The electric car becomes suitable for everyday use

Mobility in Transition

The future is electrically mobile. Experts are currently working hard to meet the technical requirements for coupling the electric grid and the electric car. The vehicles will also be designed to serve as a means of storing variable amounts of wind-generated power.

Electromobility tested under everyday conditions: Siemens and a Danish research institute research practical solutions

By 2020, hundreds of thousands of electric vehicles are to be rolling on the streets of Europe. A few years ago, such a vision seemed beyond the realm of possibility. To make it a reality, the electric car is currently being made fit for everyday use. The fact that its energy source is being upgraded to a "smart grid" gives additional impetus to development. Two main European regions are preparing the way for an electrically mobile future. Both of them – Denmark and the Harz region of Germany – obtain a large share of their electricity from renewable energy sources, and both produce a surplus of wind energy when the wind is strong.

To avoid overloading the grid, the plants are shut down in the Harz region under such conditions. The Danish energy supplier must dissipate the excess wind energy into the grids of its European neighbors, paying line usage fees to do so. The electric car could help here – as an ideal place to store variable amounts of electricity. When the wind is strong, thousands of vehicles could have their batteries charged, primarily at night, and then feed the electricity back into the grid at higher prices when the wind dies down.

Large cooperative projects

How can the electric car and the electric grid communicate reliably? How can vehicles be charged quickly and safely? And how should the billing for electricity work? Two large cooperative projects could provide the answers.

C. Andersen

Package Solutions for Charging Stations

Siemens is the only company in the world that covers the entire electromobility process chain – from the charging interface to equipping the electric cars themselves. A broad portfolio of standardized low-voltage products is already available for the easy and safe installation and operation of charging stations and wall boxes in garages or at parking places. Predefined scalable package solutions ensure that the appropriate corresponding components are used based on the required charging power and functionality. Among the proven high-quality safety, switching, measuring, and monitoring devices is a comprehensive spectrum of miniature circuit breakers with accessories such as remote and control switches, all-current-sensitive RCCBs of type B (Siquence) and e-counters with communication interfaces. It goes without saying that the products fulfill the basic requirements for installation and functionality of charging stations for electric vehicles according to the IEC 61851 and IEC 60364 standards. All components are suitable for easy top-hat rail mounting. The product and system portfolio is available in more than 190 countries and is under continuous further development in view of future electromobility requirements.

At the Risø research center of the Danish Technical University (DTU), the EDISON project (Electrical vehicles in a Distributed and Integrated market using Sustainable energy and Open Networks), assisted by Siemens experts, will plug in a fleet of cars to the electric grid for the first time. Electric vehicles are still usually fed with 11 kilowatts of electricity. For a typical battery with a storage capacity of 25 kilowatt-hours, a full charge takes more than two hours. Because the electric car does not become an attractive alternative until it can be charged within a few minutes, researchers working with Sven Holthusen from Siemens Energy Sector are developing a technology that charges at 120 kilowatts and thus drastically reduces charging times. The field trial will start in 2011 on the island of Bornholm.

For alternating current, the heat buildup during charging is one of the major challenges being faced. Testing is to be carried out both on charging regulators located in the vehicle and ones located outside the vehicle at the charging station. Charging regulators in the car reduce the infrastructure costs, as the technology does not need to be built into the charging stations. Moreover, every vehicle can use onboard technology optimized for its battery technology to regulate the charging process itself. However, external regulators do a better job of dissipating heat and thus provide better charging performance.

No one knows yet which charging technology will prevail. That is why Siemens is advancing various technologies in parallel in the "Inside Car" and "Outside Car" electromobility teams. Direct current could be used to charge a battery without any charging regulator in the vehicle. Direct current is more dangerous, however, primarily because the arcs resulting from a short circuit cannot be controlled with the standard alternating current fuses. Holthusen and his colleagues are thus working on safe methods for supplying direct current.

Communication between the car and the charging station

In the project Harz.EE-Mobility, research institutes and universities, public utilities, the network operator E.ONAvacon, Deutsche Bahn, Siemens, and the mobile communications provider Vodafone are preparing the way for electromobility in Germany's Harz region. They are trying to answer the question of how to make electrical charging convenient, intelligent, and reliable at the same time. To do this, it is necessary for the car and the charging station to establish a communication connection automatically. An agreement has now been reached regarding a Europe-wide plug standard. In addition to a charging cable for a maximum of 44 kilowatts, the plug will also have a channel for data exchange. This allows the charging station to use a communication protocol to detect whether an electric car is ready to be charged. The charging station also indicates to the vehicle how much power it can make available for charging.

Another communication channel is also activated. This channel takes care of automatic payment or can be used to transfer other vehicle data. In the future, if many cars are being charged in a parking garage at the same time, the electric

Filling up with a "spigot": Siemens tests various charging techniques

C. Andersen

A. Loos

The first American chopper with an electric drive – a joint development of Siemens and the U.S.-based motorcycle manufacturer Orange County Chopper – can reach a maximum speed of 160 kilometers per hour thanks to a series-wound motor with a peak power of 27 horsepower

grid could be overloaded locally. For this reason, it is necessary for the vehicles to coordinate among themselves as needed. Together with a number of other companies, Siemens is promoting international ISO/IEC standardization of a communication protocol that charging stations and vehicles can use to communicate via the electrical cable or via radio communication.

Around 30 Audi A2 vehicles that were converted to run on electric power will be in use in the Harz region from 2010 on. A project of this size has never before been attempted: including all wind turbines, biogas and solar power plants, small power stations, and the cars, approximately 2,000 electrical entities are linked to each other.

As easy as pumping gas

Thanks to the communication solutions that match supply with demand, even more locally generated renewable energy could be used locally in addition to the 50 percent share of green electricity in the Harz region. An overriding control system is hardly practical with such a great number of generators and consumers, however. Anticipatory algorithms are an essential prerequisite. The researchers are primarily interested in the behavior of the grid when the electric cars are connected and disconnected. In the project, mathematical rules are being developed for this, which will anticipate when, where, and how many vehicles will need electricity according to the principles of probability calculation.

In order to make charging easier for drivers, user-friendliness is also a priority. The car drivers will have to choose between at most three or four charging modes, and the use of the charging stations will be automatically billed, as with a mobile phone. In 2011, as soon as all the cars are in use, the Harz.EE-Mobility project is expected to show how charging with electricity is already as easy as pumping gas. +

LINK TO THIS TOPIC:
+www.siemens.com/beta

EUEW

Electromobility as Opportunity

Presentation at the 55th General Meeting of the EUEW

At this year's 55th General Meeting of the European Union of Electrical Wholesalers (EUEW) in the Portuguese city of Porto, Rudolf-Martin Siegers, division head of Siemens Germany, described the enormous business potential of energy efficiency and electromobility for the electrical trade and electrical wholesalers. While speaking to more than 150 electrical wholesalers, he explained that with its broad product portfolio and comprehensive know-how, Siemens can be a strong partner on the way to an electrically mobile future, and that Siemens already has solutions addressing the latest trends right now.

As an example, he named and presented components matched to each other for various types of electric vehicle charging stations. He also explained how products and systems from Siemens help save energy in existing buildings, and how buildings that are already "green" and energy-efficient can be made even greener if they make use of electric vehicles to store energy, for example. +

To represent Siemens' solutions addressing new trends, Rudolf-Martin Siegers began his presentation on an electric scooter