LC-BAT-10-2020 - Next generation and realisation of battery packs for BEV and PHEV

Proposals will have to address all of the following technical areas for passenger car applications (developed module concept scalability to delivery vans, heavy duty vehicles or busses would be beneficial, but not obligatory. Same applies to concept transfer between BEV and PHEVs):

- Design of advanced battery packs and systems satisfying lightweighting, crashworthiness, electrical and thermal requirements using advanced lightweight materials improved packaging, integration and modularity while considering aspects of ecodesign for manufacturing and dismantling (including their automation), reuse (second life) and recycling/sustainability, leading to a global LCA improvement.
- Development of specific solutions and processes for the sustainable dismantling and recycling of battery pack/modules and their materials, components and sub-systems taking into account safety and automation.
- Flexible advanced battery management systems capable of being used on different types of packs and mid-sized vehicles with different use patterns, and underlying provision to be used in second life applications.
- Advanced functionalities of battery management systems to enable control of modules and packs and their remote maintenance and troubleshooting, software updating and other functions. Safety and modularity aspects must be taken into account when increasing battery pack energy density. In addition, health and environmental aspects of advanced battery pack materials shall be considered over the lifecycle including cases of failure, and reuse/recycling.
- Development of high voltage systems compatible with high-power ultra-fast charging and related implications, including high and low temperature charging, insulation, advanced models (including for instance data mining and big data on existing databases) for monitoring thermal state and estimation of application-dependant State of Health (i.e. in first and second use).
- Development and qualification of future performance-related test procedures of developed functionalities under real-world conditions, incl. extreme environmental conditions.
- Concept validation of battery performance functionalities at full scale should be demonstrated through pack integration into an existing vehicle (no vehicle development can be included in claimed costs) which should also serve as a benchmark of achieved performance.
- Development and qualification of future safety related test procedures e.g. venting/management of gases, battery failure warning signals, thermal propagation.

The combination of achieved improvements with new components and functionalities on the vehicle and infrastructure sides coming from topics LC-GV-01-2018, LC-GV-02-2018 and LC-GV-03-2019) should allow the development of new concepts for affordable FEVs which enable long duration trips (e.g. 700-1000km day trips across different Member States) with not more than respectively 60-90 minutes additional travel time in comparison with ICE vehicles and without additional degradation impact on the FEV powertrain including the battery when used for max 10% of the charging events.

The Commission considers that proposals requesting a contribution from the EU of between EUR 8 and 10 million would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

To accelerate the mass market take-up of battery electric vehicles (BEV) and plug-in hybrids (PHEV), it will be necessary to increase the density of battery packs in terms of weight and package space in order to improve range and decrease weight. Moreover, shorter charging times for BEVs through high-power charging will enable...
travelling over longer distances, imposing further challenges on cooling needs. Higher performance of battery pack raises safety issues which require more robust and flexible advanced Battery Management Systems (BMS).

Besides research on advanced electro-chemistries and cell manufacturing, which are not part of this topic, the integration of battery rechargeable cells into battery packs plays an important role. However, the manufacturing of battery primary cells and their electrochemistry influences their shape and thermal behaviour and hence also the way they can be integrated into modules and battery packs.

Advanced concepts of BMS relating to hardware and software enabling cell/module/pack communication need to be developed in order to maximise the performance of the final battery system used in vehicles. When aiming at large-scale production of high-density battery packs, manufacturing processes of modules, and their easy and efficient integration into packs need to take into consideration the choice of materials and requirements related to safety, quality, and fast and cost efficient fabrication.

- Considerably improved performance of the EV through reduced battery system weight by 20% at constant electric vehicle range for mid-size battery electric car.
- Overcome the uncertainty of range by achieving 25% shorter recharging time with a 150kW charger compared to best in class electric car available on the market in 2018. The demonstrator must have the same battery capacity as the reference car and meet the useful battery life mentioned below.
- Improved attractiveness of the EV through achieving extended useful battery life to 300 000 km in real driving[[A realistic driving cycle like WLTC can be used, adding simulated heating, defrosting and cooling consumption along the year and slow-medium charging for normal use plus a group of two consecutive fast charges to 80% every 6.000 km and one fast charge to 80% every 2000km.]] referring to a mid-size passenger car using improved battery management, balancing and thermal management during high-power charging/discharging.
- Contribution to Circular Economy goals through a minimum 20% Life Cycle Analysis improvement compared to existing products.
- Considerably improved knowledge on module and pack sensorisation and thermal management.

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