HCMA – Hydrogen Carbon Management Austria

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Abstract

The project HCMA - Hydrogen Carbon Management Austria demonstrates sector coupling between the energy producing sector, the energy intensive industries (steel, gas, cement, ammonia) and mobility. The goal is to use synergies within the consortium and to clearly demonstrate pathways towards a CO_2-neutral society and industry by producing renewable hydrogen 5.0 for direct utilisation, or converting H_2 with CO_2 into valuable hydrocarbons closing the carbon cycle. The development of sector coupling mechanisms and chemical storage systems is a key factor for stabilising the renewable energy system.

Introduction

Excess energy in the summer period and deficiency in the winter period are challenges for the future energy system based on renewable sources (wind, hydropower, PV). HCMA demonstrates technologies to convert renewable energy into hydrogen and hydrocarbons to balance the seasonal fluctuations of renewable energy production. HCMA connects the energy producing sector with the energy consuming sector and investigates sector coupling in industrial environment.

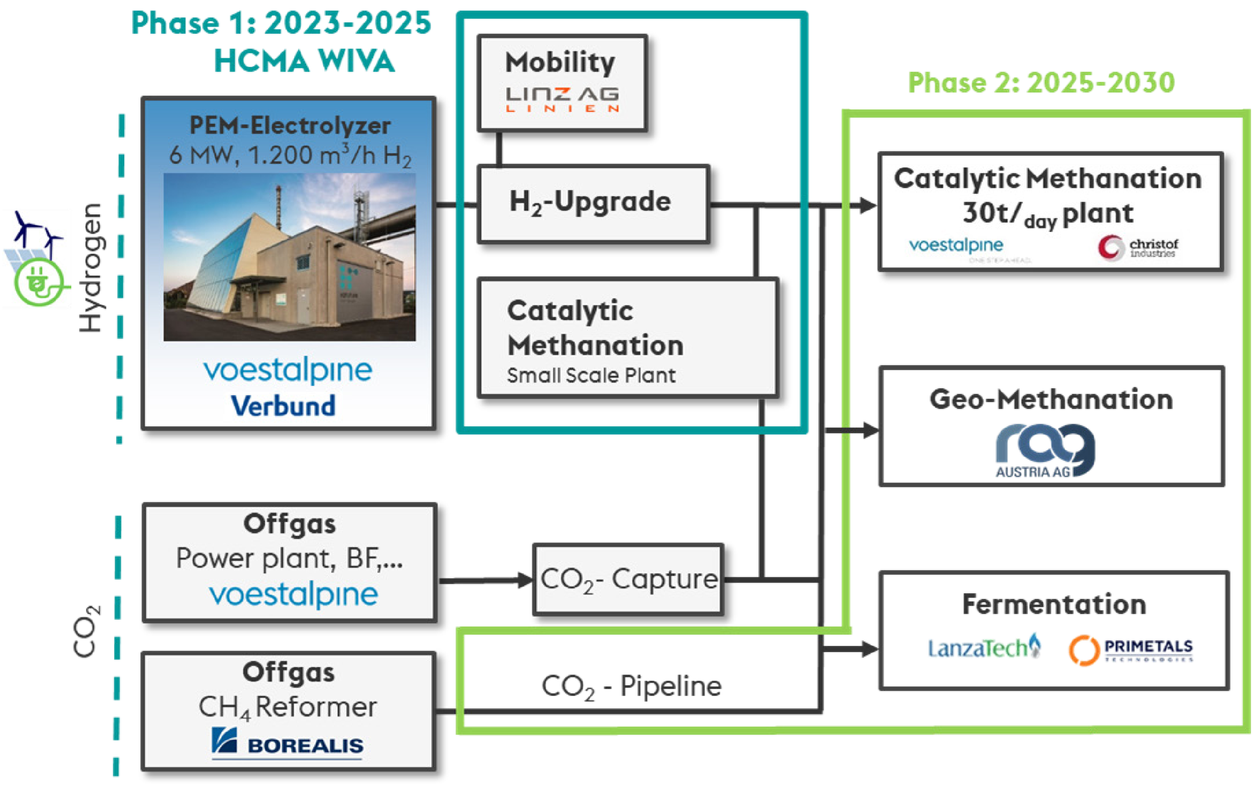

Figure 1: Concept of HCMA

Methodology

Figure 1 shows the concept of HCMA for phase 1 (2023-2025) and phase 2 (beyond 2025). Within phase 1, existing infrastructure will be used to expand the usage of **renewable hydrogen** in the energy intensive industry and the mobility sector. The basis is the **6 MW PEM electrolyser** system, which provides 1200 Nm³/h (107 kg/h) of renewable hydrogen for the local steel industry and for local public transportation. Within HCMA, a plant for hydrogen purification, compression and storage will be installed to produce **hydrogen 5.0** (H_2-Upgrade). Pure and compressed hydrogen will be directly used for **steel refining** processes and for **two fuel cell** powered buses in the public transportation sector.

Renewable hydrogen will be further used to produce synthetic CH_4 (SNG) in a catalytic methanation plant. This mobile 80 kW SNG is currently under construction and will convert H_2 and CO_2 into SNG. Up to 1 t/day of CO_2 is provided from an existing amine scrubber plant from the steel industry and will demonstrate a CCU process chain to close the carbon cycle. In phase 2, HCMA will be upscaled and expanded to energy intensive industries (cement, ammonia) to intensify sector coupling and expand the usage of CO_2-rich off-gas streams to longer chained hydrocarbons.

Results

HCMA is based on experimental demonstration and research in industrial environment. Main results will include:

- Load-flexible production of renewable H_2 purification to 5.0 quality and compression for further utilization
- Load-flexible operation of a catalytic methanation plant and production of SNG with real CO_2 and renewable H_2
- Integration of two fuel cell buses into commercial public transportation
- Identification of sector coupling mechanisms and estimation of scale-up potential in the region
- Decarbonization pathways and strategies for the energy intensive industry
- Development of an overall energy system to balance seasonal fluctuations of renewable energy production

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