



# Mobility in the closed hydrological cycle

# Coop energizes

Efforts to reduce greenhouse gas emissions have produced new drive systems. Research into carbon-neutral methods of powering vehicles stretches back over decades. Major global automotive manufacturers have already unveiled their first mass-produced fuel cell cars to the public. The biggest obstacles to the launch of this technology have always been the lack of a corresponding infrastructure and the availability of hydrogen from a renewable source. Thanks to the dense network of Coop Mineraloel AG's filling stations and its own vehicle fleet, Coop is able to get this sustainable drive train technology off the ground.

Traffic is responsible for around 30% of greenhouse gas emissions in Switzerland. Because of this, politicians are calling for mobility to be «decarbonized». The only alternative to the combustion engine is the electric engine. The electricity needed to power the engine can be obtained from batteries or hydrogen. The key benefits of hydrogen vehicles are that they are climate-neutral and emission-free and have a wide range and short fuelling times.

## Visionary mobility system

More and more car manufacturers are mass-producing vehicles that are powered by fuel cells. As long as the hydrogen is pro-

duced from renewable energy, hydrogen mobility is the most sustainable form of driving.

## Coop is driving the development forward

The complete system involved in this form of mobility dovetails very closely with Coop's sustainability principles: customer benefit, sustainability impact, role in the energy system and creating values. Supported by many partners from the realms of politics, the business community, public administration, environmental organizations and local authorities, Coop has built the complete system, establishing the conditions for sustainable electric mobility.

## Mobility in the closed hydrological cycle

### Steam

is the only emission and turns into rain. The cycle is completed.

### Fuel cell vehicle

converts hydrogen back into electricity and drives an electric engine.

### Hydrogen filling station

offers sustainably produced hydrogen.

### Run-of-the-river power plant

produces renewable electricity.

### Electrolysis

uses this electricity to break down water into oxygen and hydrogen.

### Hydrogen transport

by trailer to the Coop Pronto filling stations.



# How mobility works in the closed hydrological cycle

## Electricity production at the run-of-the-river power plant

The generation of renewable electricity forms the basis of sustainably produced hydrogen. Renewable electricity can be generated using water, wind, sun or geothermal energy. The hydrogen for Coop Mineraloel AG's filling station in Hunzenschwil is produced by means of electrolysis at IBAarau's run-of-the-river power plant. The electricity is mainly used when demand for this electricity is low.

## Electrolysis

Electrolysis is a process whereby water is split into hydrogen and oxygen. The oxygen can either be used or released into the atmosphere.

## Hydrogen

Hydrogen is the most common chemical element in our universe. It is gaseous, colourless and odourless as well as being highly volatile and does not condense until it reaches -253 degrees Celsius. Hydrogen enables the industrial storage of electricity with no discharge losses. It can also be generated if the renewably produced energy cannot be used elsewhere. The energy density per kg of hydrogen is roughly three times that of petrol or diesel.

## Hydrogen transport

The hydrogen generated by means of electrolysis is filled at 200 bar into a 23 m<sup>3</sup> tank, which is transported on a truck. Its maximum capacity is 338 kg of hydrogen. The trailer is used to transport the hydrogen from the power plant to the filling station. This process guarantees 100% sustainable hydrogen able to be traced back to the run-of-the-river power plant.

## The hydrogen filling station

At the Hunzenschwil filling station, the hydrogen supplied, which has been compressed to 200 bar, is transferred to an underground tank at pressure of up to approx. 50 bar. To enable rapid fuelling, the hydrogen is compressed over various process levels to 450 or 950 bar. Trucks and buses are fuelled at 350 bar and cars and delivery vans at 700 bar. The fuelling process takes just a few minutes and is comparable to the process for fossil fuels.

## The fuel cell vehicle

The fuel cell vehicle is an electric vehicle, and the main difference compared to a battery vehicle is the type of power on which it relies. A fuel cell vehicle uses «cold combustion» (converting hydrogen and oxygen from the ambient air into electricity and vapour) to generate the electrical power that drives the electric engine. In addition, braking energy is recovered and stored in a battery. This power can cover peak loads and aid acceleration as well as fast driving. Only vapour is emitted from the exhaust. The fuelling time, range and running costs are comparable to conventional vehicles fitted with combustion technology.

## The hydrological cycle

This new kind of mobility emits no CO<sub>2</sub>, no nitrogen oxide, no sulphur oxide and no soot particulates – just water vapour. The vapour that escapes from the exhaust is released into the atmosphere, evaporates, falls to the ground in the form of rain or snow and so returns to the water system. And because only electricity from hydropower is used, there are no emissions in this respect either. Thus Coop's hydrogen system enables sustainable mobility in a closed hydrological cycle.

## Contributing to the CO<sub>2</sub> vision

In 2008 Coop took the decision to be CO<sub>2</sub> neutral in its operations by 2023. Since then, numerous measures have helped Coop to already reduce its CO<sub>2</sub> emissions by nearly a quarter. Coop's commitment to running its own fleet of hydrogen-fuelled vehicles marks an important step in the sphere of transport and logistics towards further reducing CO<sub>2</sub> emissions.

### **Audi CEO Rupert Stadler, Bilanz 25.05.2016:**

«The most consistent form of electric driving is with hydrogen power. Also with regards to the environment provided the hydrogen is produced from renewable energy. In the long term everything speaks for fuel cells.»

For Rupert Stadler, the drive system situation on the global market can only be managed with many different alternatives. The manufacturer is currently trying to please everyone.

### **Toyota Chairman of the Board of Directors, Takeshi Uchiyamada, USA Today 15.04.2016:**

«Toyota firmly believes the benefits of a hydrogen society are enormous for a healthy global environment. That is why we are playing a leading role in bringing together automakers, energy companies, government agencies and others to help build the required refueling infrastructure.»

Toyota has invested over USD 10 billion into fuel cell development projects.

### **Jules Verne, 1870:**

«Water will be the coal of the future. Tomorrow's energy is water that has been decomposed by electricity. The elements of water, hydrogen and oxygen decomposed in this manner will secure the earth's energy supply far into the future.»

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#### Partner

