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Focus on innovation

Speeding toward a new electricity age

Siemens and RUF are working on the future of automobiles: a sports car that can also feed power back into the grid

A final scrutinizing look before installing the high-performance drive train in one of the ten test vehicles: Project Manager Tilo Moser keeps a close eye on the "marriage" of motor and chassis

By Christine Auer

It's a normal Friday morning in a perfectly normal car repair shop. And yet the air is crackling with suspense. That's because today, here at the RUF Automobile GmbH workshop in the Bavarian city of Pfaffenhausen, a very special "marriage" will take place – between an electric motor and the chassis of a sports car, the eRUF Roadster. The RUF and Siemens employees on hand for the occasion are charged with excitement.

"What is happening today is exhilarating," says Tilo Moser, head of the "Emotion without Emissions" project at Siemens Corpo-

rate Technology. "After spending a good year and a half on developing and designing electrical high performance drives and other innovative components for electromobility, we are now finally putting together the cars so we can test them in actual operation. Only then will we know whether everything works as it should." A Porsche 911 is being used as the basic vehicle, and it is jacked up in the middle of the garage floor. Underneath lies a complete drive train, ready for installation. This eRUF Roadster belongs to a fleet of ten vehicles that will be thoroughly put through their paces by test drivers in the coming weeks until September 2011.

It may seem a bit unusual to do this with a sports car – after all, not even production-ready small electric vehicles are commonplace in cityscapes. Isn't this a bit like putting the cart before the horse? "Actually, there are huge opportunities in the sports car field since the dynamics of an electric drive provide a sporty yet emission-free driving experience," explains Moser. "High-performance electric vehicles help us to examine the potential that lies in new technology and will pave the way for series production of everyday vehicles."

The objective of the project is to map the entire electromobility chain – beginning with different

»» Only in combination with a powerful and intelligent power grid will electric vehicles reveal their full potential

Tilo Moser

motor concepts and parts of the electronic control, and ranging to infrastructure topics such as public or home-based charging stations. "Gassing up" using a household outlet currently takes a good eight hours. Does that mean that driving a sports car will require a great deal of patience? "Using high voltage outlets, charging times currently

take about one and a half to two hours and result in a range of up to 200 kilometers," Moser says. "We also want to show that an effective connection to a high-voltage grid, such as 22 kilowatts, is entirely possible. We can achieve that through highly integrated power electronics, which can be used both for driving and for charging." And within the framework of this project, engineers are already working on the future of energy supply. "The charging electronics of a vehicle actually make bidirectional charging possible." If the charging infrastructure is designed accordingly, what that means is that the electric vehicle serves as a mobile storage device for the grid of the future and can feed power back into the grid. Together with the installed ComBox, current technology already provides for communication between the vehicle and charging infrastructure, allowing the car to become a part of a smart grid. In later development stages, the box can serve as a platform for additional functions, such as cell phone applications or remote control of the air conditioning. This paves the way for intelligent cars.

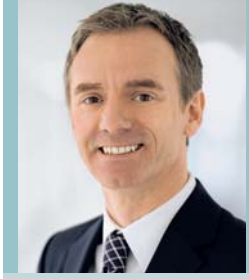


Team engineers with the prototype and the eRUF Roadster on the track



Editorial

Building a common future



Dear readers,

When Werner von Siemens and Johann Georg Halske laid the foundation in 1847 for what is now Siemens AG, it was an example of two people coming together who complemented each other perfectly. Siemens was the inventor, the mastermind. Halske was the tinkerer, the one who developed those ideas and found specific solutions that made it possible to turn Siemens' inventions into real products. Today, we all still benefit from what those two men set in motion.

Some innovative solutions are, of course, created behind closed laboratory doors. But building trusting relationships with partners both within and outside our company and working together to build a common future is part of the Siemens culture. For instance when it comes to advancing electromobility – as well as in many other areas where progress would otherwise not be possible. One cannot view electric vehicles as a stand-alone. They will be part of a world where cars not only consume power but also store electricity – from solar cells, for instance – and can feed that electricity back into the power grid.

In this issue, discover how Siemens is already shaping this world today – in collaboration with its partners. The Siemens-World team hopes that you enjoy reading this issue!

Stefan Wimmer
Editor in chief

Interview

From a driving machine to an experience machine

Electromobility is transforming cars into mobility partners – many technologies already exist

Electric vehicles not only protect the environment, they will also completely change the urban traffic landscape and how we get around. *SiemensWorld* discussed this topic with Gernot Spiegelberg, the head of Electromobility Concept Development at Corporate Technology (CT).

Where do we stand at the moment in terms of electromobility?

