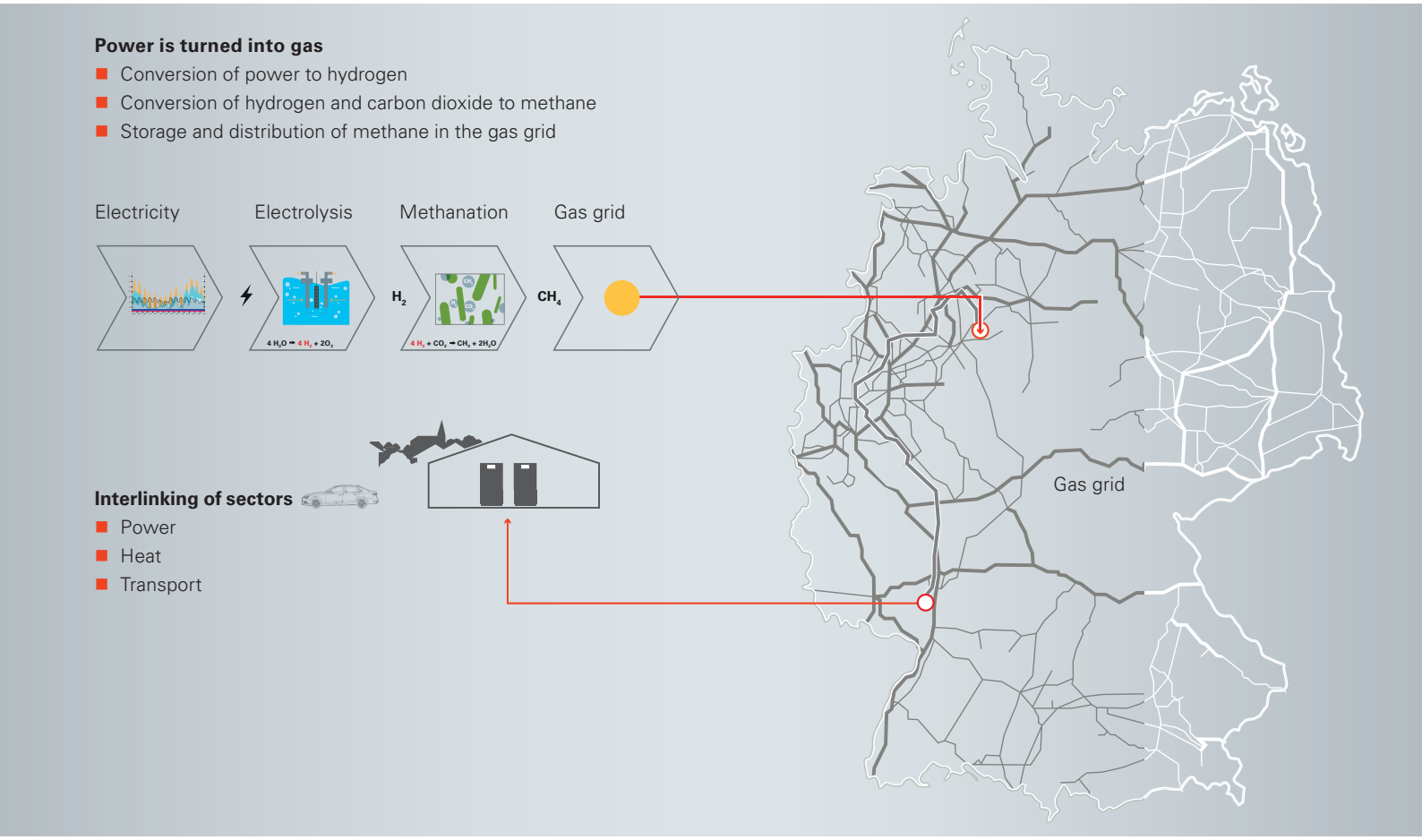
VIESMANN

Power-to-gas – key technology for linking different sectors

Heating systems
Industrial systems ◄
Refrigeration systems

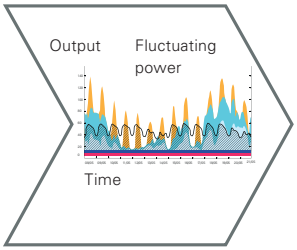
Methanation of renewable power means the gas grid can be used as a store and decarbonises the energy sectors



