Bundesministerium
für Bildung
und Forschung

Research for Electromobility

Project: **Innovative concepts relating to air-conditioning and thermal comfort, for optimizing the range of electric vehicles (E-comfort)**

Coordinator: Volkswagen AG
Project volume: 2.6 mn. € (German Fed. Min. of Education and Research's proportion of funding: 50%)
Project term: 01.07.2011 – 30.06.2014

Task of the project partners in the chain of implementation

- Volkswagen AG — Wolfsburg
  Implementing the results of the research in a demonstration unit
- Fraunhofer-Institut für Bauphysik IBP — Valley
  Using research to ascertain, and also recording, the air-conditioning-related and energy-related sequences of activities in the electric vehicle
- P+Z Engineering GmbH — Munich
  Using research to produce a software to simulate the air-conditioning-related parameters of the (immediate) surroundings

Germany – leading provider of electromobility

The greatest challenge facing the automotive industry worldwide is that of securing vehicle users' individual mobility on an environmentally sustainable basis over the long term. In view of the goals of using renewable energies and attaining zero local emissions, major expectations are being placed in electromobility. From the automotive industry's perspective, what is needed is to ensure that Germany's leading role in automotive construction is also asserted successfully in an "electromobile future." Germany's Federal Government has thus, as a first step, set itself the goal of getting 1 million electric vehicles onto Germany's roads by 2020. The aim is for the German automotive industry to become a leading provider of electromobility.

On the road leading to electric vehicles which are viable in the market, there are however still some substantial technological hurdles to be overcome. Within the context of the **funding priority allocated to "key technologies for electromobility – ELECTRICITY",** established by Germany's Federal Ministry of Education and Research, funding is being provided to joint projects, particularly in the areas of battery research, energy management and complete vehicle systems. Within this process, the ELECTRICITY funding priority takes as its orientation the recommendations of the National Platform for Electromobility.

Extending the range of an electric vehicle by optimizing the air-conditioning system

One of the central challenges involved in attaining a high level of acceptance for electric vehicles within society is that of achieving a level of comfort comparable with today's cars. In particular, this relates to the air-conditioning system for the passenger compartment and also the range attainable by the vehicles.

Air-conditioning the passenger compartment, as the greatest secondary consumer of energy, acquires a major significance with regard to optimizing the range of electric vehicles. For regulating the temperature, neither the waste heat of a combustion engine nor the driving mechanism for compressors is available. Therefore, the energy for the air-conditioning system must be provided by the battery; this in turn reduces the vehicle's range. However, energy consumption can be reduced if it is not the entire passenger compartment which is air conditioned, but rather the passengers only experience the effect of warmth or cooling where this is necessary or this is pleasant to them.

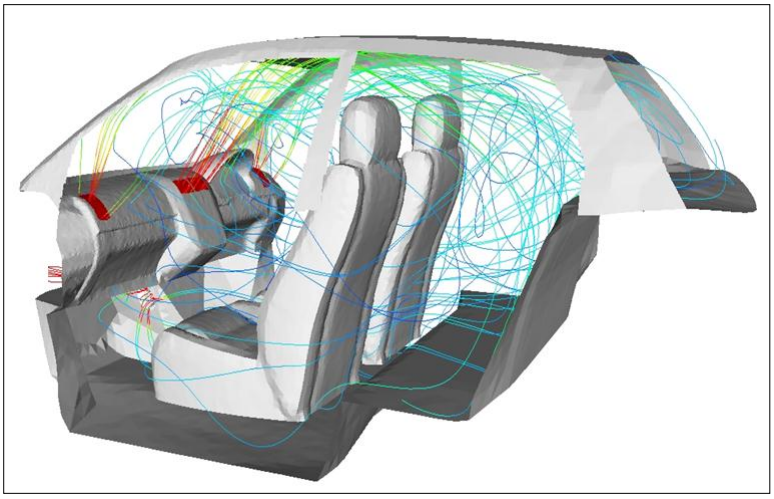

Figure 1: Simulation of the air flows in a car

The objective of the project is therefore to develop new types of air-conditioning concepts, and to use research to ascertain the effects that these concepts have on the passengers' sense of wellbeing, the energy efficiency and the range of the electric vehicle. In order to be able to visually present and readily comprehend these aspects, the plan is for computer models to simulate the energy management of the vehicle as a whole, and also the human perception of the temperature and of the sense of comfort. The plan is for tests involving the use of test individuals to confirm the theory in practice. To select the components for new kinds of air-conditioning concepts and to prepare their installation into a demonstration unit, initially a model will be produced on the computer, recording all relevant energy flows in the vehicle.

Building on this basis, various new air-conditioning concepts will be tried out. The project partners expose the test individuals to various conditions with regard to the air-conditioning system, in order to check the correctness of the air-conditioning model. Based on the results of this study, a model for comfort emerges.

Within the framework of the project, the partners fit together the various models used in the research process, so as to produce a comprehensive description of the human-vehicle-interaction system. This provides the basis for conceiving of and optimizing vehicles, a process made visually accessible using a demonstration unit. The models for comfort can be transferred to other usage concepts which work with local air-conditioning, such as trains and aeroplanes.

Accompanying the research and tests, the project planners ensure that the methods developed become established as ISO standards.

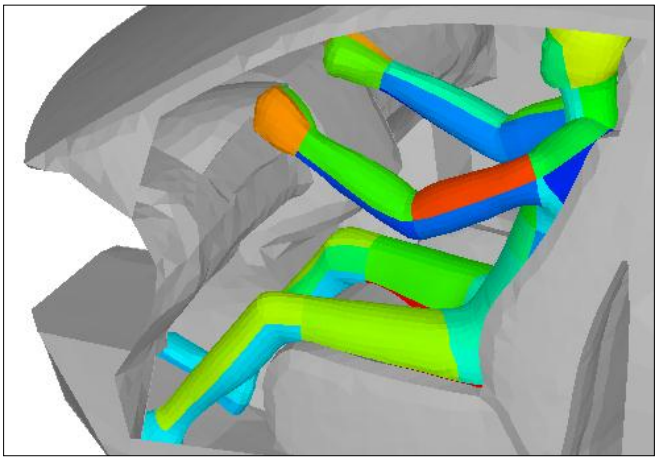

Figure 2: Thermal regulation model (THESEUS-FE)

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Programme:	IKT 2020
Contact person:	Dr. Peter Schroth – Section for Electronic Systems, Electromobility
Contact details:	E-Mail: peter.schroth@bmbf.bund.de