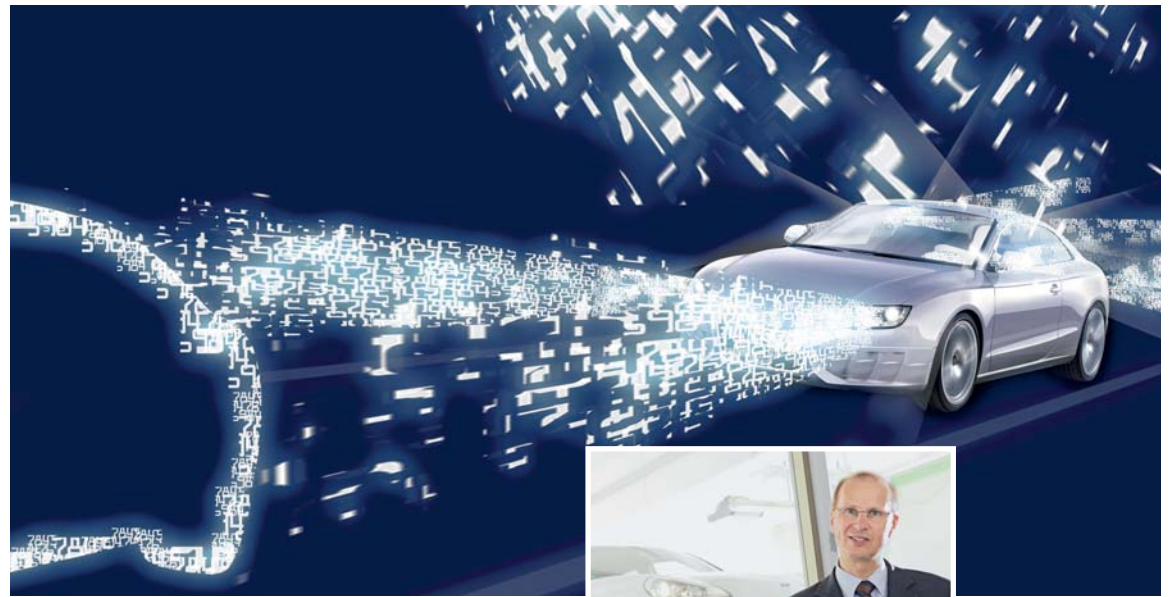
Spiegelberg: Even though the issue of battery capacity hasn't been fully resolved, we have certainly made advances in technology. Furthermore, our energy distribution networks have improved significantly and an increasing array of renewable energy sources are becoming available. In addition to enhancing environmental awareness and protecting resources, one of the greatest advantages of electric vehicles is that they will be part of the energy mix of the future by storing electricity and compensating for natural fluctuations that occur when generating wind and solar power.

So, developing the infrastructure is becoming even more important?

Absolutely. We need a sufficient number of inner-city charging stations. Our first field trials with the movE test fleet, however, also show that a lot of people charge their electric vehicles only at home in their own garage. That is yet another important reason why we need innovative concepts for fast charging as well as for the intelligent connection of electric vehicles to a smart grid – to allow energy stored in the vehicles to be fed back into the grid.

Let's time travel to the year 2030. What will a typical day with electric vehicles look like?

Electric vehicles whir through the city almost soundlessly. For my meeting, I use my smartphone



Like smartphones, cars of the future will be linked to a network and exchange data with their environment

to reserve an electric vehicle, which could possibly even drive itself up semi-autonomously. If it is my own car, it will recognize me when I get in. The dashboard becomes a touchscreen with information that is personally customized for my use. A virtual passenger greets me and, while we drive, points out items of interest from surrounding commercial establishments with which the car is networked. You might say that the car becomes a Tamagochi toy in that you build a relationship with it.

The brave new world of electromobility...

Not quite. Even in 2030 there will still be both electric vehicles and cars with internal combustion engines, with the latter only being used for long trips. Electric cars are destined to become commuter vehicles for short trips.

It is also a fact that electromobility will completely change the current concept of vehicles – going from that of a driving machine to an experience machine. It will be similar to the transition from electric typewriters to today's word processing systems.

What does that mean?

Our current concept of cars will evolve more and more to one of cars as mobility partners. It starts with cars helping us to retain our mobility as we age. With drive power distributed to all four wheels, the interior space that is gained will make new ergonomic concepts possible. It will become easier for people to get in and out, and cars might even take over that function. Changes will run the gamut to innovative applications that will be controlled by a high-level intelligence within the vehicle.

When and where does it make sense to use electric vehicles, both now and in the future?

