Mobility of the future

To achieve a sustainable mobility, a drastic reduction in the use of fossil fuels and in current levels of CO_2 emissions is mandatory. Stricter legal requirements on newly registered cars require a reduction in CO_2 emissions of well over 50 per cent by 2025. One possibility is the conversion of renewable energies into low-CO_2 energy carriers that can be stored, such as hydrogen and biogas (methane) and their use as fuels for personal and commercial transport.

Using the "Future Mobility" demonstrator, the decentralised production of hydrogen from temporary surpluses of renewable electricity is technically implemented for the first time for use in various drive concepts (electric, fuel cell and gas-powered vehicles). Energy flows that vary over time are converted into a chemical energy carrier that can be stored as fuel and is therefore available for use at any time. The new CO_2 legislation relating to passenger cars, which provides for large penalties in the event of non-compliance, also represents a financial incentive for using low-CO_2 fuels.

The addition of hydrogen to natural gas and biogas represents another substantial contribution to increasing the efficiency of future mobility: It can greatly improve the efficiency of combustion engines, which also leads to a reduction in CO_2 emissions.

The creation of the "Future Mobility" demonstrator is Empa's answer to the enormous challenges posed by renewable energies in terms of storage and distribution of electricity, but also with regard to how they are traded. Chemical energy storage plays a central role in this and is key in enabling the decentralised production of clean electricity at local network levels.

Our partners

in the field of sustainable mobility

Our research areas

- Synthetic fuel from renewable sources
- Engine research to increase the efficiency of gas engines
- Electrolysis of water for hydrogen production
- High-efficiency photovoltaic systems that use a minimum of resources
- Battery designs for the long-term storage of electricity
- Thermoelectricity solutions for converting (waste) heat into electricity
- Photoelectrocatalysis to produce hydrogen directly
- Simulation of hydrogen production and utilisation plants

Contact

Brigitte Buchmann

brigitte.buchmann@empa.ch
Phone +41 58 765 41 34

www.empa.ch

Materials Science & Technology

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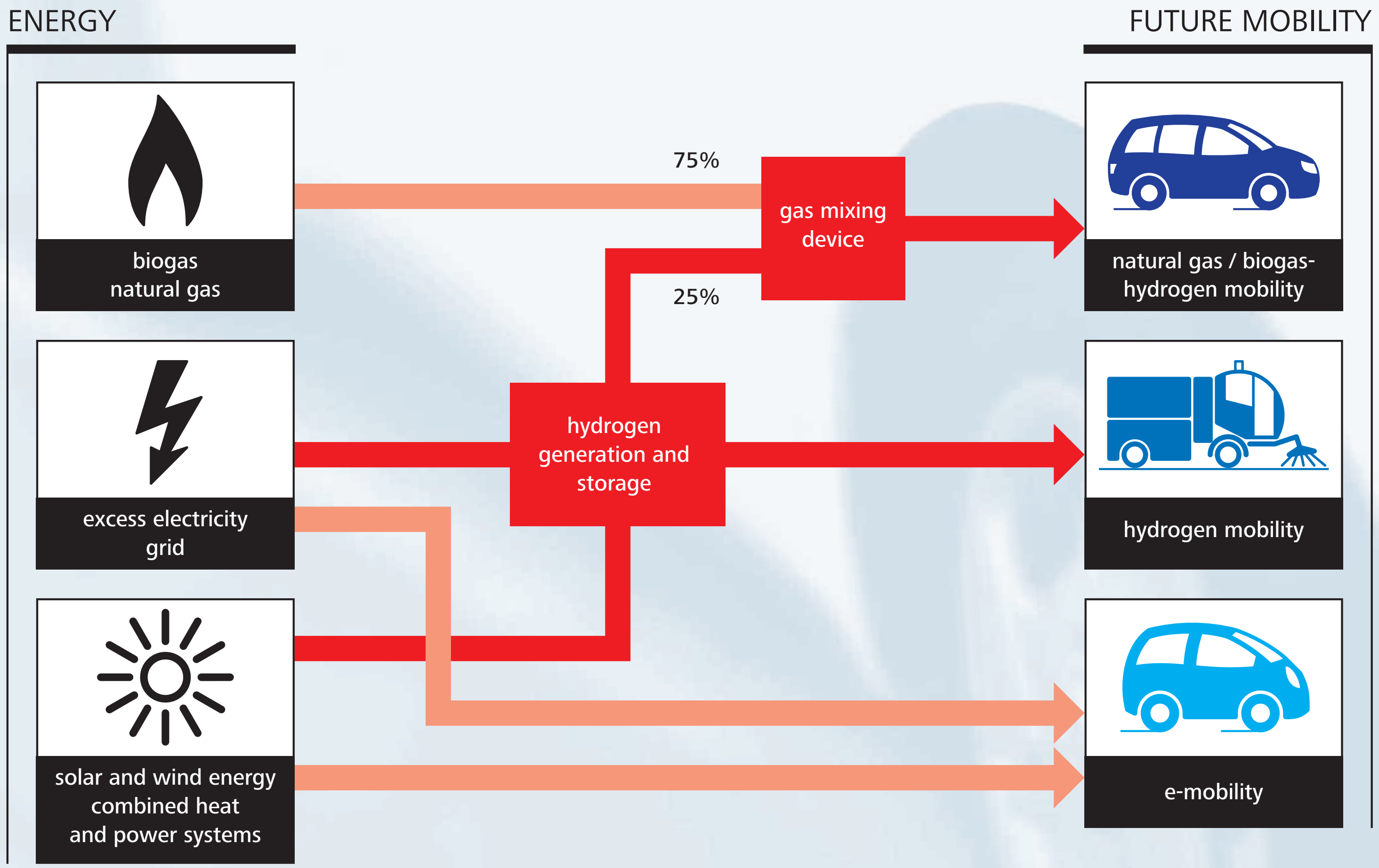
"Future Mobility"

