

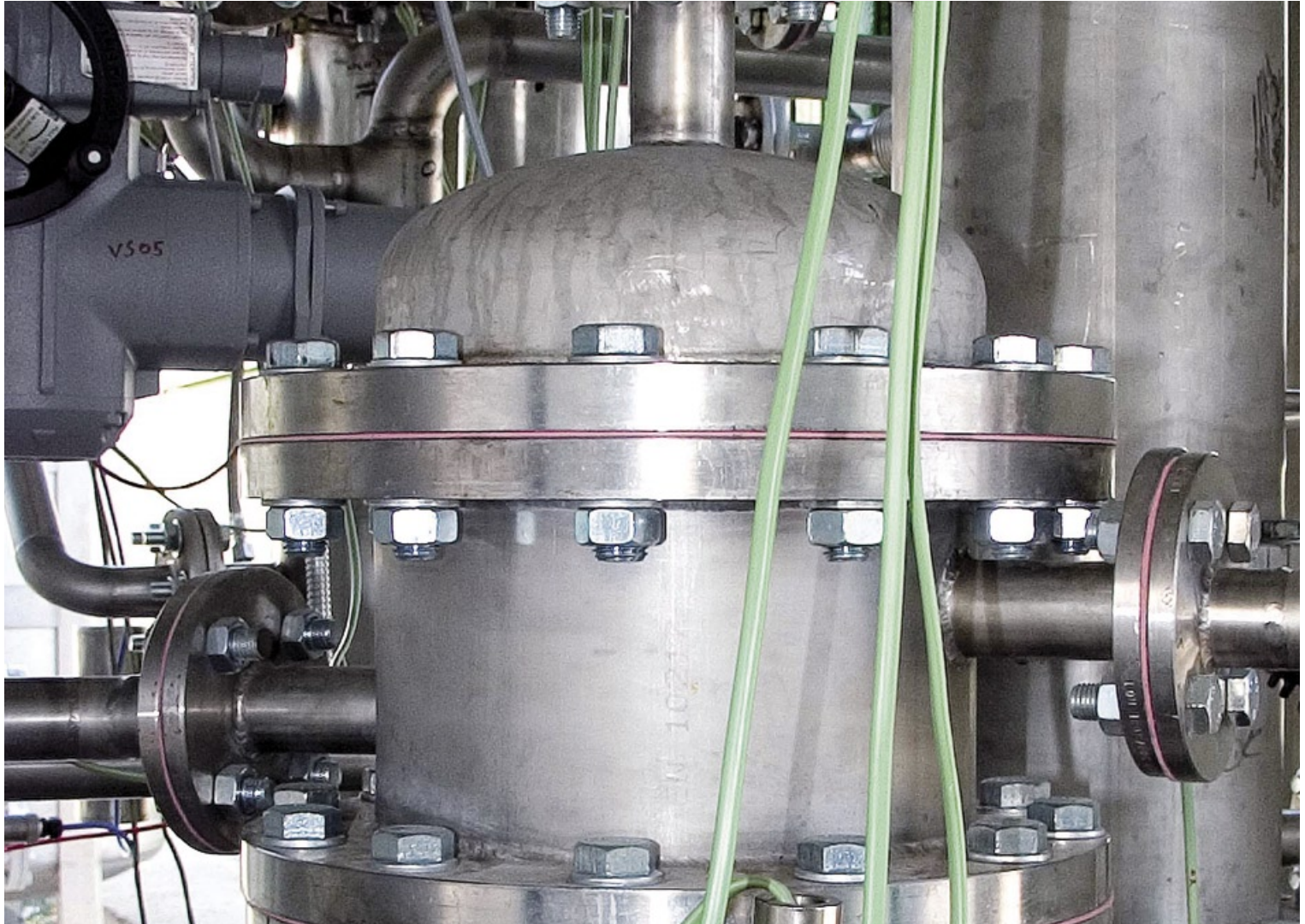
Morphic Helbio

Helbio develops and sells hydrogen fuel processors for energy applications. The fuel processors are delivered either fully integrated with fuel cells or as stand alone units. The fuel processor relies on bio fuels such as bioethanol and biogas as well as fossil fuels such as natural gas and liquid petroleum gas (LPG) as primary hydrogen carriers.

