eVolution2Grid

Vehicle to Grid model and prototype solution

Enjoy reading the eVolution2Grid newsletter!

"V2G-eVolution 2 Grid" is a research innovation project funded under the Programme Electric Mobility Europe 2016 and coordinated by IREN, and with the participation of 3 more partners from 3 European countries. The overall objective of the project is to contribute to a zero CO2 emissions future, developing testing and optimizing an integrated V2G solution composed by a light quadricycle enabling V2G, a bidirectional V2G – enabling charging infrastructure and an Energy Management and Control System (EMCS).

The eVolution2Grid newsletter is published twice a year. In this second issue we are updating you with the main progresses and results achieved during the last 6 months.

DEVELOPING OF ELECTRIC VEHICLE

One of the roles of Mecaprom is the development of the electrical vehicle. The vehicle is based on a L7e native platform, sized for achieving the requirements of homologation for European market, in terms of maximum weight and payload, electric motor rated power and maximum speed.

- Maximum weight 1550 kg
- Maximum payload 700kg
- Rated power 15kw
- Max speed 75km/h

With the aim to reduce the total weight, MECAPROM investigated the use of inflatable parts that finally were used for some parts of the vehicle.

The powertrain includes a specific designed battery pack, able to withstand the charging and discharging requests coming from V2G EVSE. A BMS and Power distribution units are integrated in the battery pack to save space and costs. A dedicated temperature management system has been implemented with the scope of allowing V2G operations in a wide thermal range.

The battery pack development is ongoing and a subset of the whole functionality has been tested: V2G interface on development at CTC will be tested as next step.

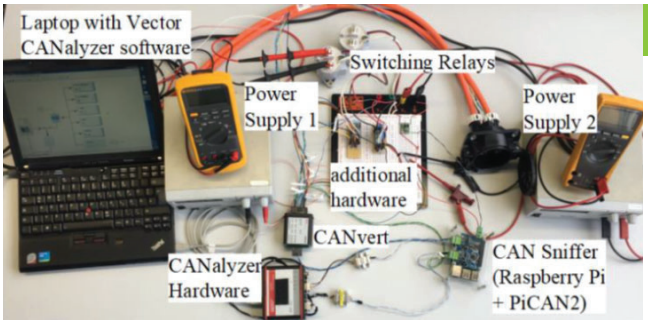
The other components of powertrain are IPM e-motor, Inverter, Gearbox and VMU, a specifically designed control unit able to supervise the powertrain system coordinating traction and charging modes, basing on physical signals from sensors and logical information.

The powertrain development activities are planned to be completed within the end of September 2019.

DEVELOPING OF VEHICLE CHARGING INTERFACE

As a partner in the V2G project, one of CTC's roles is to develop a device which manages the communication between the vehicle and the charging station and allows bidirectional charging/discharging operation. This Vehicle Charging Interface (VCI) is intended to be installed in an EV or a PHEV, which normally has no Vehicle-to-Grid (V2G) functionality, in order to enable, control and drive the energy throughput between the vehicle and the grid.

The VCI fully implements the physical and protocol level of the CHAdeMO standard. This protocol enables DC fast charging and delivers power in the range of 6kW to 200kW.



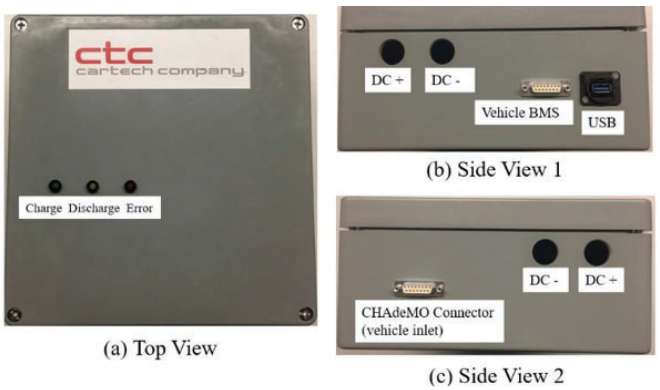
Vehicle CHAdeMO Interface HIL Lab Setup.

Testing:

Currently, the VCI is being tested in a Hardware in the Loop (HIL) setup in the lab. In this setup, the charger and the BMS functionalities are simulated using the Vector CANalyzer. Vector CANalyzer is a universal analysis and simulation tool for vehicle networks and distributed systems. The next step will be to do a real-time testing with the VCI being installed in the vehicle.

Prototype:

The VCI prototype has three Light-Emitting Diodes (LEDs) which are used for indicating the status (charge, discharge or error) of the operation. There are 2 D-Sub 15 connectors which provide interface to the CAN and digital/analog lines of the vehicle BMS and the CHAdeMO connector (charging station). The USB port is needed (temporarily) for data logging. The 2 DC High Voltage (HV) cables connect the CHAdeMO connector to the EV/PHEVs battery pack.

