,15kg/h CH3OH: 500to/Y = 62,5 kg/h

Contact



We welcome your request!

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