

Demonstration of 1st European Solid Oxide Fuel Cell Truck APU on a Vehicle

Recently the goal of the DESTA project (to demonstrate the first Solid Oxide Fuel Cell Auxiliary Power Unit on a heavy duty truck in Europe) has been achieved. The results are a major breakthrough for fuel cell based APU systems for trucks.



DESTA truck with SOFC APU (without fairing)

The APU system developed and supplied by Eberspächer, was integrated and tested by Volvo on a long haul truck for the North American market. Until today, several weeks of smooth operation were demonstrated on conventional US diesel fuel (< 15 ppm sulfur). With the DESTA system, 3 kW of electrical net power can be supplied with an efficiency of 30%, very low NO_x emissions, no diesel particles and a noise level of about 58 dB (A) outside the vehicle and less than 40 dB (A) inside the vehicle. Compared to engine idling of a heavy-duty truck the CO₂ emissions could be reduced by 71 %. The diesel consumption is 1.0 l/h at an electrical net power of 3 kW.

These objectives fulfill the major technical targets of the project. The start-up time of the APU system lies between 30 and 70 minutes, depending on the stack temperature (cold and warm start). The system has a weight of 160 kg and a volume of 178 l. Production costs and lifetime are the major challenges to be solved in future.



DESTA SOFC APU

Within DESTA, Eberspächer and AVL proposed already existing SOFC APU systems which were thoroughly evaluated through a benchmark test at each of the partners at the beginning of the project. Volvo defined a test cycle for this benchmark test. The project partner Forschungszentrum Jülich had the responsibility to monitor that Eberspächer and AVL keep in line with the test cycles, to analyze the test results and to classify whether the systems are mature enough to perform well in a truck demonstration. The consortium chose the Eberspächer system which was ready for integration after one design loop. The task of the Eberspächer technicians was to design, build up and to pretest an APU which converts conventional US diesel into a hydrogen and carbon monoxide rich gas and finally into electricity. Volvo's role in the project contained the development of the vehicle requirements, the design of power electronics and the control system for vehicle communication, to perform the electrical and mechanical integration into the vehicle and to conduct extensive vehicle testing.

The final event of the DESTA project was held at Volvo Truck in Gothenburg on 9th June 2015. During the meeting the vehicle with integrated APU was demonstrated to the entire project consortium and a representative from the Fuel Cells and Hydrogen Joint Undertaking which DESTA was funded by.

Truck and integrated APU went through a real life testing cycle including driving and stopping periods through day and night. More than 2,000 km of driving and 50 hours of APU power production during parking were demonstrated. In order to gather as many vehicle test data as possible, the tests will continue at Volvo and proceed until the official end of the project on 30th June, after which Eberspächer plans to continue lifetime and cycling tests.

Finally, with this electrical net power class of 3 kW, the world premiere of a diesel-operated SOFC APU on a long haul truck could successfully be presented.