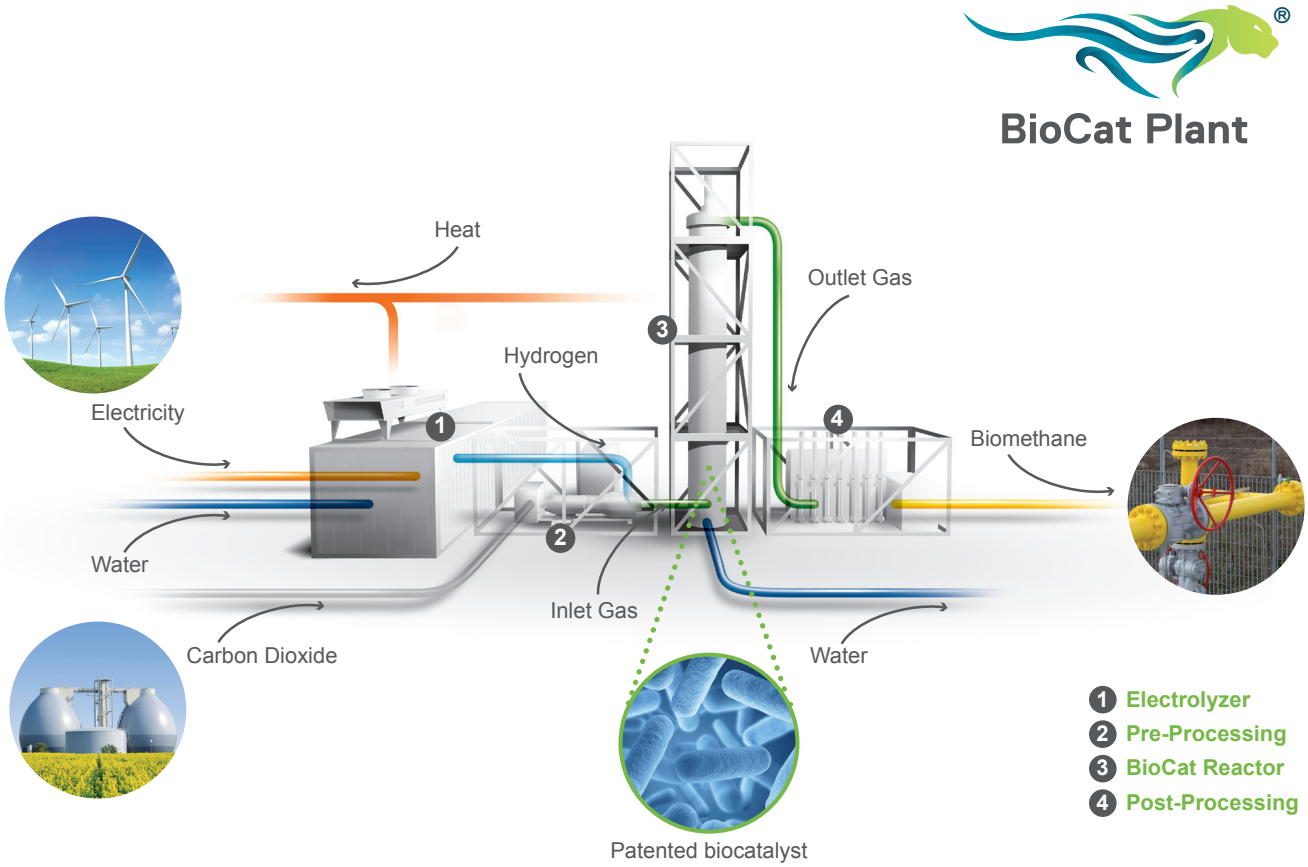
Electrochaea
CARBON AND ENERGY STORAGE

Electrochaea's "Power-to-Gas" technology is available for a wide range of biomethanation sites and can be built for applications from 1 to 10 MWe and can be scaled to systems larger than 100 MWe. The technology produces renewable natural gas, by storing electrical energy in the chemical bonds of methane, using carbon dioxide in the process.

