

**Schmack** 

by Hitachi Zosen INOVA

**BiON<sup>®</sup> – Robust, Flexible, Eco-Friendly**  
Synthetic Methane from CO<sub>2</sub> and H<sub>2</sub>



## Green and Clean: the BiON® Process

# Biological Methanation Using Microorganisms

Produce renewable gas using nature's efficient methods. In the BiON® process, hydrogen and carbon dioxide are converted into pure methane, which can be injected into the natural gas grid in unlimited quantities. BiON® is therefore an all-round process:

- Upgrading technology for process gases containing CO<sub>2</sub>
- Power to gas application for storage of green electricity
- Production process for synthetic methane

The key to this crucial step in the energy transition are special microorganisms. Thanks to these tough natural helpers, evolved to perfection over millions of years, this process offers huge potential and a raft of benefits.

### | The Power of Two – CO<sub>2</sub> and H<sub>2</sub>

The BiON® process transforms the two gases into a universal energy source. Available CO<sub>2</sub> and energy-rich hydrogen are converted into methane, which can be easily stored and transported.

The process of biological methanation links technology and nature for the benefit of the environment. It enables innovative industrial companies to utilise

their waste products economically and sustainably, produce energy and replace fossil fuels.

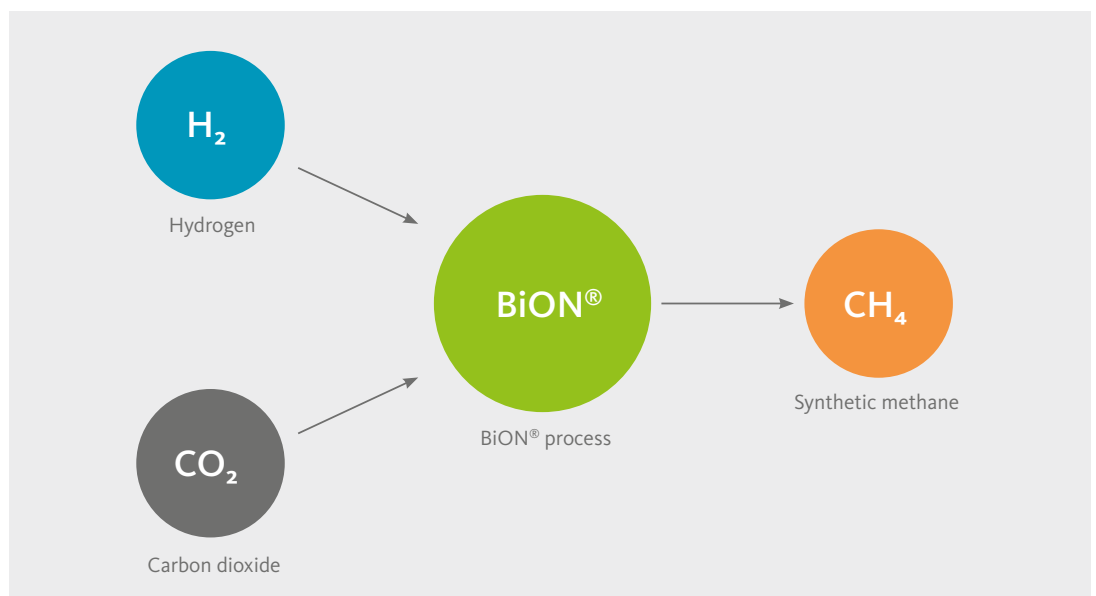
Synthetic methane generated by the BiON® process is an ideal substitute for natural gas in the gas grid – as well as a concentrated source of energy.

### | Powerful Technology – Robust and Flexible

Hydrogen and CO<sub>2</sub> flow into an oxygen-free pressure vessel. In this reactor, special microorganisms metabolise the gases and convert them into methane. This anaerobic process is easily scalable and different sizes are available.

The development of BiON® allows us to offer crucial advantages over conventional technologies. BiON® handles impurities in the raw gas effortlessly. The system retains its momentum in on-off mode: after being switched off rapidly, it starts up again just as reliably. Flexible control over production rates is assured at all times – from standby to full load. As virtually no energy is required for the slow reactor startup or system flushing, BiON® offers the added plus of environmentally responsible operation.

The BiON® process converts hydrogen and carbon dioxide into synthetic methane.



### | Biological, Resource-Conserving and Versatile

We have refined our biological expertise in this process technology, creating conditions in which the microorganisms deliver peak performance. Following nature's example, the process conserves resources – the microorganisms are at their best at low temperatures of 65 °C and can withstand pressures of 5 to 10 bar with no problems.

If BiON® is connected to a fermentation plant, the process makes clever use of the available feedstock – sewage sludge or fermentation residue. This reduces costs for logistics and additives. Effective integration in existing processes means that with BiON®, disposal problems do not even arise.

At sites without fermentation plants, the nutrient supply is a simple synthetic medium. Whatever the requirements, the biological process remains stable and efficient, yet flexible to control. To provide the impetus needed to get production going when the system is commissioned, or following interruptions, microorganisms from our own laboratory can be used. These give the system a rapid kickstart, and ensure high and stable production rates. Incidentally, these anaerobic organisms cannot survive outside the closed process – i.e. if they come into contact with oxygen – and therefore pose no health risk whatsoever.

