



## ECO2LIB Project Newsletter

Dear readers,

welcome to the newsletter of the Horizon2020-project ECO2LIB. In the first issue, we want to give you an overview about the following topics:

- Summary of the ECO2LIB project
- Project activities in the first 6 months
- The project consortium



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[ECO<sup>2</sup>LIB Project](#)

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### Summary of the ECO2LIB project

After the successful EU-project Sintbat, ECO2LIB aims to continue the effort by focusing on a new KPI, the cycle related costs per energy: €/kWh/cycle. This KPI very well reflects the real need of the customers in the energy storage market if a minimum volumetric energy density is added. The research and development activities will be supported by a clear recycling concept and an extended Life Cycle Assessment, to judge the environmental impact of the different options and to choose the best. To show both ECO-aspects (**ECO**logical and **ECO**nomical) of our project the acronym ECO<sup>2</sup>LIB was created.

The consortium decided to continue the improvement of the well-established **Lithium-Ion system** with advanced materials, methods, and corresponding recycling-concept. So, it will be possible to directly exploit the results of ECO<sup>2</sup>LIB in an IPCEI project, which is under preparation.

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### Summary of the ECO2LIB project

Unfortunately, right from the beginning, the work has been slowed down by the COVID-19 crisis, but the delays can probably be caught up during the coming months.

**Electrodes and Electrolytes:** A benchmark for the silicon grades has been carried out and an interesting solution has been found. A composite material with relevant cycle life has been selected from a European supplier with a confidentiality agreement which should make it possible to carry out all the comprehension work envisaged by the project. Fluorine-free electrolytes show interesting results. Work is initiated for 3D current collectors with nice morphology. Thin Li film deposition trials have demonstrated good homogeneity.

**Requirements specification:** High-level, industrial requirements have been defined for both, stationary applications, and high current applications like high-quality vacuum cleaners in close collaboration between the work package partners. In both cases, the requirements were derived in a top-down approach, starting at system level, and proceeding from the module level to the cell level. The use case analysis carried out for this purpose points to future and trendsetting products around 2025. Besides other important requirements, the energy density and power density, C-rate capabilities and lifetime expectations have been specified. Based on the requirements for the project cell, a specification for the respective battery packs has also been drawn up.

**Recycling:** A comparative study on existing, industrial available Li-ion recycling technologies in the world has been carried out as benchmark. In the coming months, the recycling technologies will be summarized and evaluated from points of view of their technical, economic, and environmental performances.



Testing of a VARTA element system in the application laboratory of the R&D team (Source: VARTA Storage GmbH).

**Characterisation:** A selection of numerical and experimental techniques to be applied in the project has been performed, with a brief description of the outputs for each. Discussions among the academic partners allowed to propose to the industrial partners and materials suppliers a workflow compatible with materials availability and publication policy.

**Modelling:** A literature review has been conducted and the development of a micromechanical model of the anode, accounting for several different phases - graphite, silicon, binder, which are connected to the current collector, has been initiated. A CutFEM-based method has been chosen to model discrete cracks emerging in the anode microstructures. The implementation of the method into the model of the anode microstructure has been initiated. Since modelling of the discrete fracture requires three separate elements - accounting for crack opening under prescribed traction-separation law (1), accounting for the contact conditions at crack closure (2), and movement of the crack tip due to configurational force (3) - the implementation has been started step-by-step. At the moment, part (1) has been fully implemented and tested for the linear traction-separation law, and part (2) has been partially implemented and partially tested.

**Sustainability:** In an ongoing and iterative approach, the gathering of life cycle inventory data of the activities within ECO2LIB and all related up- and downstream processes has been started. In parallel, already existing LIB manufacturing and recycling approaches has been reviewed and started to evaluate, as they will serve as benchmark for comparative LCA and LCC studies at a later stage of ECO2LIB. As the ecological and economic impact of battery cell manufacturing is mainly driven by the supply of active materials, especially cathode-related, recycling in ECO2LIB will focus on efficient and closed-loop approaches, whose ecological as well as economic viability will be investigated and directed by project accompanying LCA and LCC analyses.

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## The project consortium

### VARTA Microbattery GmbH (Germany)

VARTA Microbattery (VMB) is an internationally leading and globally active manufacturer of retail and OEM batteries and has been operating for more than 125 years. [Read more](#)

### CEA (France)

CEA is a French government-funded technological research organization. With more than 15,000 researchers and co-workers, its activities cover four main areas: Energy, Defence & security, Health & information technologies, and Fundamental research. Two institutes from CEA, both located on the CEA Grenoble centre, are involved in the ECO<sup>2</sup>LIB project. [Read more](#)

### Warwick Manufacturing Group (UK)

WMG is a world leading research and education group, transforming organisations and driving innovation through a unique combination of collaborative research and development, and pioneering education programmes. [Read more](#)

### VARTA Micro Innovation GmbH (Austria)

VARTA Micro Innovation GmbH (VMI), with registered office in Graz, was founded in 2009 as a joint venture between VARTA Microbattery and Graz University of Technology. Within VARTA Micro Innovation both, the industrial fabrication know-how from VARTA Microbattery and the basic research know-how from Graz University of Technology for various electrochemical energy storage systems are merged. [Read more](#)

### EurA AG (Germany)

EurA AG has been established in Ellwangen (Baden-Württemberg, Germany) in 1999. The company currently employs more than 140 persons on 9 locations in Germany, Portugal, and Belgium. As an innovation service provider, EurA advises more than 1,500 mainly medium-sized companies in Germany, covering all industrial sectors. [Read more](#)

### Uppsala University (Sweden)

Uppsala University, founded in 1477, is the oldest University in the Nordic countries, and generally ranked among the top 100 universities in the world. Today, it trains more than 43,000 students, and employs 6,000 people. There are about 2,500 active graduate students; 44% of these are women. Each year, the University awards some 270 doctoral degrees. [Read more](#)

### Materials Center Leoben Forschung GmbH (Austria)

The Materials Center Leoben Forschung GmbH (MCL) is the leading Austrian institution in the field of applied materials science with around 150 employees. [Read more](#)

### VARTA Storage GmbH (Germany)

VARTA Storage GmbH (VS) is a developer and manufacturer of stationary battery storage systems based in Nördlingen, Germany. The company has substantial know-how in the field of energy storage by using long-life lithium-ion batteries and conducts in this context innovative research and development activities. [Read more](#)

### University of Warsaw (Poland)

University of Warsaw (UW) was founded in 1816. The University brings together scholars from a variety of disciplines. It is the place of a diversity of scientific research. Nearly 60,000 people study at the University of Warsaw every year. [Read more](#)

### ACCUREC Recycling GmbH (Germany)

Accurec is a German SME company, founded in 1995 with its primary target to constitute the consumer battery recycling market in Germany. [Read more](#)



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