



Developing smart and affordable vehicle-to-grid technologies and systems that enable widespread adoption of electric vehicles

Ricardo Automotive & Industrial (A&I) is a trusted engineering-services partner for clean, efficient, integrated propulsion and energy systems. For over 100 years, Ricardo has been using engineering research and development expertise to help global vehicle manufacturers innovate and improve the efficiency and performance of their products to bring them to market quickly, cost effectively and without compromising safety or quality.

## CHALLENGE

Widespread adoption of electric vehicles is a critical factor in reducing CO<sub>2</sub> emissions from transport and improving urban air quality. However, such a large number of vehicles could cause challenges for the electricity grid when satisfying their charging demands.

Vehicle-to-grid (V2G) technology represents an opportunity not only to manage the charging demand of the vehicles that are connected to it, but also provide significant energy storage capability to assist with the intermittent nature of many renewable energy sources.

V2G makes grid balancing possible for the time an EV is plugged into a smart charger. For EV owners they are able to charge their vehicles overnight, when there is less demand and electricity is cheaper and sell back to operators at peak times, at a higher rate.

The challenges that the consortium is seeking to address relate to the development of suitable optimisation algorithms, pricing frameworks and load balancing approaches while also providing vehicle user satisfaction.

## APPROACH

Ricardo has developed, assembled and tested the first prototype of its novel integrated on-board charger (OBC) and DC-DC converter.

- State-of-the-art Silicon Carbide and Gallium Nitride devices have been used to provide high efficiency
- V2G functionality has been incorporated into the software functionality, aligning to the protocols defined in the XL-CONNECT project and industry-accepted standards
- The novel hardware topology provides a low-cost and power dense solution through close component-level integration

## RICARDO'S USP

Ricardo's capability and expertise in electrification enables novel solutions to be developed that meet vehicle OEM and Tier 1 requirements and accelerate the widespread adoption of electric vehicles. This includes:

- Thought leadership to offer future-proof solutions
- Existing technology solution blocks for speed to market
- Class leading engineering to provide a one-stop shop from component design to systems integration
- Available design IP and production intent prototypes to accelerate the route to market
- Proven processes, tools and skills to support application engineering



## RESULTS

- Vehicle OEMs and Tier 1s will have a demonstration of a cost-effective integrated OBC and DC-DC converter prototype, which could be productionised to provide high efficiency and power dense V2G functionality for their electric vehicles
- Vehicle OEMs and Tier 1s will also be able to integrate Ricardo's V2G software into their existing OBC hardware

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- Future-proof electric vehicle components and systems
- Design and development from concept through to production
- Novel hardware and software available for integration into existing products