Storing power in the gas grid

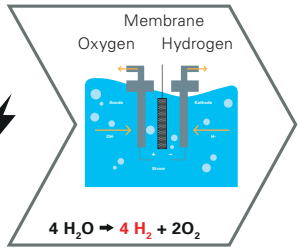
Renewable power becomes primary energy

Electricity



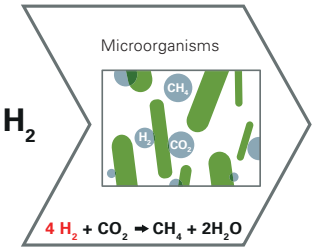
CO_2 neutral power is obtained from fluctuating renewable energy plants

Electrolysis



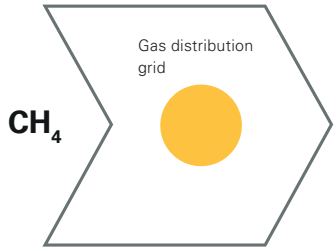
Water is split into its individual elements of hydrogen and oxygen using electricity

Methanation



In the BiON process, microorganisms metabolise the hydrogen and carbon dioxide to synthetic methane (SNG)

Gas grid



Synthetic methane is fed into the gas grid

Power-to-gas as a conversion technology for storing energy

Power-to-gas converts hydrogen and carbon dioxide (CO_2) from various sources to methane. Possible sources of CO_2 include industrial processes, ambient air or biogas and sewage plants. Hydrogen is produced in an electrolyser or obtained from industrial processes. The synthetic methane obtained in this manner can be stored in a gas tank and converted back when needed or fed directly into the gas grid for storage and distribution.

Carbotech GmbH – plant construction specialists

The power-to-gas process begins in the electrolyser, where water is split into hydrogen and oxygen. Carbotech GmbH, a Viessmann subsidiary, supplies the modular electrolyser based on PEM technology. The highly efficient plants are available in the multi-megawatt range.

