

Electric vehicles: CEA and Renault Group develop a very high efficiency bidirectional on-board charger

- This more compact, high-efficiency charger will reduce energy losses by 30% and recharge the vehicle's battery faster.
- The bidirectional charger will also allow the connected vehicle to inject energy from the battery into the electrical network.
- The subject of 11 patents, this unique French innovation will be deployed on Renault vehicles by the end of the decade.

Boulogne-Billancourt, 16 January 2023 – What if the vehicle became a pillar of the electricity network? This is the principle of V2G, or vehicle-to-grid, a bidirectional exchange technology that will soon enable Renault vehicles to restore part of the electricity stored in the batteries to optimise the operation of the grid and compensate for the intermittent nature of renewable energies.

On this subject, and to go even further, the CEA, a major player in research, and Renault Group, a pioneer and expert in electric vehicles, are already working on future generations of these V2G technologies which will be deployed by the end of the decade. To this end, the CEA and Renault Group have jointly developed **a new electronic power converter architecture** directly integrated into the vehicle's charger. The result of nearly three years of research and the subject of 11 joint patents, this power converter*, developed from innovative materials and more compact, will reduce energy losses by 30%, improve the vehicle's recharging time and guarantee the battery's durability. Better still, it will be **bidirectional** by storing energy from the electricity network.

Innovative materials

The CEA and Renault Group R&D teams have combined their expertise in the field of on-board power electronics, in particular in the field **of wide band-gap semiconductor materials**, whether in Gallium Nitride (GaN) or Silicon Carbide (SiC).

As a result, the new architecture based on the wide band-gap semiconductor materials makes it possible **to reduce energy losses by 30% during conversion**, and to reduce heating by the same amount, making it easier to cool the conversion system.

Reducing the volume of the loader

In addition, the engineers' work to optimise the active (semiconductors) and passive (capacitors and wound inductive components) components has enabled a **reduction in the volume and cost of the charger**. Thanks to the use of ferrite materials, dedicated to high frequency, and a shaping injection process called "Power Injection Molding", the converter has become more compact.

* A power converter is an electronic device, placed between the source of electrical energy and the load being supplied, that allows the source to be matched to the load and the transfer of energy from one to the other to be controlled.

Towards more performance

This new converter architecture offers a **charging capacity of up to 22kW in three-phase mode**, allowing for faster charging of the vehicle while ensuring the durability of the battery. It also allows **the charger to be bidirectional**, so that the energy stored in the battery can be fed back into the grid or used to supply the energy needs of an autonomous house, provided that the house is equipped with a bidirectional meter. The solution is compatible with the electromagnetic compatibility (EMC) standards of the networks and the car.

Jean-François Salessy, Vice-President Advanced Engineering, Renault Group explains "This project with the CEA has exceeded our expectations by confirming the ability to achieve the expected performance in terms of efficiency and compactness. It opens up strong prospects for power electronics, which is a real challenge in the electric vehicle, in order to make the best use of the batteries' capacities. With bidirectional charging, the vehicle serves the electrical network and enables the end consumer to reduce energy costs."

"We are proud to support Renault Group in this development", says Sébastien Dauvé, CEO of CEA-Leti. "We were able to bring together Renault Group's system vision for the electrification of the vehicle and the drive train, and the skills of our teams in converter architectures and components; in the end, we implemented an architecture adapted to the needs and with high added value."

"The use of innovative materials with joint Renault Group - CEA patents on the charger made it possible to manufacture the dedicated transformer, which is a key component in this type of development, as it allows for a reduction in volume with performance that goes beyond the state of the art", describes François Legalland, CEO of CEA-Liten.

PRESS CONTACTS

CEA

Guilhem BOYER
+33 (0) 6 73 41 42 45
guilhem.boyer@cea.fr

RENAULT GROUP

Coralie JOLLY
+33 (0)6 85 91 09 38
coralie.jolly@rpbbyco.com

About CEA

The CEA is a key player in research, development and innovation in four main areas: energy transition, digital transition, technology for the medicine of the future and defense and security.

As a French public research institute listed among the Top 100 Global Innovators (Clarivate 2021), the CEA acts as catalyst and driving force for innovation to boost French industry. We help businesses in all sectors be more competitive, creating high-performance products that stand out from the crowd and developing trail-blazing solutions that lead to changes in our society. We deploy this dynamic approach at sites all over France, aiding local partners to innovate themselves, thus helping to create sustainable value and jobs nationwide, tailored to meet actual industry needs. Alongside this, the CEA provides more than just a kick-start to our 215 startups, agile vectors for transferring the disruptive technology and knowledge developed at our laboratories to industry.

For more information: www.cea.fr

About Renault Group

Renault Group is at the forefront of reinventing mobility. Backed by its alliance with Nissan and Mitsubishi Motors, and its unique expertise in terms of electrification, Renault Group draws on the complementary nature of its four brands - Renault - Dacia - Alpine and Mobilize - to offer its customers sustainable and innovative mobility solutions. With operations in more than 130 countries, the Group sold 2.7 million vehicles in 2021. It employs nearly 111,000 people who embody its raison d'être on a daily basis, so that mobility brings us closer to one another. Ready to take up challenges on the road as well as in competition, the Group is committed to an ambitious and value-generating transformation. This is centred on the development of new technologies and services, and a new range of even more competitive, balanced and electrified vehicles. In line with environmental challenges, Renault Group's ambition is to achieve carbon neutrality in Europe by 2040.

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