

# Project Information



**Subject:** Compressor / Expander Units for Fuel Cell Systems with Optimised Efficiency

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**Project Duration:** 07.08.2000 - 31.12.2002

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## Project description / Status of work:

The objective of this project is to increase the efficiency of PEM fuel cell systems by selection and optimisation of air supply units. Appropriate compressors and expanders are selected, evaluated, and if necessary adapted and measured. On the basis of a simulation model of the fuel cell system, different concepts are computed and optimised, with and without energy recovery by utilisation of the cathode pressure. In addition, with the help of these simulation tools the best operating mode for the air supply components can be ascertained and adapted to the desired targets like optimum system efficiency.

For an increase of the efficiency of the measured screw compressor and for the optimisation of the cathode air humidification, a direct water injection valve was integrated into the aggregate and measured in operation. Due to the decreasing temperatures by the evaporation of the injected water a higher compression efficiency up to 5% can be achieved. Furthermore, the humidification can be controlled accurately and dynamically. These investigations formed the basis for the development of the complete air supply unit for the fuel cell demonstrator vehicle "HY.POWER".

Additionally performed simulations with an expander show an increase in system efficiency of up to 10% by recovery of the cathode pressure, if the expander is properly dimensioned and the system pressure is controlled for optimum efficiency.