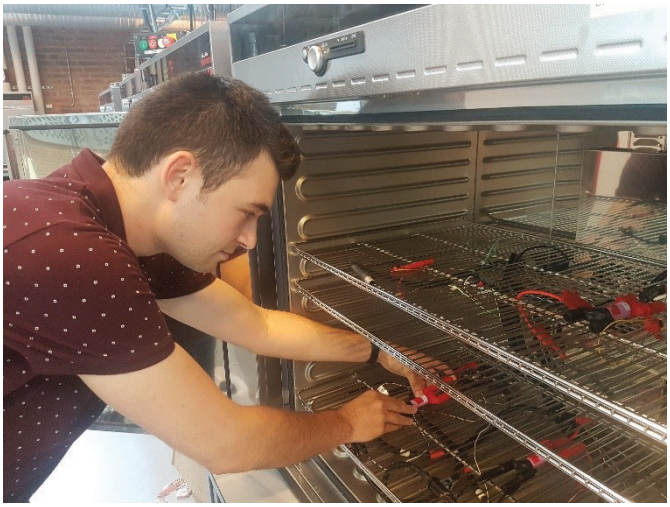


Vehicle CHAdeMO Interface Case Top and Side Views.

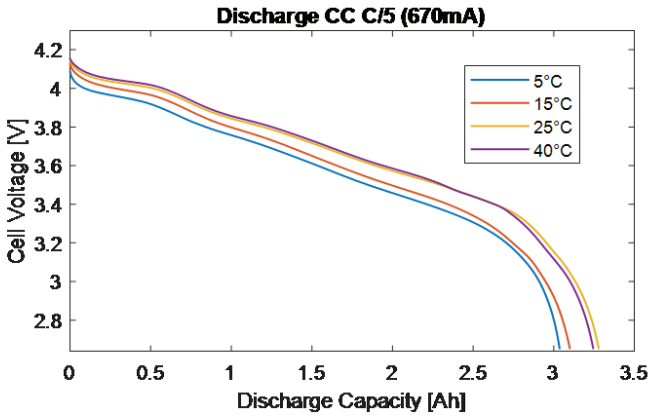
The VCI is a prototype developed by CTC cartech company. As the number of EV/PHEVs increases, this device can play an important role in the future by allowing the vehicles to store and release electrical energy in order to support and stabilize the Smart Grid.

BATTERY TESTING

One of the roles of Aalborg University (AAU) in the V2G-project is to develop battery State-of-Charge (SoC) and State-of-Health (SoH) algorithms to be implemented in the electric vehicle with V2G-capability. This requires extensive test of the batteries as they are sensitive to many parameters, e.g. temperature, current level, number of cycles, storage conditions, etc. Therefore, tests have continuously been conducted for more than five months by now at the Battery Laboratory at Aalborg University. The tests are separated into characterization, aging, and reference performance tests

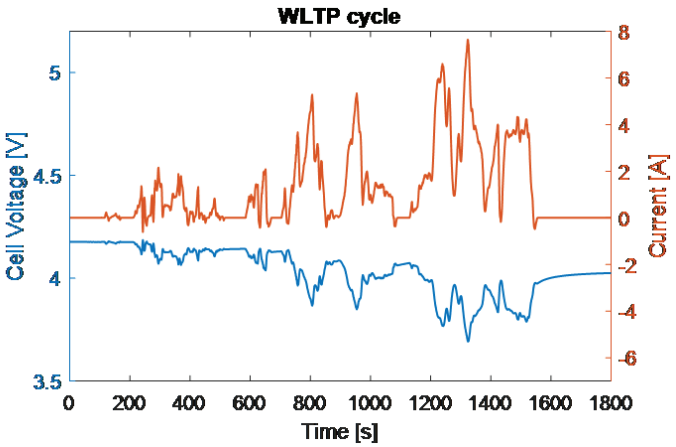


Research Assistant Alejandro Gismero
connecting battery cells for testing in the Battery Laboratory
at Aalborg University.



In the characterization tests, the performance and selected states of the batteries are mapped with respect to certain values of the temperature and current. The characterization is performed on fresh cells at their Beginning-of-Life (BoL). The characterization test results are valuable inputs to the SoC algorithm.

In the aging tests, the cells are being exposed to a mission profile based on the World Harmonised Light Vehicle Test Procedure (WLTP) in order to verify the proposed SoH algorithm. We have chosen the WLTP based mission profile as this is considered to be a realistic aging profile of the electric vehicle. The cells are also being exposed to different temperatures in order to monitor the influence of this parameter on the aging.



In the reference performance test (RPT), a predefined test procedure is applied on the cells exposed to the aging test. The RPT is conducted on a regularly basis, i.e. approx. once per week per cell, in order to monitor the performance and evolution of selected parameters due to the aging. The aging tests and the RPT will be conducted until the End-of-Life (EoL) of the batteries have been reached.

- On May 9, 2019, *Alejandro Gismero* from AAU presented a paper related to the V2G-project during the **14th International Conference on Ecological Vehicles and Renewable Energies (EVER)** conference in Monte Carlo, Monaco. The title of the paper is: "*Calendar Aging Lifetime Model for NMC-based Lithium-ion Batteries Based on EIS Measurements*" with the following authors: Alejandro Gismero, Daniel-Ioan Stroe, and Erik Schaltz.

- On May 21, 2019, *Federico Boni Castagnetti* from IREN presented the V2G project during the **32nd International Electric Vehicle Symposium (EVS32)** in Lyon, France. During the presentation, Federico talked about the project's objectives, innovations, status of each task and the next steps for the completion of the project.

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If you want to learn more about the V2G project and to get in touch with one of the V2G partners, please visit the V2G website, or follow the project on Twitter and LinkedIn.

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The V2G website is now available.
If you like our content subscribe to our newsletter and like, follow and share our social media accounts and posts to get the most recent news on events and results.

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For more info about the project visit the V2G website at:
www.evolution2grid.eu