

BiON® - Pure methane through CO₂ upgrade

The energy-rich gases hydrogen and methane, which can be produced via the power-to-gas (PtG) process, are crucial for the energy transition. As renewable synthetic gases, they absorb energy from wind and PV power and make it storable in the gas grid. Methane is particularly well suited for trouble-free application in climate protection projects due to the widespread availability of the gas grid and the established technology.

HZI Schmack GmbH has completed an industrial PtG plant at a waste to energy and wastewater treatment complex owned by Swiss utility Regiowerk Limeco (Dietikon, Canton of Zurich). The PtG plant produces high purity methane gas from hydrogen and CO₂ in a biological reaction and the produced methane gas is fed into gas grid.



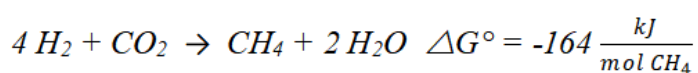
Limeco plant, Dietikon, Switzerland © Limeco

As a pioneer in the industry, HZI Schmack GmbH developed the BiON® process for biological methanation. In this process, microorganisms convert hydrogen and carbon dioxide, preferably from sewage or biogas, into methane. The resulting synthetic methane is indistinguishable from fossil natural gas and can be fed into the existing gas grid.

What distinguishes the BiON® process

BiON® is an innovative biological process in which the two gases hydrogen and carbon dioxide are continuously fed into a pressure vessel. There, special microorganisms – hydrogenotrophic methanogenic archaea – metabolize the gases into methane at around 65°C and 7 bar. The product gas quality is up to 98% of methane. Impurities in the raw gas, such as hydrogen sulfide and ammonia, are not a problem here, but rather serve as nutrients for the microorganisms.

The scientific features:



Numerous and common microorganisms within the domain Archaea convert the compounds hydrogen (H₂) and carbon dioxide (CO₂) into methane in a bio-catalytic way. The therefore relevant metabolic processes run under strictly anaerobic conditions and in an aqueous environment.

Biological methanation is characterized by high flexibility and fast reaction times and can also be flexibly controlled in on-off operation at high production rates.

BiON® - Advantages at a glance:

High flexibility	: Reaction time of seconds
Very robust	: Microorganisms survive almost everything
High tolerance	: Sulfur components and Ammonia are no problem
High purity	: Gas with more than 98% methane in one reaction step
User-friendly	: High similarity to the operation of a biogas or sewage

Biological methanation on an industrial scale

In Dietikon in the canton of Zurich, Europe's largest power-to-gas plant with BiON® microbiological methanation is feeding synthetic methane into the Swiss natural gas grid with an electrolysis capacity of 2.5 MW (450 m³ of hydrogen per hour) since March 2022. The plant is fully automated, continuously operated and produces synthetic methane with a methane content of more than 98%. The builder and operator of the power-to-gas plant is the Limmattal energy supplier Limeco in cooperation with a consortium of municipal utilities and under the supervision of the municipal utility alliance Swisspower AG. HZI Schmack realized the project as general contractor.



Figure 1 : Methanation reactor, Volume 50 m³ © Limeco

Limeco-Plant Performance Values:

- 50 m³ Bioreactor
- 2.5 MW PEM electrolysis
- 450 Nm³/h hydrogen
- 0.8 MW usable waste heat
- 18,000 MWh renewable gas per year
- 240 Nm³/h sewage gas

The technology is adapted to the location

The site conditions in Dietikon are ideal, as a waste incineration plant from Hitachi Zosen Inova AG supplies the renewable electricity on the site of the Limmattaler Regiowerk and a wastewater treatment plant also provides sewage gas with the required CO₂. The Swiss thus produce renewable methane from waste and wastewater and replace fossil heating gas. The CO₂ savings amount to 4,000 to 5,000 tons of CO₂ annually, which corresponds to the emissions of around 2,000 households for heating. During operation of the plant, the industrial suitability of the power-to-gas technology is to be proven over 15 years.

Process and plant expertise accompany the project

The green-tech company Hitachi Zosen Inova combines process expertise, many years of experience in plant construction and technology competence for power-to-gas and electrolysis under

one roof. As a competent partner, HZI Schmack accompanied the project through all phases, from the idea, feasibility study and implementation to maintenance, process support and service.

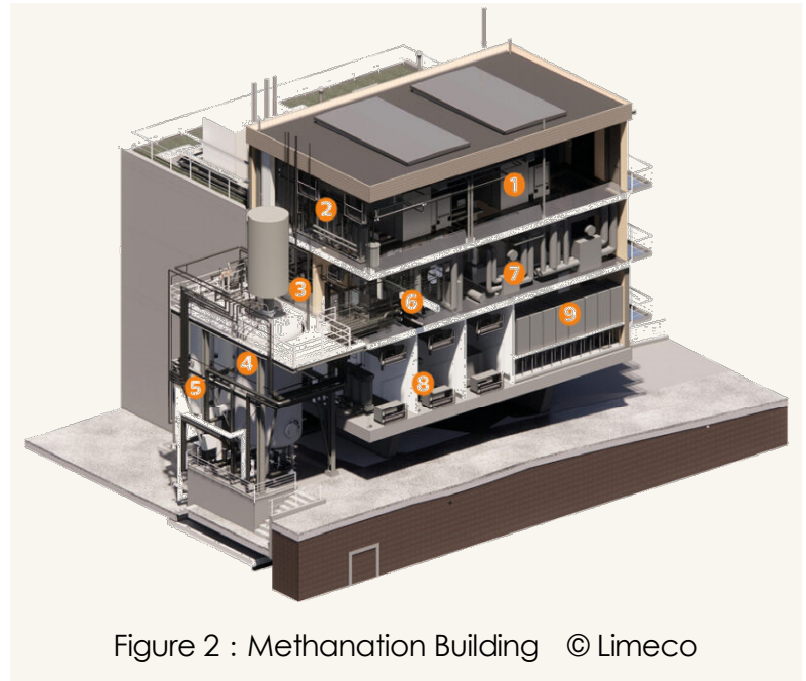


Figure 2 : Methanation Building © Limeco

Electrolysis

- ① electrolysis stacks
- ② water treatment

Biological methanation

- ③ gas pretreatment
- ④ bioreactor
- ⑤ gas purification

Technical room

- ⑥ media distribution
- ⑦ cooling water/hot water distribution

Electrical installation

- ⑧ transformers
- ⑨ switch cabinets

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