Applications of Electrochaea's BioCat biomethanation technology

- Increasing biomethane output of waste water treatment, biogas plants and landfill sites
- Processing of geothermal or biomass gasification upstream gases
- Utilization of carbon dioxide from industrial sources (e. g. fermentation, cement and steel plants)



How it works

1. Our proprietary biocatalyst [a] is fed with CO_2 and H_2 to produce biomethane.
2. The process takes place in our unique reactor achieving the complete conversion of input gases into biomethane and recoverable heat.
3. The biomethane is ready to be injected into the gas grid. This biomethane enables decarbonization of the grid by displacing an equivalent unit of fossil CH_4, links the gas and electricity grid bi-directionally and recovers the excess heat produced to be transferred to local heating grids or used in on site processes.

[a] The patented biocatalyst is exclusively licensed from the University of Chicago. Electrochaea's IP focuses on Power-to-Gas technology including the biomethanation reactor, control strategies, operation of the system, the biocatalyst and products produced using this technology. The system and reactor design and know-how related to design, engineering, control and operation of the system are subject to ongoing intellectual property prosecution.

BioCat Plant

Specifications of Electrochaea's BioCat methanation plants

	BioCat 1	BioCat 5	BioCat 10
Biocatalyst [b]	ECH 0100	ECH 0100	ECH 0100
Nominal gas input	200 Nm^3/h H_2 50 Nm^3/h CO_2	1000 Nm^3/h H_2 250 Nm^3/h CO_2	2000 Nm^3/h H_2 500 Nm^3/h CO_2
Installed power	45 kW	135 kW	220 kW
Nominal outputs • Grid quality gas • Thermal energy • Metabolic water	 50 Nm^3/h CH_4 130 KWth 80 l/h	 250 Nm^3/h CH_4 640 KWth 400 l/h	 500 Nm^3/CH_4 1275 KWth 800 l/h
Reactor temperature and pressure	63 °C, 10 barg	63 °C, 10 barg	63 °C, 10 barg
Efficiency at nominal load • Biological methanation reactor • Energy conversion efficiency H_2 to CH_4 • Total system energy conversion efficiency	 >99% >74% [c] 52…58% [d]	 >99% >74% [c] 52…58% [d]	 >99% >74% [c] 52…58% [d]
Footprint	150 m^2	340 m^2	480 m^2
Controls and automation	Fully automated operation, according to client requirements/systems		
Conformity	According to client requirements and jurisdictions		

System interconnections

Electricity	According to local grid specifications
Cooling stream (if heat recovery applies)	2–4 bar, <50 °C
Water discharge to sewer	Bioreactor liquid composition meets standard discharge requirements
Tap water	2–6 bar, 10–30 °C
Gas for flare pilot burner	Grid connection or delivered in bottles
Nitrogen for purging and inerting	Delivered in bottle bundles

Optional modules

Flare	Flare for burning the product gas when no injection or storage possible
Media recovery	The metabolic water produced in the process contains a portion of the nutrients. The media can be recycled/recovered in a module incorporated into the plant having a positive impact on the operational cost
Biomass retention system	The metabolic water produced in the process contains a portion of the biocatalyst. The biomass can be recycled/reintroduced in a module incorporated into the plant to maintain a higher biocatalyst density
Post processing unit	Post column gas processing to meet local grid injection standards and variability in input gas composition
Winterization	According to local climate conditions
Gas buffer module	Gas storage option to accommodate duty cycle and power availability

[b] The biological catalyst ECH 0100 is sold along with a license agreement. The catalyst warranty is provided for 2 years after successful commissioning and use within Electrochaea's system operating parameters. Electrochaea's biocatalyst is integrated in all our plants and can be tracked.
[c] Efficiency calculation based on high heating values.
[d] Assuming water electrolysis as source for H_2. Current industry conversion values range from 4.5 to 5 kWh/Nm^3 H_2.