HYDROGEN
100% PERFORMANCE
0% EMISSIONS

oecoplan

The world's first fuel cell heavy goods vehicle able to fulfil Coop's logistics requirements

ESORO – together with a partner consortium – has developed the world's first fuel cell truck in the 34-tonne category that has the necessary load capacity to be fully integrated into the regular Coop logistics management process.

There are as yet no fuel cell trucks in serial production. Truck manufacturers integrated into larger automotive groups have so far usually delegated the development of fuel cell components and their integration into vehicle systems to passenger car development departments. This is because the latter can distribute their development costs across much higher quantities and thus achieve larger economies of scale.

Recently however, several truck manufacturers have turned their attention increasingly to the topic of hydrogen as – apart from Coop – well-known European retailers such as ASKO and Colruyt as well as other transport companies and operators of municipal vehicles are expressing growing interest in hydrogen technology. The manufacturing costs of a fuel cell truck are still considerably higher than those of a conventional diesel truck. However, on the basis of a 'TCO' (total cost of ownership) analysis comparable figures can be seen for both options in Switzerland. Fuel cell trucks are exempt from mineral oil tax and are not subject to road charge. They also have lower maintenance costs. In addition the further development of fuel cell technology will result in substantially lower costs for these vehicles.

In its distribution logistics for the Coop retail outlets, Coop mainly uses four-wheel 18-tonne diesel trucks with trailers (total 34 tonnes). This type of truck emits around 70-80 tonnes of CO_2 per year. In order to further reduce the CO_2 emitted by its goods transport activities Coop is always on the lookout for alternatives. Hydrogen technology offers the following advantages: hydrogen-powered trucks offer the same performance as conventional diesel vehicles and they emit only steam instead of CO_2 and other pollutants. A hydrogen-based energy supply also enables problem-free operation of the auxiliary units on the truck (chiller units, etc.).

Fuel cell – the mobile power plant in a Coop truck

A fuel cell vehicle is an electric vehicle that obtains energy directly from an on-board chemical reaction of hydrogen and oxygen. This reaction takes place in the fuel cell.

The three most important components of a fuel cell are the two bipolar plates (anode and cathode) and the membrane. Oxygen from the ambient air is channelled into the fuel cell and is simultaneously distributed at the membrane on the side of the cathode bipolar plate. To generate electricity the hydrogen – stored at 350 bar in carbon fibre tanks – is channelled to the membrane located at the anode bipolar plate. The membrane between the anode and the cathode prevents any direct contact of the gases. Only the protons in the hydrogen atoms can pass through it. This electro-chemical reaction releases electrons generating the electricity that drives the vehicle. On the other hand the hydrogen protons react with the oxygen and the electrons travelling along the electrode to create H_2O (i.e. steam). Steam is thus the only 'emission' of this mobile power plant.

Electricity from the fuel cell drives the electric motor

The cleanly produced electricity powers the electric drivetrain via the high-performance electric motor and the modified automatic gearbox. Surplus energy is channelled to a lithium ion battery that serves as a storage unit. Energy recovery converts the braking energy into electricity which is stored in the battery. At full acceleration the battery serves as a power boost and ensures good driving dynamics.

Hydrogen storage unit instead of a diesel tank

Behind the driver's cab a rack holds seven carbon fibre tanks with a pressure capacity of 350 bar; these are situated directly on the refrigerated body. These tanks provide the truck with max. 31 kg of hydrogen. Around 3.5 kg of hydrogen remains on board unused (gross capacity 34.5 kg), as a certain amount of residual pressure must be maintained in the system. The high-pressure hydrogen storage units are subject to strict inspection regulations and are specified and certified for mobility use. The hydrogen storage unit is filled up via the tank nozzle on the driver's side in a few minutes as with diesel fuel.

ESORO fuel cell truck with trailer

100kW fuel cell system by SwissHydrogen and ESORO with a PowerCell fuel cell stack.

Electric engine

High-pressure storage unit for truck

Technical data

Fuel cell truck specifications	
Fuel cell truck supplier	ESORO
Supplier/chassis	MAN TGS 18.320 4x2
Electric truck supplier	Emoss / Ceekon
Range	375-400 km
Consumption	7.5-8.0 kgH_2/100 km
Filling time	approx. 10 mins.
Charge capacity	60 wheeled containers (for solo incl. trailer)
Max. weight	34 tonnes

Engine, transmission and battery	
Engine type	Synchronous engine
Engine manufacturer	tm4
Engine output	250 kW (approx. 340 diesel hp)
Transmission	Automatic
Battery type	Li-ion (LiFePO4)
Battery manufacturer	CALB
Battery capacity	120 kWh (2x60 kWh)
Battery voltage	500-750 V DC

Fuel cell system	
Supplier	SwissHydrogen
Manufacturer of stack	PowerCell
Fuel cell system manufacturer	SwissHydrogen
Fuel cell system integration	ESORO
Continuous output	100 kW
Number of cells	455
system efficiency	52%
Voltage	250-500 V DC

Tank system and storage unit	
Storage unit manufacturer	Luxfer
Tanks	7 on rack
Capacity	4.93 kg/tank
Capacity H_2	34.5 kg gross 31.0 kg net
H_2 tank nozzles	350 bar HighFlow WEH, TN1 H_2

Refrigerated body	
Structure	Frech-Hoch
Refrigeration	Fröhlich/Thermoking