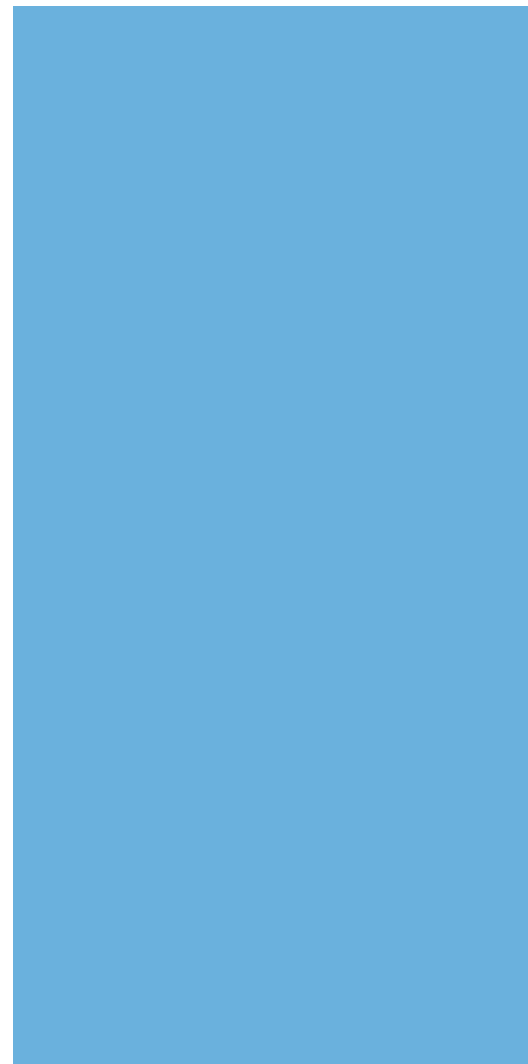
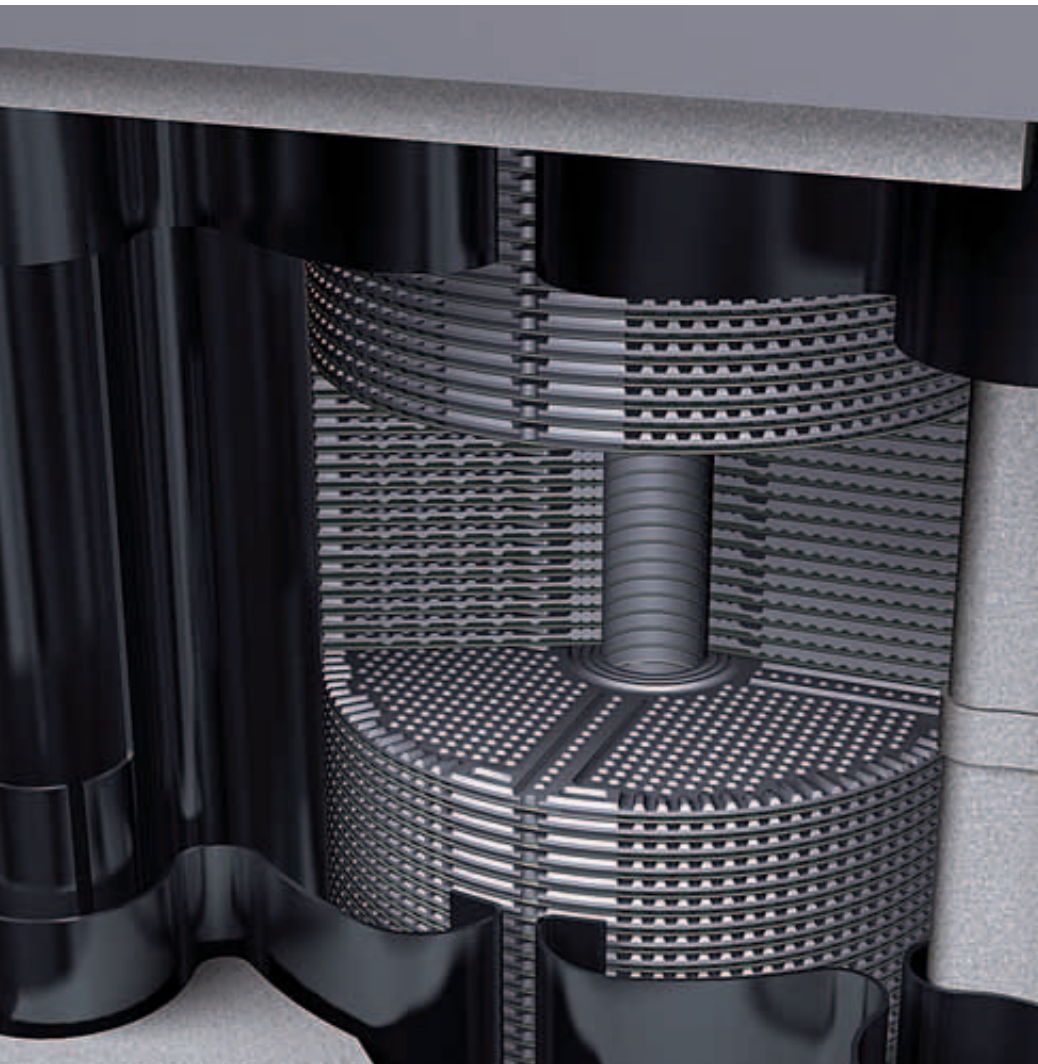