Helbio's technology is based on proprietary, patented reactor-catalyst configurations for reformation processes. The reactor configurations utilize the concept of the *Heat-Integrated Wall Reactor (HIWAR)* for rapid heat exchange. One of the major advantages of Helbio is its novel, proprietary

catalysts that have been developed for the reformation of fuels by steam or partial oxidation. These catalysts improve activity, selectivity towards hydrogen and thermal stability. They are used as thin films on metallic surfaces or on other structural forms such as monoliths and foams. Helbio has also developed novel,

non-pyrophoric and highly active catalysts for the *water-gas shift (WGS)* reaction and for the selective methanation of carbon monoxide. Helbio's entire series of catalysts enable the efficient production of high-purity hydrogen for use in low-temperature fuel cell applications.



APS-5000

Fuel Cell Power System / Off-grid heat and power through natural gas, propane or liquid petroleum gas

APS-5000 is a novel, highly-efficient fuel cell power system for off-grid applications. It satisfies the need for heat and power in residences, remote cabins and the like. The unit runs on natural gas, propane or LPG. Hydrogen is extracted from the fuel in the fuel processor to feed a PEM fuel cell that can produce electricity of up to 5 kW. The system is also configured to run in combined heat and power (CHP) mode to simultaneously produce hot water.

TECHNOLOGY

Reformer: Steam reforming
Water-Gas Shift: High and low temperature
CO Minimization: CO selective methanation
Fuel Cell: Low-temperature PEM fuel cells

CHARACTERISTICS

Electric Power: 5 kW
Voltage: 24VDC, 220 VAC/50 Hz
Thermal Power: 7 kW (hot water @ 65 oC)
Fuel: Natural gas, propane, LPG
Weight: 320 kg
Dimensions: 1.6x0.7x2.0 m (LxWxH)
Noise Level: 70 dBA @ 1m

GH2-BE-5000

Fuel Cell CHP System / Off-grid CHP generation through bioethanol

GH2-BE-5000 is an efficient fuel cell power system used to generate power from renewable energy sources. The system incorporates a unique fuel processor that uses bioethanol to produce a hydrogen-rich stream suitable for PEM fuel cells. GH2-BE-5000 cogenerates heat and power, making it suitable for residential use and other off-grid applications. The heat-integrated system delivers the maximum in efficiency. It is designed for stand-alone, unattended operation and includes advanced automated control systems.

TECHNOLOGY

Reformer: Pre-reforming / Steam reforming
Water-Gas Shift: High and low temperature
CO Minimization: CO selective methanation
Fuel Cell: Low-temperature PEM fuel cells

CHARACTERISTICS

Electric Power: 5 kW
Voltage: 24VDC, 220 VAC/50 Hz
Thermal Power: 7 kW (hot water @ 65 oC)
Fuel: Bioethanol
Weight: 350 kg
Dimensions: 1.6x0.7x2.0 m (LxWxH)
Noise Level: 70 dBA @ 1m

GH2-BG-20000

Fuel Cell Power System / biogas utilization power system

GH2-BG-2000 is a fuel cell-based power system that addresses the need to extract power from renewable energy sources to eliminate CO2 emissions. GH2-BG-2000 is designed to utilize biogas that is produced from anaerobic digestion processes, such as in waste water treatment plants and municipal solid waste facilities. Hydrogen, which is extracted from the biogas in the fuel processor via steam reforming, feeds a PEM fuel cell. The fuel cell yields 20 kW of electrical power, with direct connection to the grid, and 25 kW of thermal energy in the form of hot water. The unit is designed for major biogas producers, such as municipal organizations, industries, farms, etc. Units that yield up to 250 kW are currently in design.

TECHNOLOGY

Reformer: Steam reforming
Water-Gas Shift: High and Low temperature
CO Minimization: CO selective methanation
Fuel Cell: Low temperature PEMFC

CHARACTERISTICS

Electric Power: 20 kW
Voltage: 400 V 3ph
Thermal Power: 25 kW (hot water @ 65 oC)
Fuel: Biogas
Dimensions: 5x2.4x2.5 m (LxWxH)

Auxiliary Power Units

Off-grid power generation through propane or LPG

Our portable fuel cell auxiliary power units are designed for a variety of off-grid applications. The products generate voltage between 250 W and 5 kW, ideal for use in campers, caravans, RVs, boats,

remote cabins, special vehicles, etc. It relies on widely-available, commonly-used liquid fuels: propane and LPG. Hydrogen is extracted from the fuel in the fuel processor to feed a PEM fuel cell.