Excess electricity from renewables and grid –
a demonstrator for tomorrow's sustainable mobility

From "green" electricity to clean fuels

Storage and utilization of renewable (excess) electricity is crucial for a successful energy turnaround. Empa and PSI are cooperating with numerous partners on mobile, decentralized research and technology platforms bridging cutting-edge science to applications-oriented innovations. Empa's Demonstrator "Future Mobility" is a showcase for this visionary concept.



Using renewables
Renewable energies such as hydrogen, methane/hydrogen blends or biogas can be used to create sustainable fuels such as hydrogen, biogas and even synthetic fuel.

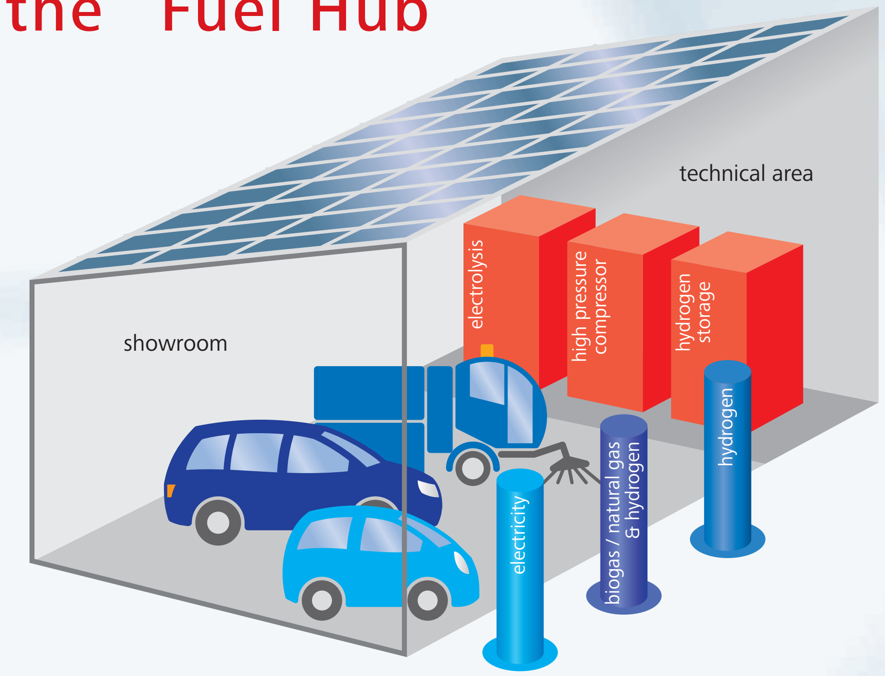
Utilising excess energy
Excess electricity of solar or wind power plants can in future be stored in the form of hydrogen, rather than going to waste as is currently the case.

Linking markets
Linking the electricity to the gas market enables the long-term storage and economically attractive exploitation of excess electricity.

Reducing CO_2 emissions
Adding hydrogen to natural gas and biogas increases the efficiency of combustion processes and results in significantly lower CO_2 emissions.

Building expertise
This demonstrator, as an example of the scalable implementation of sustainable mobility, builds competencies in systems engineering and interconnection.

Fuels of the future – the "Fuel Hub"



The electrolyser converts solar electricity as well as excess energy from the grid into hydrogen, which is then compressed and stored. Hydrogen is made available at the pumps both in pure form (for fuel cell vehicles) and mixed with natural and/or biogas (for gas-powered vehicles).

The Fuel Hub in figures

Photovoltaic peak power	40 kWp
Power for electrolysis	< 35 kW
Power range	0 – 100 %
Hydrogen production (max.)	approx. 15 kg per day
Hydrogen storage capacity	approx. 50 kg
Refuelling pressure	350 bar
Hydrogen vehicles, fuelling	approx. 5 per day
Gas-powered vehicles (10 vol-% hydrogen), fuel-fillings	approx. 70 per day
Gas-powered vehicles (25 vol-% hydrogen), fuel-fillings	approx. 30 per day