Electric Vehicles Reduce Costs and Protect the Environment

RheinMobil Project Shows When Electric Vehicles Are Worthwhile/Positive Ecological and Economic Balance after 300,000 km of the Fleet Test

Economically efficient operation of electric vehicles is possible. This is the result of the Siemens and Michelin fleet test in business and commuter traffic. (Photo: KIT)

Monika Landgraf
Chief Press Officer

Kaiserstraße 12
76131 Karlsruhe, Germany
Phone: +49 721 608-47414
Fax: +49 721 608-43658
E-mail: presse@kit.edu

For further information, please contact:

Kosta Schinarakis
PKM – Science Scout
Phone: +49 721 608 41956
Fax: +49 721 608 43658
E-mail: schinarakis@kit.edu

Under which conditions are electric vehicles less expensive than diesel vehicles? What are the positive environmental effects? And what about their acceptance by users and reliability in practice? The RheinMobil project coordinated by KIT answers these questions in a study of a fleet test covering two and a half years of operation with 300,000 electrically driven kilometers. The results were presented at the International Motor Show (IAA) in Frankfurt.

“The data show that electric vehicles already now are cheaper and more compatible with the environment than comparable cars with a combustion engine,” Olaf Wollersheim, who heads the project at KIT, says. However, some prerequisites have to be fulfilled. The project demonstrated that commuter and business traffic between fixed locations is an ideal application for replacing diesel cars by electric vehicles.

“For economic efficiency, high milages are crucial. To protect the climate, the electric car has to be charged with 100% green electrici-

ty. Only then is electric mobility sustainable," Wollersheim says. "In addition, users want to neither do without their usual comfort nor change their mobility behavior when replacing the combustion engine by an electric drive. These prerequisites were ideally fulfilled by the fleet test at our industry partners of Michelin and Siemens."

The study does not only evaluate operation data of the vehicles and charging stations, but also covers regular user surveys. The findings of the more than 30 months of project duration can now be used to formulate criteria for an economically and ecologically successful electrification: High milages are required with easy-to-plan individual tours of a maximum of 100 km. In the RheinMobil project, for instance, monthly milages of an average of 3,500 km per vehicle were reached. This requires a high reliability of vehicles and charging stations as well as an exact analysis in advance of the real fuel energy consumption and charging behavior.

The project data reveal that electric vehicles "compensate" their investment costs at a milage of about 200,000 km, as their operation costs are smaller than those of cars with a combustion engine. Electric cars are more climate-friendly thanks to a reduced emission of carbon dioxide and other pollutants from a milage of about 30,000 km already, provided that the complete vehicle lifecycle is analyzed and operation with 100% green electricity is assumed. (The limit is about 100,000 km, if today's power mix of the German and French power grid is assumed).

"Vehicle operation is economically and ecologically reasonable when the vehicle is charged with green electricity and is driven always when it is not charged," Wollersheim explains. "We found that operability of the vehicle was especially high in the winter without significant limitations of the range." Quick charging should only be performed when this is urgently required for reasons of time. In this way, premature aging of the battery can be prevented.

For the vehicle users, ecological advantages were particularly important. The fact that the routes of commuters and business travelers can be planned well helped overcome initial concerns regarding the limited range of electric vehicles. Contrary to expectations, daily commuting between France and Germany did not represent a problem. Charging of the vehicles worked without any problems on both sides of the border.

Of course, these results cannot be transferred to all conceivable vehicle uses in general. "But many applications, such as taxi traffic, inner-urban logistics, or mobile care have similar use profiles and

requirements and, hence, are excellently suited for an economically and ecologically sustainable electrification. With the experience gained from the RheinMobil project, we can now push economically efficient electric mobility," Max Nastold, Director of the project partner e-Motion Line, emphasizes. "For the average private user, however, economic efficiency cannot be reached under today's framework conditions."

RheinMobil is a joint project of Michelin, Siemens, Karlsruhe Institute of Technology (KIT), the Fraunhofer Institute for Systems and Innovation Research ISI, and the mobility services company e-Motion Line (eML). The project is part of the "LivingLab BW^{e} mobil" electric mobility showcase funded by the Federal Republic of Germany. RheinMobil is aimed at demonstrating that certain utilization profiles allow for an economically efficient operation of electric vehicles with commuting and business traffic between Karlsruhe and the Alsace region being used as an example. Daily, six mini buses with seven seats each are commuting for Michelin, while Siemens operates a compact vehicle for business trips. Monthly milage per vehicle was increased to an average of 3500 km in the course of the project.

The results of the present study were presented by Maximilian Schücking of the e-Motion Line project partner at the IAA in Frankfurt. His presentation entitled "RheinMobil: Über 300.000 km unter Strom im grenzüberschreitenden Pendler- und Dienstverkehr" was part of the electric mobility showcase forum.

The study can be downloaded at:
http://www.competence-e.kit.edu/rheinmobil.php

The RheinMobil project is one of about 40 projects in the Baden-Württemberg "LivingLabBW^{e} mobil" electric mobility showcase. It is funded with about one million euros by the Federal Ministry of Transport and Digital Infrastructure (BMVI) under the showcase program of the federal government. In April 2012, the federal government selected four regions in Germany as "electric mobility showcases". In these regions, research and development of alternative drive trains are funded according to the decision made by German parliament. For the showcase program, the federation provides funds in the total amount of EUR 180 million. In large-scale regional demonstration and pilot projects, electric mobility is tested at the interface of energy system, vehicle, and traffic system. More information is provided at www.schaufenster-elektromobilitaet.org.

schaufenster elektromobilität
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“LivingLab BW^{e} mobil” Electric Mobility Showcase

In the Baden-Württemberg “LivingLab BW^{e} mobil” showcase, more than 100 partners from industry, science, and public institutions are studying electric mobility in practice. The projects concentrate on the region of Stuttgart and the city of Karlsruhe and ensure high international visibility. “LivingLab BW^{e} mobil” stands for a systematic approach based on coordinated projects for everybody to experience electric mobility from the electric bike to the electric car to the electric van to plug-in shuttle buses. The projects address aspects of intermodality, fleets, commercial transport, infrastructure and energy, urban and traffic planning, vehicle technology, communication, and participation as well as training and qualification. “LivingLab BW^{e} mobil” is coordinated by the State Agency for Electric Mobility and Fuel Cell Technology e-mobil BW GmbH and the Stuttgart Regional Economic Development Corporation (WRS). More information is given at **www.livinglab-bwe.de.**

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Karlsruhe Institute of Technology (KIT) is a public corporation pursuing the tasks of a Baden-Wuerttemberg state university and of a national research center of the Helmholtz Association. The KIT mission combines the three core tasks of research, higher education, and innovation. With about 9,400 employees and 24,500 students, KIT is one of the big institutions of research and higher education in natural sciences and engineering in Europe.

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