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Coupling of Biomass Based Processes with PtG

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Status and challenges for PtCH₄

- Plenty of R&D activities in methanation
- Several companies offer PtCH₄ (SNG) technologies
- First demonstration plants are in operation, e.g.
 - 6 MW plant in Werlte (Audi E-Gas project, **catalytic** methanation)
 - 400 kW plant Allendorf (Viessmann Group, **biological** methanation)
- Need for **suitable carbon source** (CO or CO₂)
- **Methanation processes** have to be flexible, robust and simple
- Advanced **process integration** is essential to increase overall efficiency
- **Production costs** have to be lowered significantly

Potential for PtG in combination with biomass

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$\approx 500 \text{ m}^3/\text{h CO}_2$

$\Rightarrow \approx 2\,000 \text{ m}^3/\text{h H}_2 (\approx 10 \text{ MW}_{el})$

product gas (biomethane + SNG):

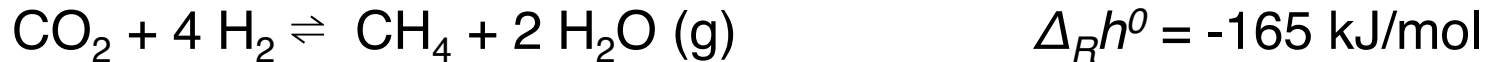
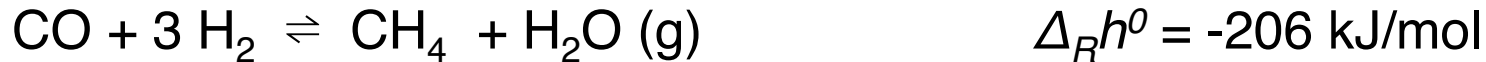
$1\,000 \text{ m}^3/\text{h CH}_4$



- Potential for coupling biogas with PtG in Europe
 - Appr. 14,000 biogas plants in Europe (2012, EBA)
 - Electricity storage capacity: 30 GW
 - Annual operation of 3000 h/a:
ca. 90 TWh electricity could be stored
- Biomass gasification plants could also be green carbon sources

Methanation technologies (I)

Equations

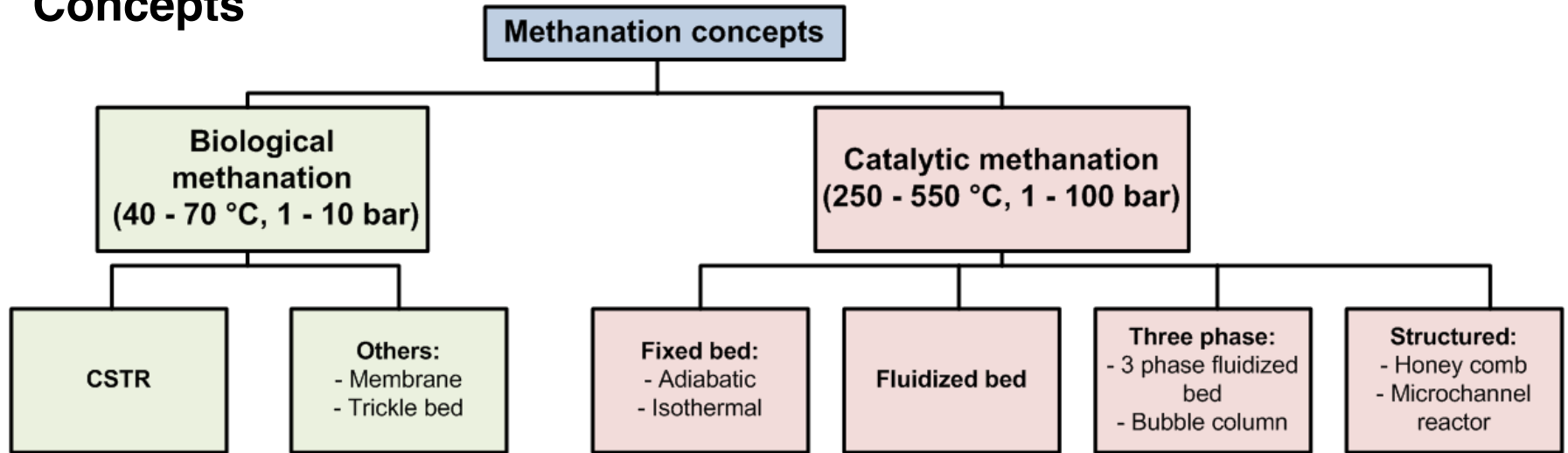


Operation parameters

p in bar	T in °C	catalyst
1 - 100	200 - 500	nickel
1 - 10	40 - 70	microorganisms

Methanation technologies (II)

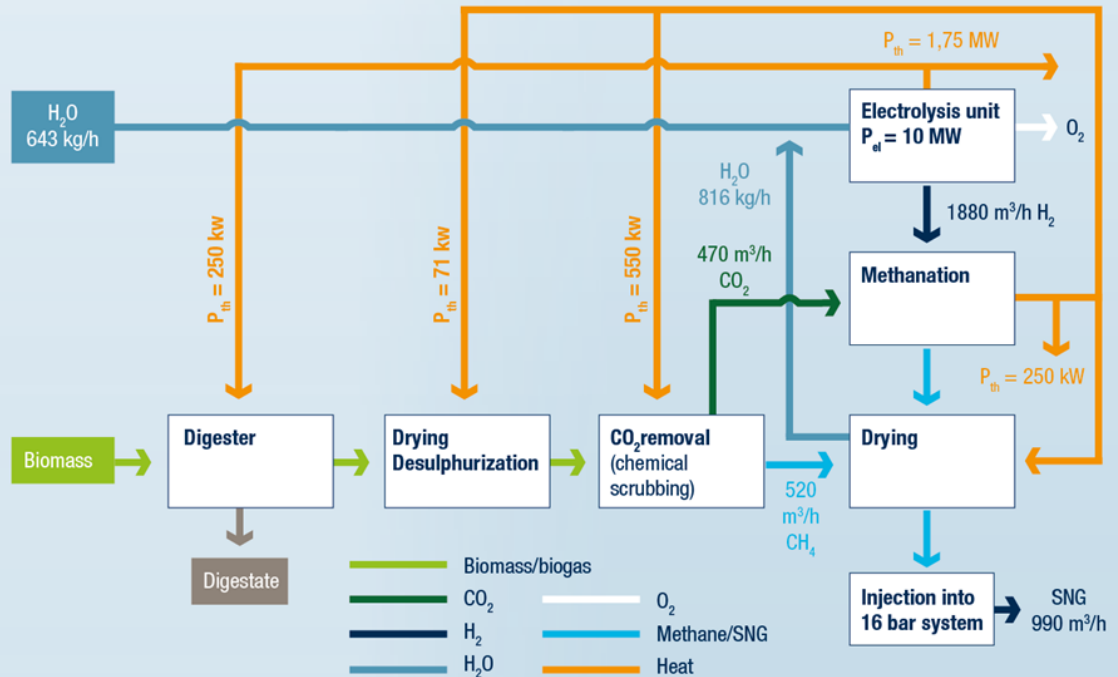
Concepts



CSTR: Continuous Stirred Tank Reactor

Example: PtG and biomethane

	Energy efficiency
SNG	58 %
SNG + heat integration. + power integration	76 %
SNG + heat integration + power integration + heat extraction	86 %



If the heat generated in the process is used, high efficiencies of up to 80% can be reached.
The oxygen produced by electrolysis can also be utilized.

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What are the SNG production costs?

BM: Biological methanation
 CM: Catalytic methanation

