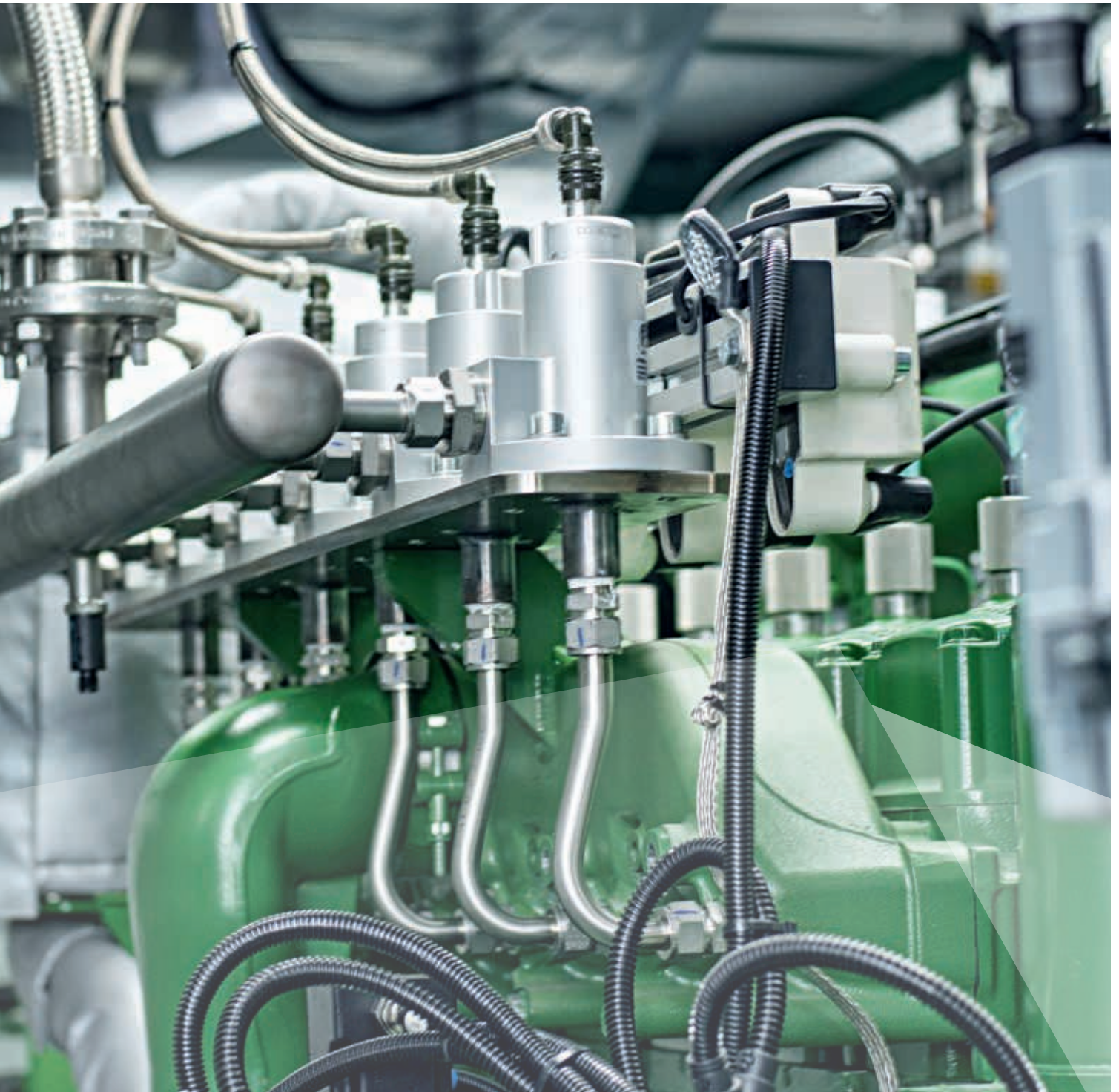


Power-to-Gas-to-Power

A SMART COMBINATION



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ELECTROLYSIS

Electrolysis splits demineralized water (H_2O) into oxygen (O_2) and hydrogen (H_2). The oxygen is released and the hydrogen delivered to a storage tank. The process takes place at temperatures from 60 to 80°C and a pressure of about 35 bar.