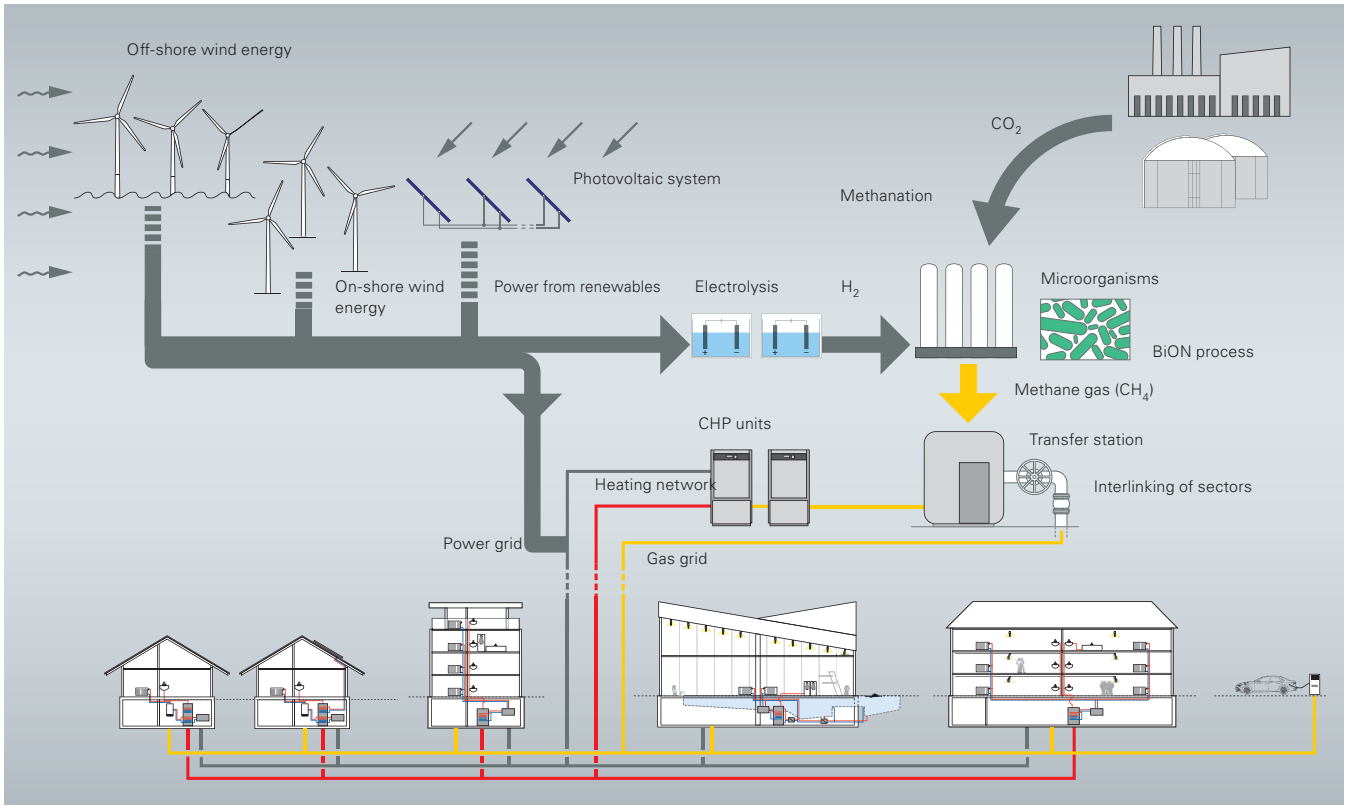
The next step in the power-to-gas process involves the generation of the substitute gas, methane. Viessmann subsidiary MicrobEnergy GmbH has developed the BiON process for methanation. Here, highly specialised microorganisms, also referred to as archaea, produce pure methane from hydrogen and CO_2.

This biological process is characterised by a high degree of flexibility, a moderate requirement for gas purity and low operating temperatures and pressures. In addition to the commercial upgrading of biogas, the BiON process enables the purification of raw biogas without methane slip.

Successful interlinking of sectors and decarbonisation

Power-to-gas is an ideal way to interlink the consumption sectors of electricity, heat and transport. Electricity is used as the primary energy source across the entire gas grid, enabling the decarbonisation of all energy sectors. Whether for demand-dependent electricity generation using combined heat and power technology, or usage as a biofuel, methane offers a variety of utilisation opportunities and is central to the success of the energy transition.

Microorganisms convert hydrogen and carbon dioxide directly into methane.



Power is converted into methane gas using electrolysis and CO_2. This can be transported and stored in the gas grid.

Power-to-gas plant

The world's first power-to-gas plant is located at the Viessmann Group head office in Allendorf (Eder). This plant uses biological methanation and has been running successfully since 2015, winning awards from the German gas industry and the German Energy Agency.

