Technology: Methane

GENERAL DESCRIPTION

Mode of energy intake and output

Power-to-gas

Summary of the storage process

At first, an electrolyser splits water into hydrogen and oxygen using surplus electricity from renewable sources. The hydrogen (H_2) is then fed into a reactor along with carbon dioxide (CO_2) where a catalyst processes both into methane (CH_4). Both, biological and chemical catalysts are available for this process. The hydrogen could come from any other possible source. The carbon dioxide can be obtained from all types of mixed gases, whether naturally occurring (e.g. biogas) or industrially produced.

System Design

There is a multitude of options available for methane storage. Typically, it is fed directly into the available gas grid with no intermediate storage. This provides almost unlimited storage capacity, allowing the methane to be utilised anywhere and at any time, e.g. in mobility applications.

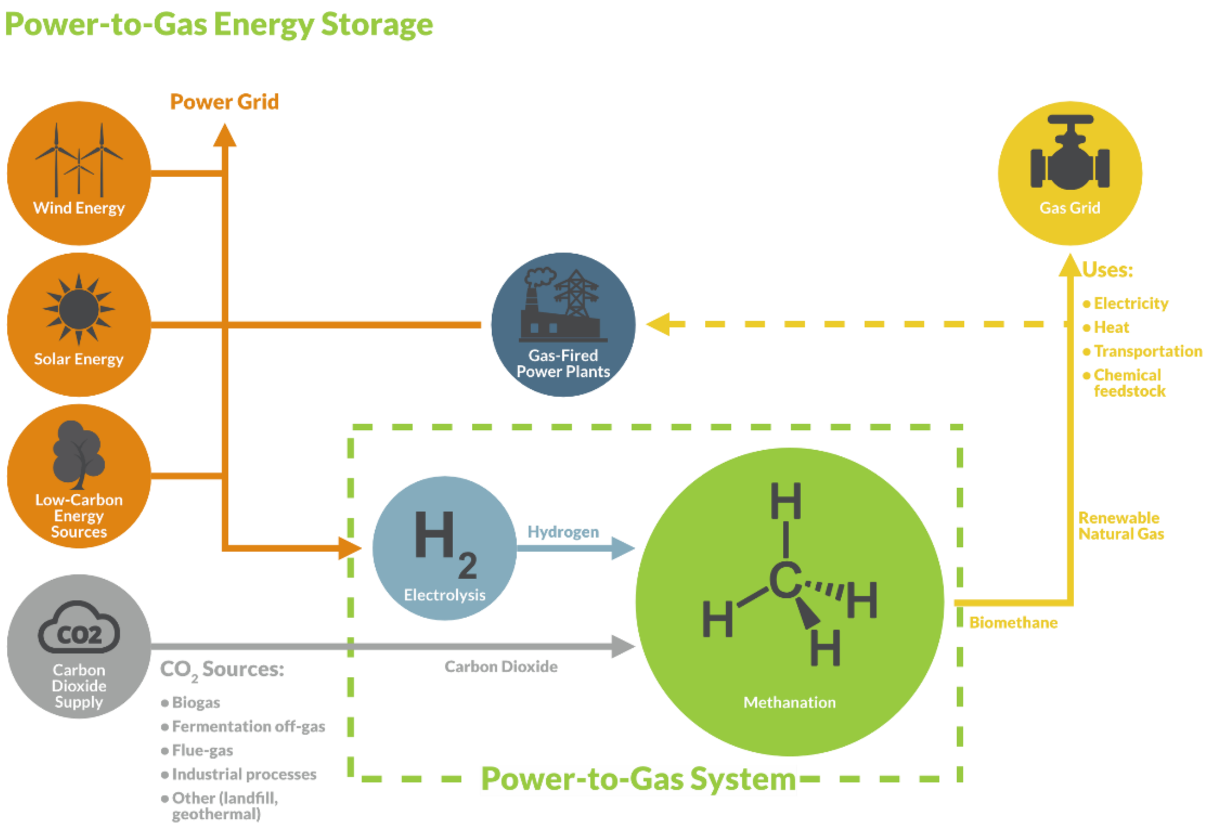

Figure 1: Power-to-gas paths for methane (adapted from Sterner, Specht 2008)

Focus on provision of power or energy

Energy

Suitable fields of application

Recovery of surplus energy and storage for days, weeks, or months; provision of negative balancing energy; deployment of methane for use in transport (fuel), industry (raw material), the energy and the heating sectors (fuel).

State of development/commercial availability

Demonstration stage. TRL 7.

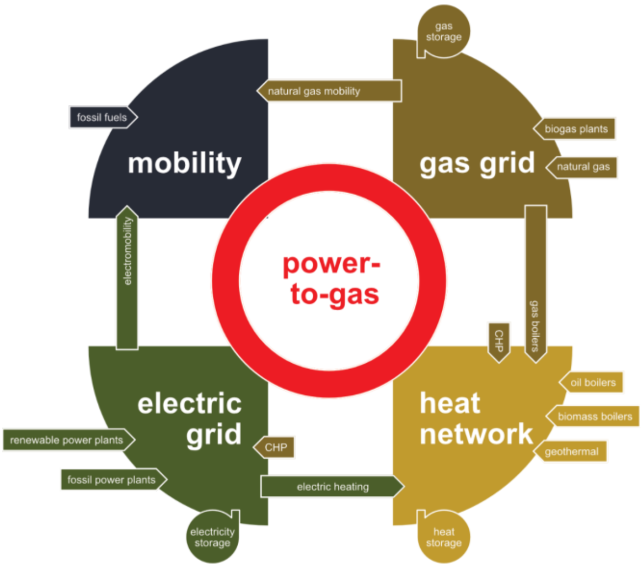

Figure 2: Power-to-gas as a link between sectors

TECHNICAL SPECIFICATIONS

Specific energy storage density	kWh/m³ 11-6,600	kWh/kg 15-9,000
Specific power density	kW/m³ 10-20	kW/t 10-20
Typical/feasible storage size	MWh_{out} 0.001-4,000,000	MW_{out} 0.001-500
System efficiency	Depends on efficiency of hydrogen source	
Storage efficiency	79 %	
Storage duration	Hours-years	
Response time	Seconds	
Service life (maximum)	Cycles -	Years 20
Loss per time in %	-	

NOTES

These values apply for biological methanation with a biocatalyst. The efficiency values include losses from the conversion of hydrogen obtained via electrolysis or from other sources into methane. Losses occurring during feed-in to the gas grid or the subsequent utilisation of the methane are not accounted for.

ECONOMIC SPECIFICATIONS

Investment cost per kW

700-1,500 € (300-700 € expected for 2030)

Investment cost per kWh

0.01-7.50 €

Strongly dependent on duration of full-load operation

Notes

The specific costs stated refer to the total investment for biological catalysis, including engineering of the bioreactor system, authorisation, and installation.

Operating and maintenance cost

2-5% of total investment per year