### | Advanced Reactor Geometry – Efficient and Built to Last

There are certainly benefits to relying on tried and trusted technology. In a classic continuous stirred tank reactor (CSTR), the short agitator shaft is relatively unaffected by vibrations, which helps to preserve the bearings. The cubic geometry of the reactor facilitates temperature maintenance in standby mode. This means lower costs for insulation and heating. The design allows for easy access for inspection, maintenance and servicing. The high grade materials have proved to be durable and resistant to corrosion. With this solid construction, the efficient BiON® process achieves optimum methane quality in the product gas.

### We Support Your Project from the Initial Idea to Realisation and Maintenance

We develop a preliminary concept based on your early project ideas. This is followed by a feasibility study which includes all the data you need to make your investment decision. Site-specific technical and geographical parameters and important soft facts are recorded and professionally evaluated. A detailed summary of all the essential data allows a concluding viability analysis.

To minimise the risk to you, we test the agreed concept in the technology centre first. This allows thorough, realistic testing for subsequent operational use. Our findings in these tests enable us to refine the concept and implement the engineering. Plant construction can then begin.

Once the system is up and running, we remain available as your service partner to answer any questions you may have.

The first industrial scale pilot plant has been operating in Allendorf (Eder) since 2015.





### | Plant Engineering with Biological Expertise

At HZI Schmack, process expertise and plant engineering know-how are closely intertwined. Under the umbrella of Hitachi Zosen Inova, our innovative BiON® process aligns biology and technology with the objective of sustainable defossilisation. Our combined experience of constructing successful power to gas plants is brought to bear for the benefit of our customers.

Take advantage of our project management expertise and enjoy peace of mind with our reliable all-inclusive service concept. With our energy experts, your individual requirements are in the best hands.

### | Harmonious Interfaces: Fitting the Pieces Together

Renewable energy flows through all systems. The way to harness it is to create useful interfaces. We link the electricity and gas grids by means of future-proof technology. We do this using your CO<sub>2</sub> or hydrogen – since nothing is inherently superfluous – and convert it with BiON® to deliver a new, powerful level of energy. This requires clear communication with all parties concerned to ensure that the complex processes run smoothly.

As a system component, BiON® supports sector coupling, including solar and wind power, electrolysis, resource recovery from process gases, heat supply and mobility. We offer intelligent solutions to address the complex challenges of the energy transition.

### | Our Expertise for Your Success: Green Profits

Looking for a futureproof business model? Interested in protecting the environment for generations to come? Want to meet CO<sub>2</sub> targets and make the fuel switch? Then we have a lot in common. And what's more, with our know-how we can offer you extensive support.

From gas upgrading and utilising surplus green electricity through to gas injection – we customise our processes to suit your individual situation and requirements.

Whether your project is on a large or small scale, renewable methane from the sustainable BiON® process allows you to generate ecological added value to keep your company attractive and continue operating successfully with a clean conscience.

Integration of biological methanation at a biogas plant in Allendorf (Eder).



MICROBIOLOGY  
**POWER-TO-GAS**  
SUSTAINABILITY  
TECHNOLOGY  
DEFOSSILISATION **METHANE**  
BIOLOGICAL METHANATION  
AUTOMATION **CO<sub>2</sub>-PRICING**  
BIOTECHNOLOGY **BION®** GREEN GAS  
PERFECTION INNOVATION  
STORAGE TECHNOLOGY  
GAS GRID GREENING  
PROCESS GAS UPGRADE **HYDROGEN**  
**SERVICE SECTOR COUPLING**  
OPTIMISATION ENGINEERING  
**CARBON DIOXIDE**  
ROBUSTNESS PROJECT MANAGEMENT  
**PLANT CONSTRUCTION**  
FLEXIBILITY GAS TREATMENT  
SYNTHETIC METHANE  
BUSINESS MODEL

#### Technical Parameters BiON® 400

General details	System scalable to custom size
Input: H <sub>2</sub> flow rate	400 Nm <sup>3</sup> /h
Input: CO <sub>2</sub> flow rate	100 Nm <sup>3</sup> /h
Possible input gases without further purification	Clean gas, sewer gas, biogas, pyrolysis gas, landfill gas
Nutrient medium for micro-organisms	Sludge from sewage plants and biogas plants, synthetic medium
Operating parameters	Up to 10 bar at 65 °C
Operating mode	Continuous load and partial load
Overall efficiency	Up to 95% (including heat utilisation)
Usable heat produced	Up to 350 kW

#### BiON® 400 basic

Biological methanation	Increase in methane content in processes
Product gas flow rate	100 Nm <sup>3</sup> /h moist methane with carrier gases
Methane concentration	Up to 97%
Space requirement	Up to 1,000 m <sup>2</sup>

#### BiON® 400 economic

Biological methanation with gas purification and drying	Injection into gas grid with high H <sub>2</sub> tolerance
Product gas flow rate	100 Nm <sup>3</sup> /h upgraded methane (SNG)
Methane concentration	Up to 97%
Space requirement	Up to 1,200 m <sup>2</sup>

#### BiON® 400 pro

Biological methanation with gas purification and drying	Injection into natural gas grid with low H <sub>2</sub> tolerance
Product gas flow rate	100 Nm <sup>3</sup> /h upgraded methane (SNG)
Methane concentration	Up to 99%
Space requirement	Up to 1,500 m <sup>2</sup>