

## Electrical energy supply with direct methanol fuel cells (DMFCs)

### Innovation

The DMFC combines the reliability of a fuel cell with the advantages of a liquid fuel. Due to the extremely high energy density of liquid methanol ( $\sim 16$  MJ/l) DMFC systems provide an economically interesting alternative to existing electrochemical techniques because they allow longer operating times by a factor of 3-4 in the same volume as compared to batteries. Compared with hydrogen fuel cells (PEMFC), the advantage of DMFCs lie in the simple logistics of the fuel. Fuel cell systems have lower emissions (emissions and noise) and favourable maintenance costs compared to emergency diesel aggregate systems. The advantages DMFC systems have over existing lead-acid battery and internal combustion engine technologies are useful for various applications while bringing lower operating costs, and thus clear economic benefit. Advantages are:

- Greater availability,
- Longer active service time due to fast refuel,
- Lower energy costs due to providing simple logistics,
- Improved handling due to large energy storage density,
- Reduced maintenance due to simple design with no mechanically wearing parts
- Useable in areas with limits on pollutant and noise emissions.



warehouse vehicle (concret example)

### Technology

Direct methanol fuel cells (DMFCs) are low-temperature fuel cells that operate at a temperature of  $70^{\circ}\text{C}$  and convert the liquid fuel methanol directly into electrical energy. The Forschungszentrum Jülich (IEK-3) has over ten years of experience in the development of DMFCs and the construction of complete DMFC systems. The development of DMFC technology is well advanced, and the main scientific and technical demands have been met. Thus, it has been possible to reach the current system lifetimes of more than 13,000 hours of operation. This long-term stability is an important prerequisite to establish an

economically attractive system. In a study by the consulting firm Management Engineers it was demonstrated that the DMFC power systems that have been developed for material handling vehicles are economically superior to conventional lead-acid batteries when operated on a three-shift rota.

Another cost-effectiveness and feasibility study has shown that our DMFC system can be applied profitably in other low-emission areas, and with bio-methanol our invention is a CO<sub>2</sub>-neutral alternative to other energy producers. Based on the current state of development of DMFC technology, products related to mobile, portable or stationary power supply of up to 5 kW(el) can be developed and commercialized. Particularly promising are applications for consumers separated from the power grid, and their use as backup systems for emergency power or uninterrupted power supply (UPS). Here, especially uninterruptible power supply (UPS) are commercially interesting for radio base stations in developing countries and emerging markets.

### **Stage of development**

The Forschungszentrum Jülich has extensive expertise in this field and holds several patents. We want to develop the technology further and are seeking for cooperation partners and/or licensees.

### **Application**

DMFCs are suitable for applications requiring up to 5 KW electric energy.

- Backup power supply
- Power supply for small, mobile vehicles
- On-board power supply
- Portable power supply
- Off-grid power supply
- Your application

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