Mobility behavior is changing in general. The more we see our infrastructure reaching its limits, the more we will be asking ourselves what mode of transportation we want to use to travel a particular route. Electric cars are ideal for what we call "the first and the last mile." For the dis-



Gernot Spiegelberg

tances between these points, airplanes, railroads, and ships will be used. We are convinced that the future lies in intermodal transport, and it is our job to bundle options in a way that a mobility service is created.

To what degree will Siemens be involved in this development?

Siemens, of course, won't actually manufacture cars. We are much more interested in a holistic approach. From components for automobiles to systems for power supply, power storage, accounting, and traffic management, we cover all these areas and will use them to create a complete range of solutions. At Corporate Technology, we are paving the way – before these solutions are ready for series production within the company. And even though some of what I've mentioned may sound like utopia, keep in mind that many of these technologies already exist – it's simply a matter of linking them together intelligently.

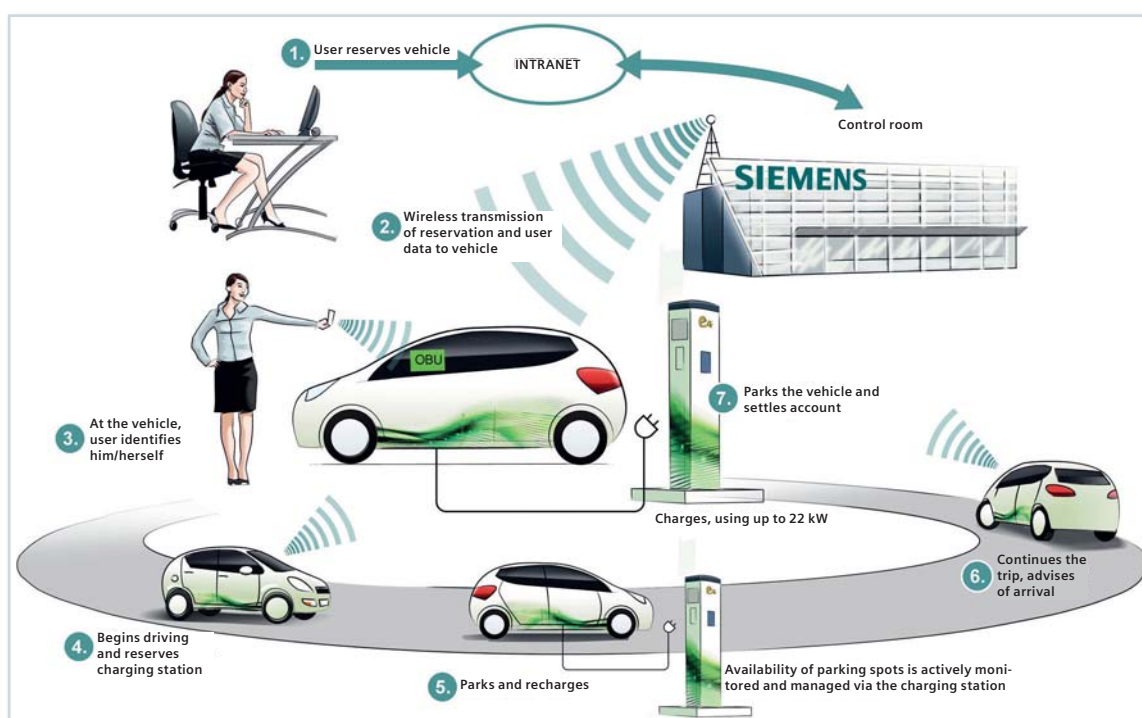
Interview by Christine Auer

Research

The future begins now

Real electromobility projects from Corporate Technology fuel visions as well as a tremendous amount of research

Siemens employees already have the opportunity to step into the new age of electricity – and soon this will also be true in Berlin. Beginning in the fall of 2011, Siemens departments will be able to test a car sharing concept using a fleet of 15 electric vehicles. The core of this subproject is a central control room that uses eCar Sharing management software. This software manages the fleet of vehicles and enables employees to reserve them on the intranet. An onboard unit in the car identifies drivers, based on their employee ID card, and unlocks the car. During trips, the onboard unit displays available charging stations and can reserve them. "The experience gathered during this project will be used to optimize electrical drives, charging stations,



A central control room is at the core of the eCar Sharing project, which will be launched soon in Berlin

network control, and fleet management. We can also test different business models and their effect on the requirements for electromobility solutions," explains Project Manager Andreas Romandi.

In the future, batteries in electric vehicles could be charged without cables. Developed in a partnership between Corporate Technology and BMW, touchless technology for inductive charging is safe and convenient, and enables batteries to be charged even during short stops. Virtually invisible charging stations can be integrated into any environment. In the future, this kind of technology could even be suitable for smart energy use, whereby electric vehicles would be used to temporarily store surplus power generated from solar and wind systems.