Transforming volatile power from renewable resources to CH_4 by honeycomb methanation.

The Honeycomb Methanation (Power-to-Gas)

Methanation is a suitable technology for storing renewable energies in chemical energy carriers. Thereby, a mixture of hydrogen and carbon dioxide or carbon monoxide reacts to methane. The honeycomb methanation (HCM) is a 2-phase catalytic process with enhanced heat transfer. Dispersion of the highly active catalyst makes up for an optimized reaction zone. Depending on the reaction conditions, a single catalytic stage conversion of up to 99 % is achievable. Due to the large void fraction of the honeycombs, the reactor is ready for quick start-up alongside low pressure drops. Along with the gas cleaning and liquefaction periphery, the output of gaseous methane is 10 m³/h (NTP).

Key data

- Feed gas: syngas with H_2 and CO_2 (or CO) Product: CH_4
- Nominal power: 100 kW (CH_4 output)
- Pressure: 1 – 20 bar
- Temperature: 220 – 350 °C
- Modular reactor for interchangeable honeycombs
- 40´ shipping container

Facts

- Scale: Pilot plant can supply around 50 households with CH_4
- Reaction: Enhanced heat removal, high catalyst stability, low pressure drop.
- Deployment: Mobile container unit for stand-alone operation due to container integrated syngas compressor and watergas-shift reactor.

The picture of the process room shows several main components (before retrofit): gas mixing rack, electric and oil heater, honeycomb reactors, condenser (f.l.t.r.)

Headerphoto: A. Bramsiepe, KIT

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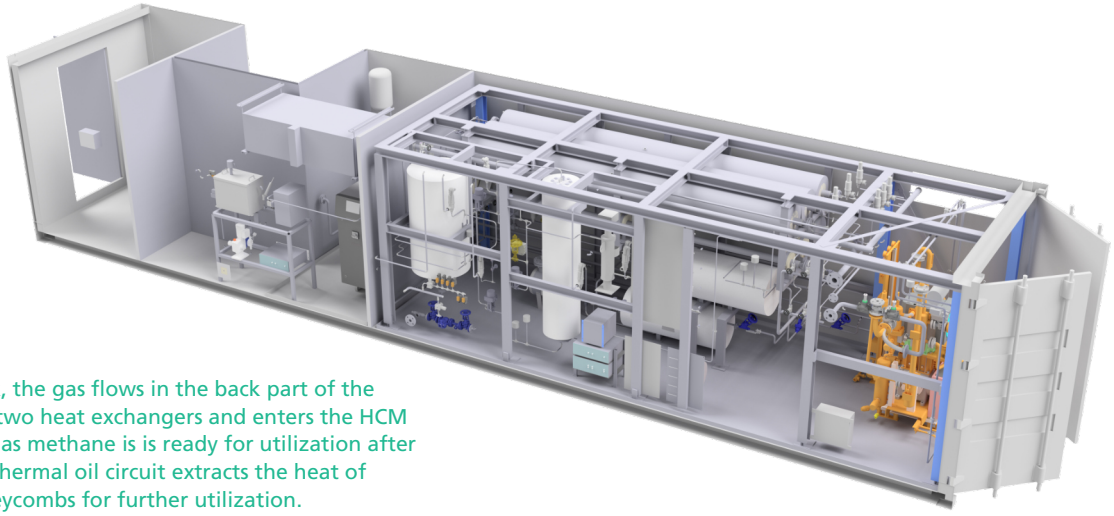

Scheme of the HCM:
Via the gas mixing rack, the gas flows in the back part of the process room through two heat exchangers and enters the HCM reactors. The product gas methane is is ready for utilization after cooling and drying. A thermal oil circuit extracts the heat of reaction from the honeycombs for further utilization.

Project background

With its largest research initiative to date on the subject of the energy transition, the Federal Ministry of Education and Research (BMBF) is supporting Germany's entry into the hydrogen economy. The three hydrogen lead projects are the result of an ideas competition. The lead projects form a central contribution of the BMBF to the implementation of the National Hydrogen Strategy.
Over a period of four years, the lead projects intend to remove existing obstacles to Germany's entry into a hydrogen economy. The projects involve the series production of large-scale water electrolysers (H2Giga), the generation of hydrogen and downstream products on the high seas (H2Mare) and technologies for the transport of hydrogen (TransHyDE). In the H2Mare project, the Engler-Bunte-Institute and the DVGW research center will work on a process chain to produce LNG (liquefied natural gas) from H2.

The HCM plant

The HCM plant, along with a downstream gas scrubber and Stirling liquefier, will create research results for the production of renewable gaseous (CNG) and liquefied (LNG) methane. The operation of the interconnected plants will demonstrate the feasibility of the overall process at technical scale as part of the Energy Lab 2.0. Moreover, the innovative modular reactor system will speed-up the evolution of optimized, large-scale methanation reactors for PtG and BtG processes.

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