AGENITOR H_2

2G's agenitor H_2 hydrogen CHP unit is available with electrical outputs of up to 360kW and thermal outputs of up to 371 kW. The overall efficiency is over 80%. In addition to pure hydrogen, it is adaptable for use with a wide range of gases. The agenitor H_2 was awarded the prestigious 'Innovation Award' from the GAS (German Agricultural Society) in 2021 and was the only innovation to be awarded the gold medal.

Power-to-Gas-to-Power

A SMART COMBINATION

Based in Heek, Germany, 2G Energy AG is a leading international manufacturer of combined heat and power plants (CHP) for decentralized electricity and heat provision. For more than 10 years, 2G Energy plants have relied on the Bachmann M1 automation platform. This also applies to their latest venture: the world's first combined heat and power plant to run on pure hydrogen, constructed in the Bavarian town of Hassfurt, Germany.

The Key to Energy Transition

Electricity from renewable energies is highly volatile. When the sun shines and the wind blows, there is usually too much; when there is a lull, there is too little. Technologies that enable the long-term storage of large amounts of energy, even from renewable sources, are becoming increasingly important for ensuring a secure supply. Power-to-gas plants play a key role: In the event of an oversupply, instead of shutting down power generators or taking them off the grid completely, surpluses are used to operate electrolyzers that produce hydrogen. This can be used to fill suitable storage facilities or mixed directly with natural gas in the gas network.

The municipal utility of Hassfurt in Lower Franconia operates exactly this system: since 2016, they have been producing green hydrogen in a power-to-gas plant. A PEM (polymer electrolyte membrane) electrolyzer, with a peak output of 1.25 megawatts, converts surplus electricity from wind and solar power plants.

This hydrogen, often referred to as 'windgas', is then fed into 2G Energy's hydrogen CHP unit, which converts the energy into electricity or heat as needed. Electricity is absorbed by the city's power grid, and heat is fed into a local heating network to supply public buildings and an industrial plant.

Complete Grid Compatibility

First and foremost, PEM electrolyzers are extremely responsive and follow load changes almost instantaneously. They can be switched from standby to full-load

Reliable synchronization:
 Integrated directly into the M1 automation system, the GSP274 grid measurement and protection module guarantees VDE-AR-N 4105-compliant single-fault grid and system protection. The design eliminates interfaces, thus reducing complexity and costs.



operation within seconds, stabilizing grid frequency and preventing an overload. Since the hydrogen CHP also demonstrates high dynamics, real 'control energy' is available from the overall system of power-to-gas and gas-to-power. This compensates for power surpluses and shortfalls from renewables in the local balancing group or in the main distribution grid. When waste heat from the CHP is also fed into the local heating network, its overall efficiency increases to well over 80 percent.

"This application shows how existing technologies can drive the energy transition forward," says Frank Grewe, CTO at 2G Energy, enthusiastically. In contrast to the previous practice of adding hydrogen to the natural gas grid, the cogeneration plant allows for reverse power generation via a hydrogen-powered gas engine, without fossil fuel components. The hydrogen storage currently available in Hassfurt enables around 15 hours of continuous CHP operation.

2G ENERGY AG

- Headquartered in Heek, Germany
- More than 650 employees worldwide
- Listed on the stock exchange since 2007
- One of the leading international suppliers of combined heat and power plants. The company has installed more than 6,500 plants around the world.

www.2g-energy.com

An Emission-Free Future

The plant is part of a Stadtwerk Hassfurt GmbH research project. The project is investigating the system conditions and operational behavior of the H₂-CHP in conjunction with the P2G plant. In the meantime, 2G Energy has also set up other CHP unit projects in Germany, the UK, Japan and on the Arabian Peninsula. The most effective operations strategies are still in development, as well as technically- and economically-optimized operational modes for the system, Grewe says. "Even if the overall P2G2P (power-to-gas and gas-to-power) efficiency is currently below 50 percent, the system already demonstrates how bidirectional sector coupling can succeed with full grid efficiency."

This type of configuration utilizes electricity that would otherwise be curtailed, further reducing the importance of this figure. The combined heat and power plant converts green hydrogen back into electricity, thereby putting surplus renewable energy to good use on site. Windgas plants are therefore an important building block for a successful energy transition. And so, this smart combination is paving the way to an emissions-free future.

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