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'Electronic Road' Charging For EVs Moves Forward

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NUREMBERG – Speakers from Renault detailed the French automakers' progress in developing with partners a dynamic electric vehicle charging (DEVC) technology during the keynote address at the PCIM Europe conference here last week.

The partners, which also include Qualcomm and Vedecom, a public-private R&D institute based in France, have been demonstrating their DEVC technology—sometimes referred to as "electronic road"— on a specially built test track as part of the FABRIC project in Versailles, France. The demo, which is based on Qualcomm's HALO technology, showed that vehicle batteries can be charged at up to 20kW while travelling at up to 100km/h down the track.

A Renault Kangoo BEV is charged while driving the FABRIC test track in Versailles, France.
(Image courtesy of Qualcomm)

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Speakers Robert Lassartesses and Antoine Caillierez of Renault explained that the issues with current electric vehicle charging technologies mean they could never meet users' expectations in terms of speed and convenience.

"If you compare [today's] fast charging with gasoline, it's not equivalent," said Lassartesses. "Even in our best dreams [EV charging] is 300kW. We are 20 times below what you can do with gasoline and it's important to keep this in mind. Equivalent service between electricity and [traditional] fuel cannot be expected."

Renault's figures showed that with current 400V batteries the typical charging power is around 140kW. Using an 800V battery makes 300kW charging possible, Lassartesses said, but that battery would be very heavy. To meet European drivers' requirements of a two hour, 250km range at 140km/h from a single 15-minute charge would require a battery weighing 700kg, obviously unsuitable for the majority of the market in Europe, which is for small to medium sized BEVs (battery electric vehicles).

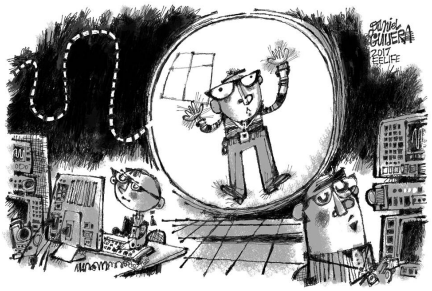
Earlier charging alternatives put forward by Renault have had mixed success. QuickDrop, proposed in 2009, involves pulling in at a service station where a machine removes the battery from the car and physically swaps it with a fully charged one. While this process takes only a few minutes, the idea was abandoned due to business model issues. More successful was hydrogen fuel cell range extender technology, which is on the market today in some of Renault's Kangoo vans.

The technology Renault is currently backing for the future of BEVs is the electric road, whereby vehicles are charged as they move along the road by mains-connected infrastructure buried in the tarmac, with either a conductive (wired) or wireless connection to the vehicle. Crucially, this allows small vehicles to run for long distances at high speed with only small, lightweight batteries.

The test track built by Vedecom, Renault and Qualcomm as part of the EU-funded FABRIC project has demonstrated DEVC under real-world highway conditions. Qualcomm's HALO system uses 50cm coils of wire buried in the road which are inductively coupled to similar coils in the vehicles as they pass overhead.

Since the vehicle coils pass over the ground coils at speed, and there is a significant air gap, coupling efficiency is relatively low, meaning a resonant power supply topology must be used to compensate. Underground coils either side of the one actively charging a vehicle at any moment in time must be held at short circuit to ensure only one coil charges each BEV at a time. These coils can currently be switched on and off within 4ms, though Renault's Caillierez insisted that this could be improved. There is still also optimization to be done in terms of the magnetics and packaging of the coils in the roadway, Caillierez said.

Regarding the economic challenges of installing this infrastructure on a country-wide scale, Lassartesses presented the findings of a study carried out by Renault alongside French electricity supplier



EDF and French highway operator SANEF. This study put the cost of installing wireless dynamic electric vehicle charging at around 4 million euros per km of highway (for both directions of travel). This cost breaks down to 35 percent for works to the national grid, 55 percent for the electronics and coils and 15 percent for roadworks.

The total cost to install the system across all French toll highways (9000km) is around 40 billion euro, or 2 billion euro a year spread across 20 years. Even with increased highway tolls to cover some of this investment, the study showed that the cost per kilometer of highway driving was cheaper for small battery (50kWh) BEVs using wireless dynamic charging compared to driving large battery (130kWh) BEVs with existing charging methods.

Lassartesses also highlighted the potential for substantial reductions in CO2 emissions as a result of wireless direct charging.

Lassartesses' closing remarks highlighted Renault's view that electric road technology is currently the leading solution for the future of BEV charging. However, he pointed out that while dynamic wireless charging has now been proven on a full scale test track, there is still a lot of work to do before it can be deployed in real roads.

"Industry partners need to organize themselves to focus on the best technology, conductive or wireless, for all users. We need a solution for everybody: trucks, coaches and cars," he said. "Due to the huge investment required for highway deployment – at 40 billion euro for only one country – the European Commission and member states need to secure the business model in order to extend the experimentation with industrial partners to a larger scale."

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