

Energy Technology and Catalysis: VeGA – LPG Based Power Generation

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Introduction

The fuel cell / fuel processor system VeGA is under joint development of TRUMA Gerätetechnik GmbH & Co. KG and the Institut für Mikrotechnik Mainz GmbH (IMM). The system, for which TRUMA has received the f-Cell Award in silver in 2007 and the Bavarian Energy Award in 2008, will work as a battery charger for recreational vehicles with an electrical power output of max. 250 W. While the fuel processor (reformer) has been developed by a research team of IMM, TRUMA developed the fuel cell stack, many BoP components and the system.

Liquefied Petroleum Gas (LPG) was chosen as fuel, because it is readily available on recreational vehicles and, thus, no additional infrastructure needs to be set up, clearly facilitating market introduction. The fuel cell system makes the consumer independent of the power grid, which is an attractive feature in the recreational field, especially with regard to the increased demand for comfort being closely related to electrical appliances.



Figure 1: VeGA – 250 W LPG based Auxillary Power Unit for recreational vehicles developed by TRUMA Gerätetechnik GmbH & Co. KG

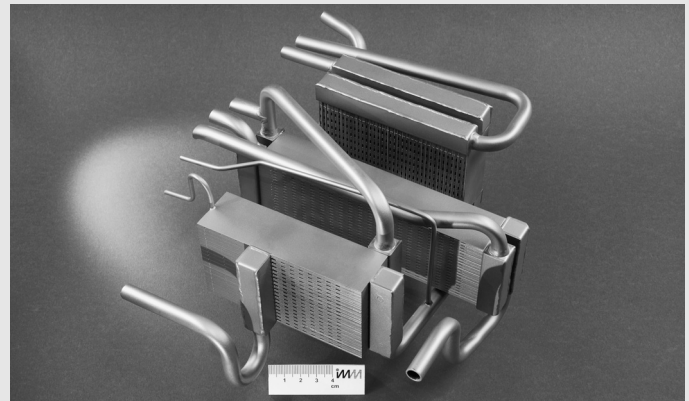


Figure 2: Early fuel processor prototype developed for the VeGA system by IMM

Summary

The LPG is desulphurised in the system, converted into hydrogen in the fuel processor and further into power in the fuel cell stack. A DC/DC converter adapts the voltage of the generated power to the requirements of the battery, which is loaded by the system as soon as the voltage level falls beneath a certain critical value. By these means, about 28 kWh power can be generated out of an 11 kg LPG-container.

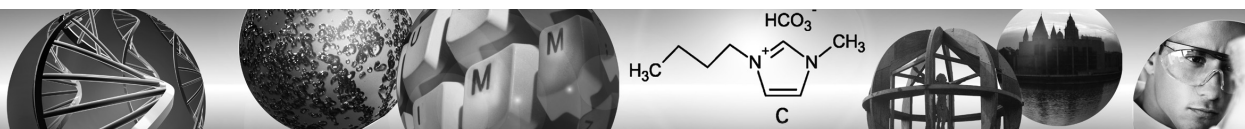
The average costs for power generation are around 0,50 € / kWh. The system has a volume of 94 l and a weight of 40 kg, and therefore it can be easily integrated into a recreational vehicle.

The fuel processor components are based upon microstructured plate heat-exchanger technology, which makes possible the introduction of unique features into the fuel processor. They allow for a rapid system start-up as well as the direct coupling of endothermic

and exothermic processes, which are integrated in one single component. By direct coupling of energy consumption and energy generation, heat losses are minimised. This is crucial for fuel processor systems of the smaller scale to maintain efficiency.

Development started in 2003 in the field of catalysts. In 2004, single components of the fuel processor were built and subsequently tested. Two generations of prototypes of the fuel processor could be realised in 2005, what opened the way for a third generation in 2006. A smaller number of devices of an α -series was realised in 2007. First systems of a β -series have been inserted into recreational vehicles in 2008. Since early 2009, about 100 of these devices have been tested in field trials. The system has successfully passed a 170,000 km vibration test and operation by end-users on the road, even in Africa.