Fans, blowers and pumps for fuel cells



Our contribution
to alternative power generation

ebm-papst engineering achievements for fuel cell technology

Limited resources demand efficient energy use and the development of new technologies. With the goal of a power generation system that is highly efficient, that creates little or no pollution, and that is independent of environmental influences, research and development is paying special attention to fuel cell technology as the "energy converter of the future." Blowers, fans and pumps are important components of any fuel cell design. As one of the world leaders in fan and motor manufacturing, ebm-papst keeps close ties with industry and research establishments and is involved as an engineering partner in numerous projects that are focused on the future.

Energy efficiency: the challenge

To convert fuel cell applications from laboratory standards into competitive line products, and to distinguish them from other forms of power generation, further technological developments are needed, not only to improve the fuel cells themselves, but also to perfect the components they require.

The use of energy-efficient fans, blowers and pumps is one option that will play a decisive role in attaining the highest level of efficiency within the entire system. With this in mind, one of the primary objectives of the research done at ebm-papst is to achieve the greatest possible overall efficiency of the motor/blower unit. With the low energy consumption of the latest ebm-papst EC drive motors and the use of optimized, highly efficient turbomachines, this goal has already been reached in various projects and in a variety of application areas.

Based on the world's largest range of product versions, models and sizes, it is easy to realize a multitude of fuel cell applications. With our vast knowledge base in the areas of drive engineering, aerodynamics and electronics, we can both adapt existing products and develop new products to accurately meet the specific requirements of fuel cell technology.

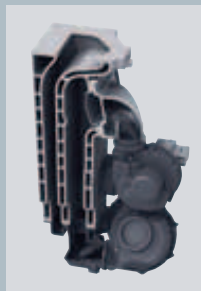
Another ebm-papst goal is to optimize the noise emission characteristics of such systems. The aerodynamically optimized, and thus noise-optimized design of fan blades, impellers and ducted housings in their respective application areas has always been at the core of our competency, and is a cornerstone from which our development partners can grow.

Fans and blowers for fuel cell applications

ebm-papst is involved in implementing fuel cells in a vast variety of application areas: from blowers for cooling electronic components and capacitors, to supply blowers for cathode air, to blowers for fuel gas supply.