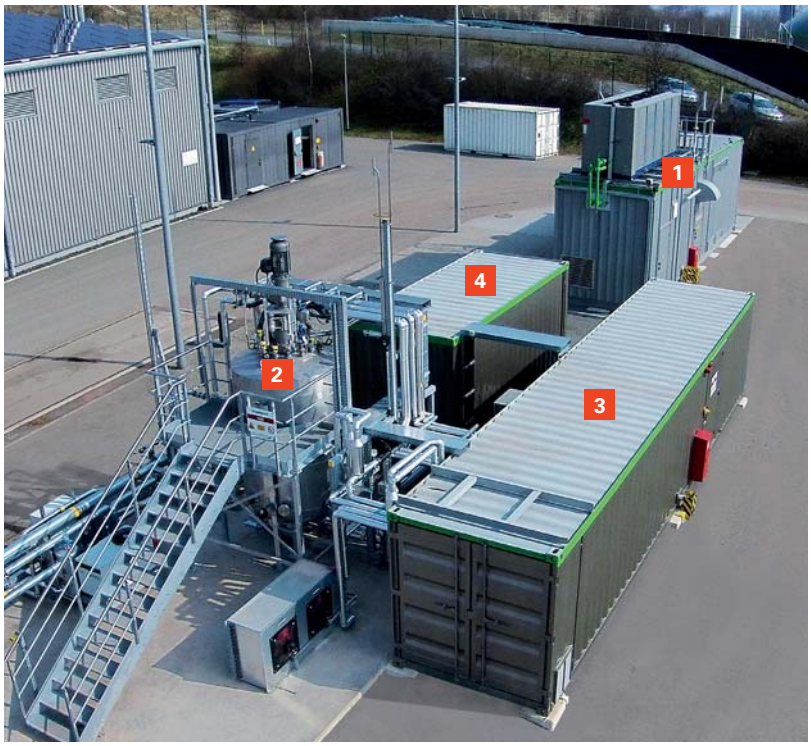
Green gas for g-tron fleet
Methane gas can be stored for relatively long periods in the gas grid, which has a storage capacity of several months thanks to its pipelines and underground chambers. This means that political aspirations to interlink the electricity, heat and transport sectors can be furthered: irrespective of the place of generation, the gas can be used to supply heat, produce electricity or provide an environmentally friendly fuel for cars that run on natural gas. As a result, Viessmann has entered into an agreement with Audi to supply biofuel to the car manufacturer.

Other projects

- enera project
  Cooperation partners include ENERCON GmbH, EWE AG;
  plant size 1 MW
- Hybrid power plant project
  Cooperation partner: Swisspower AG;
  plant size 1.5 MW

Power-to-gas plant

Power-to-gas plant



1 PEM electrolyser
- Proton exchange membrane technology
- Electrical connected load 300 kW
- 2 stacks with 150 kW each
- Hydrogen production max. 60 Nm^3/h
- Operating output pressure 40 bar
- Water consumption 1 l/Nm^3 H_2
- H_2 buffer tank 20 Nm^3

2 Biological methanation – BiON process
- Pressure reactor volume 5 m^3
- Operating pressure max. 16 bar
- Operating temperature 60 to 70 °C
- Microorganisms in growth medium
- Methane production max. 15 Nm^3/h
- Aeration stirrer 400 rpm

3 Process technology (biol. methane)
- Growth medium supply
- Process air generation
- Temperature control system
- Gas analysis (H_2, CO_2, CH_4)
- pH value control station

4 Control technology
- Electrical plant controller
- Process control equipment
- Data recording system
- Communication and monitoring system (EUVIS)

BioPower2Gas

BioPower2Gas research project

The power-to-gas plant in Allendorf (Eder), Germany, is one of the demonstration models supported by the German Federal Ministry for Economic Affairs and Energy as part of the "Biomass energy use" funding programme.

The aim of this project is to look at ways of improving the flexibility of biogas and biomethane plants. As energy supply systems are increasingly reliant on renewables, these types of plants will have an important supportive role to play in the future. Companies and organisations involved in the project include MicrobEnergy GmbH, a subsidiary of the Viessmann Group; the grid operator EnergieNetz Mitte GmbH; energy supplier EAM EnergiePlus GmbH from the EAM Group; consulting engineers CUBE Engineering GmbH, and the IdE Institut dezentrale Energietechnologien gGmbH research institute, acting as project coordinator. Jühnde, a bioenergy village, is an associated partner on the project.

Project objectives:
- Develop biogas plants to become supporting components in the renewable energy system
- Utilise potential for increasing flexibility
- Enable demand-dependent power consumption

Possible solutions:
- Optimised energy and timetable management for decentralised CHP plants
- Biogas plants as peak load power stations and for relieving the burden on the power grid

Envisaged project results:
- Operational optimisation of plants – operations managed in line with market conditions
- Contribution from plants with greater flexibility to the energy system
- Development of control software for plant operation
- Simulation models, software and optimisation tools
- Strategy for environmental protection
- Analysis of regional value-added effects
- Recommendations for the improvement of the legal framework and the markets

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