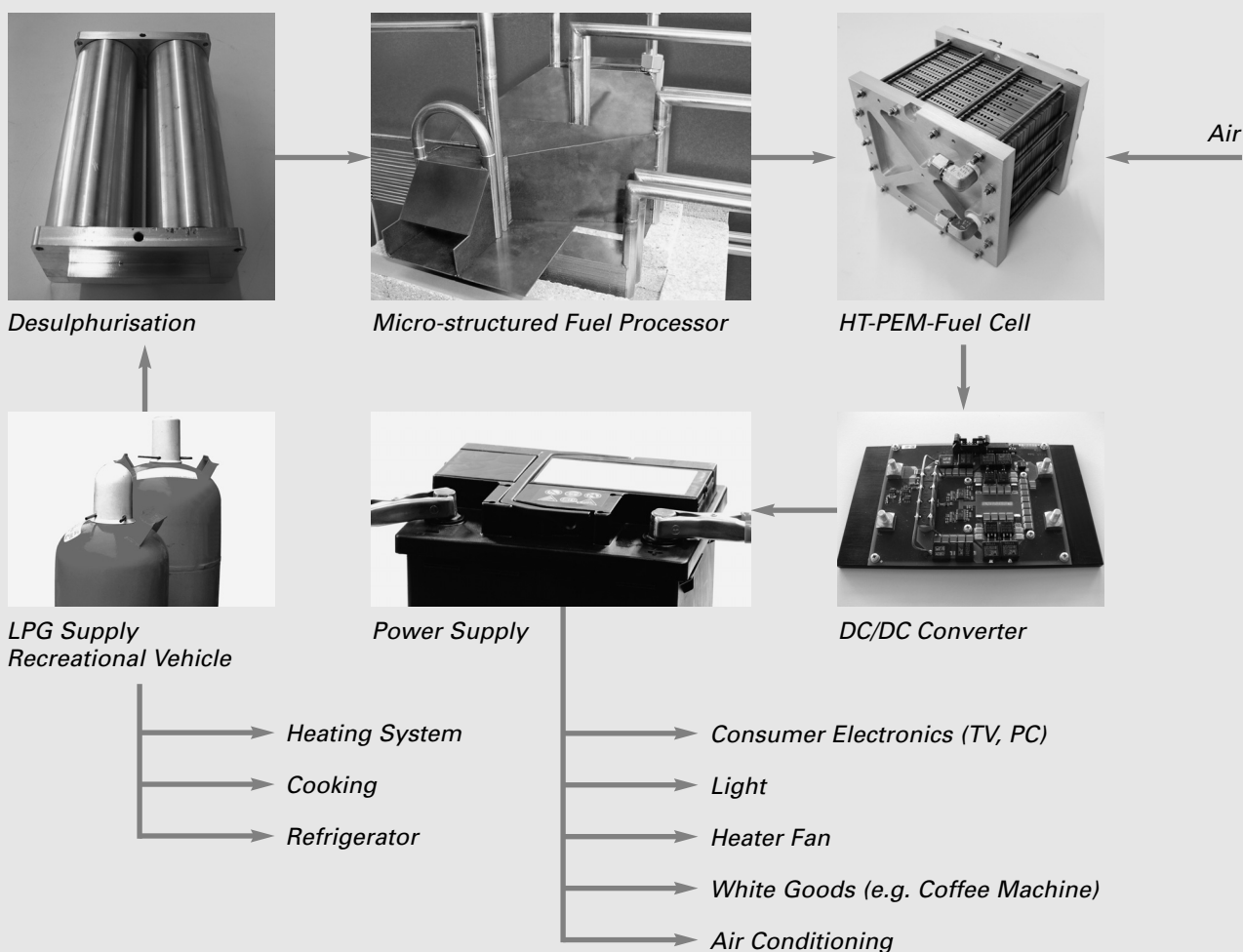
At the same time, production techniques have been developed to adapt the new technology to large-scale production requirements.



Technical data of the VeGA system

Fuel	Regular Liquefied Petroleum Gas (LPG)	Charging Current	up to 20 A
Charging Capacity	6,000 Wh/d	Fuel Consumption	ca. 100 g/h LPG
Power	max. 250 W net energy	Fuelling Costs	ca. 0.5 €/kWh
Power for BoP	50 W	System Size	700 x 465 x 290 mm (94 L)
Supply Voltage	11.5 - 14.4 V	Weight	40 kg

Functional scheme of the system



Partner

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