The following ebm-papst products are currently available and suited for use in fuel cell technology:

- ▶ **Fans and blowers for oxygen and air supply for fuel cells with reactive air**
- ▶ **Fans and blowers for transporting heat generated by the fuel cell**
- ▶ **Fans and pumps for cooling the fuel cell**
- ▶ **Fans and blowers for transporting steam**
- ▶ **Fans, blowers and pumps for conveying reactive gas, hydrogen or natural gas**
- ▶ **Blowers for reformer burners**
- ▶ **Blowers and compressors for hydrogen recirculation**



Heat exchangers for stationary application with two integrated blowers



1-stage high-pressure EC blowers



2-stage EC centrifugal blowers for supplying air to cathodes



4-stage high-pressure EC blowers

Stationary, mobile and portable applications:

The key points of our development partnership

One of the main focuses of our current research is to develop stationary fuel cell applications for household generation of electricity and heat, and to develop stationary power generation. In these segments, we lead the market in conventional technologies and have an extraordinary amount of experience as well as enormous potential as an engineering partner.

Based on the wide range of centrifugal blowers for the heating industry, we are working intensively to create components with a performance spectrum to match the requirements of fuel cell technology. This is taking place in close cooperation with various manufacturers, which already belong to our clientele, and which are based in the fields of conventional heating and even fuel cell development. The current stages of development of the systems range from initial prototypes to pilot-series devices.

In the area of mobile applications, too, research is taking place not only among the leading manufacturers of the automotive industry, but also among manufacturers of industrial trucks, lift trucks and forklifts. The objective is to develop high-efficiency applications with high load-shift characteristics while simultaneously attaining optimized space utilization. We are deeply involved in a variety of research projects for mobile applications.

Fuel cells for portable applications are already in limited production and are not far from stepping into full production. These fuel cells are used primarily in emergency power supply systems, as power sources for constructions sites and in the field of emergency medical services. Two particular advantages of these devices are their low noise characteristics and zero emissions, making it possible to use them even in closed spaces, such as in tunnel construction.

High efficiency, reliability and maximum energy density place high demands on the fuel cells and likewise require highly compact and efficient fan technology.

Project: electric vehicle with DMFC, Jülich Research Centre, Germany

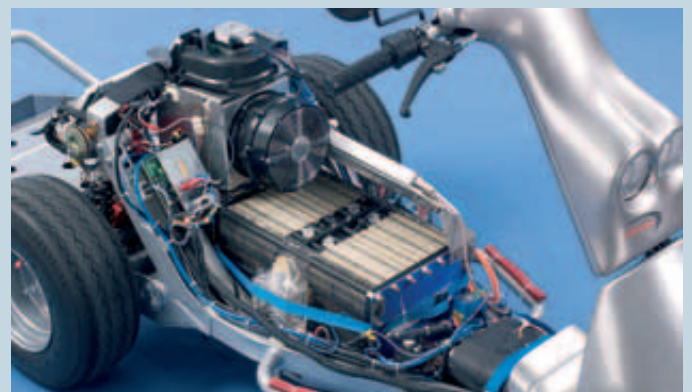
This research project has an ambitious goal:

An existing, conventional, electric vehicle that runs on lead batteries is to be retrofitted for operation using a methanol-fueled fuel cell that is to be as compact as possible. The system attains an electrical output of 1 kW.



The available space in the conventional design with lead batteries.

ebm-papst has redesigned the blowers and fans specifically for this task. Based on a basic type that is known to be reliable, the motors used here have been reworked to ensure maximum efficiency at the required operating point of the cell. To achieve this, the motor coil and motor electronics have been specially tuned to each other.



The compact DMFC, which does not require any additional installation space.

With its advantage of low CO₂ emissions and its reduced impact on the greenhouse effect, the fuel cell has great potential to become the alternative form of power generation of the future. As a manufacturer of important components for fuel cell applications and as a committed engineering partner, ebm-papst can provide valuable contributions to research and development. If you are interested in developing a partnership with ebm-papst, Mr. Harald Böhm looks forward to hearing from you: **Harald Böhm, phone: +49 (0) 871 / 707-392, e-mail: harald.boehm@de.ebmpapst.com**

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