

With a newly developed fuel cell for methanol, the action radius of electric cars can be tripled, and as methanol can be distributed in the same way as petrol, the fuel cell can help give the electric cars a crucial breakthrough.



photo: torben skøtt/biopress

At the inauguration of the energy town Frederikshavn, it was possible to test drive the various electrically driven cars.

Methanol can get the sale of electric cars

By Torben Skøtt

It is not many years ago that biofuels were launched as the green, environmentally friendly alternative to petrol and diesel, but since then, there has been a sometimes rather fierce criticism of the “green” oil. NGOs from most of the world are worried that large-scale use of biofuels might affect food safety, and several researchers have presented documentation that the environmental advantages of using biodiesel and bioethanol are very limited.

Conversely, electric cars have had some good fortune lately, for example with a new bill from the minister for climate and energy, Connie Hedegaard (K), who wants the EU to assess cars on the basis of their ability to displace fossil fuels. This will give the electric cars a much better position than the various types of biofuels, for example because an electric engine has a much higher efficiency than a combustion engine.

The sore spot of the electric car is still its range, which is usually 150-200 kilometres. For many people, this would be completely unacceptable, and that is probably one of the main reasons the electric cars have never really made it big.

But why not combine the efficiency of the electric cars with the ability of the biofuels to store energy over a long time? That is the philosophy behind a new concept proposed by the Northern Jutlandic

development company SerEnergy. With a newly developed fuel cell, they are able to triple the action radius of the electric car, and as the cell is run by methanol, the trouble of building expensive and complicated infrastructure for hydrogen is avoided.

From biomass and waste to electricity

The new concept was presented on the 3rd of November in connection with the official inauguration of the energy town



photo: torben skøtt/biopress

Anders Korsgaard from SerEnergy with one of the fuel cells that can give the electric cars a larger action radius.

Frederikshavn. In that town, the city council has decided that the town should be self-sufficient with renewable energy in 2015, and already in September 2009, the first green filling station, where citizens and the home care service can fill up the new environmentally friendly cars, will be opened.

The idea of combining fuel cells and batteries is not new at all, but it is unique that the town of Frederikshavn has chosen to use a liquid fuel such as methanol, which is converted into hydrogen in a transformer built into the fuel cell. In this way, they avoid having to build an expensive and complicated distribution system, as methanol – unlike hydrogen – can be distributed and stored in the same way as petrol and diesel.

Methanol, which is also called wood alcohol, is currently one of the most frequently used chemicals in the world, and it costs pretty much the same as diesel. Among other things, it is used as anti-freeze and solvent, and it is also used in the production of various chemicals. Methanol can be produced on the basis of fossil fuels such as coal and natural gas, but biomass can also be used as raw material.

– Our system builds a bridge between past and future. We can get started today because we use a familiar fuel like methanol, and we can improve the along the way as we become better at producing methanol on the basis of biomass and

Technology	CO ₂ Kg/GJ	SO ₂ Kg/GJ	NO _x Kg/GJ	Particles Kg/GJ
Conventional diesel	333	0.01	0.62	0.02
Conventional petrol	352	0.01	0.13	0.00
Natural gas	294	0.01	0.10	0.00
Bioethanol (1. gen. E85)	225	0.04	0.57	0.00
Bioethanol (2. gen. E85)	139	0.02	0.27	0.00
Biodiesel (RME)	150	0.01	1.02	0.02
Rape oil	138	0.01	1.03	0.02
Methanol from biomass	80	0.02	0.18	0.00
Hydrogen	402	0.16	0.67	0.00
Electric cars	185	0.07	0.31	0.00
DME	120	0.04	0.74	0.02

Table 1. The environmental impact connected with the use of various technologies in the transport sector in 2025. The environmental impact is stated in Kg/GJ of mechanical energy. Source: Alternative fuels in the transport sector (Alternative drivmidler i transportsektoren), The Danish Energy Agency, January 2008.

waste, explains Anders Korsgaard, who is the manager of SerEnergy. He considers methanol to be a brilliant method of getting more renewable energy into the transport sector. Windmills can charge the car's batteries during periods with excess current, and when the batteries no longer suffice, you can switch to methanol, which supplies energy to the electric engine through a fuel cell.

The Danish Energy Agency backs up the project

In the Danish Energy Agency's report from January 2008, "Alternative fuels in the transport sector", they also point out the many environmental advantages of combining electric cars with fuel cells for methanol. For instance, the CO₂ emission as well as the emission of sulphur and NO_x are significantly lower for methanol than for bioethanol and biodiesel, and methanol is described as a solution with good energy exploitation and great flexibility (see figure 1).

A disadvantage is that it is an expensive solution as long as the production of fuel cells is limited. Once an actual mass production takes place, we can expect to see cars with fuel cells to a greater extent.

Biomass cannot be converted directly into methanol, but it can be converted into gas, and then, the gas can be included in the production of methanol. Subsequently, the methanol has to be converted into hydrogen, which is then turned into electricity through the fuel cell, which means that there is a long line of conversions of energy, which each result in a loss, but this does not concern Anders Korsgaard:

– It may be that, in the end, only a fourth of the biomass is actually converted into mechanical energy, but that is not particularly significant if we can utilise the wind power optimally in this way and get the sale of electric cars going, says the manager of SerEnergy.

Twice as effective

At the official inauguration of the energy town Frederikshavn, the press was shown a number of different electric cars, which will be characterising the townscape in the future. The selection ranged from little two-person city cars through delivery vans to a truck with an open truck bed.

What gathered the most interest was an eight-person electrically driven Fiat, which will be equipped with fuel cells from SerEnergy before long. At the presentation, the car was equipped with an electric 60 kW motor and a number of

lithium-ion batteries, but the plan is to mount three fuel cells with a total wattage of a bit more than 13 kW.

Previously, the market has been divided into low- and high-temperature cells, which operate at 60-70 degrees and 600-1,000 degrees respectively, but SerEnergy has chosen to construct a fuel cell where the temperature will usually be at about 160 degrees. Thereby, they have achieved a sturdy construction that is better at enduring that the quality of the fuel varies than the types that are currently on the market.

Anders Korsgaard estimates that the electric car with fuel cells will have a total efficiency of about 50 percent, which means that it will be at least twice as effective as a traditional petrol-driven car. With batteries, the operating costs will be at about DKK 0.75/kWh and almost DKK 1/kWh when using methanol as fuel. ■



Among other things, the working group behind "Alternative fuels in the transport sector" recommend:

"..... that the development effort within thermo-chemical conversion of biomass and waste into biofuel through gasification is strengthened through the national research and development programmes for new energy technology. This technology may involve some fundamental advantages in the shape of better utilisation of energy and increased flexibility compared to biological conversion."