Innovate UK

Results of Competition: Faraday Battery Challenge: Innovation R&D - Round 2

Competition Code: 1801_CRD_TRANS_BATTERY_R2

Total available funding is £23 million

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
ILIKA TECHNOLOGIES LTD	The PowerDrive Line	£3,306,693	£2,314,685
CENTRE FOR PROCESS INNOVATION LIMITED		£846,896	£846,896
HONDA R & D EUROPE (U.K.) LIMITED		£122,000	£0
RICARDO UK LIMITED		£926,601	£463,301
University College London		£758,710	£758,710

Project description - provided by applicants
This 30-month collaborative project will develop a Lithium based solid-state battery for plug in hybrid and Electric Vehicles, establish a pre-pilot line for solid-state battery cell technology and develop processes for a new UK based solid-state materials supply chain. The innovative solid-state technology will enable safer, more energy and power dense cells that will facilitate ultra-fast charging (enable a PHEV or BEV driver to charge their car in 15 to 25 minutes) and put the UK on a path to produce materials for the manufacture of solid-state battery cells and packs and in a world leading position to exploit the technology globally. Ilika will apply its solid-state battery development processes to formulate an automotive cell capable of achieving Autocouncil 2025 performance targets in energy density and charge rate. Ricardo will apply its Battery Management system to the solid-state cell and develop the capability to super & ultrafast charge the cells (50 to 350kW charging) demonstrable in a prototype battery module. Ilika will build upon its success of manufacturing micro solid-state batteries and will develop a pre-pilot line to enable prototype cells to be manufactured reliably and consistently to support vehicle development programmes and other solid-sate research undertaken within other research institutions. Using their expertise in Ink formulation and hydro-thermal synthesis, CPI and UCL will develop a UK based production capability that is scalable to hundreds of tonnes per year for the production of solid state electrolyte (SSE) powders, required for making SSB's. This project is supported by Honda who will provide essential exploitation guidance and also will conduct functionality testing at their facilities.

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ICONICHEM WIDNES LIMITED	R2LIB (Reclamation, Remanufacture of Li Ion Batteries)	£1,321,879	£793,127
CIRCA SUSTAINABLE CHEMICALS LIMITED		£52,690	£36,883
JAGUAR LAND ROVER LIMITED		£244,306	£122,153
M-SOLV LTD		£616,362	£308,181
PV3 TECHNOLOGIES LTD		£328,642	£230,049
University of Warwick		£661,971	£661,971
University of York		£330,823	£330,823

Project description - provided by applicants
With the increase in electric vehicles and the slow fade out of fossil fuelled combustion engines, there is an ever-increasing demand for energy storage devices in the automotive industry. This in turn means that there is an ever increasing requirement for critical elements such as cobalt, nickel, manganese, lithium and graphite. In addition, at the end of life of these energy storage devices, increased value can be obtained from extracting and reusing the components and materials. To answer this critical need, responding to the business opportunity, we must develop the supply chain for battery materials reclamation and reuse. Enabling a circular economy with a more connected supply chain for the automotive battery, and ensuring a traceable supply of good quality materials for anode and cathode materials production, supports the future activity for the UK in this sector. In order to investigate the reuse aspects of cell materials and remanufacture of lithium ion batteries from the reclaimed and recycled components this project will develop the first UK industrial scale capability to reclaim and reuse battery essential metals. R2LIB will bring together ICoNiChem, the only cobalt salt producer in the UK, to manufacture transition metal precursor salts, to provide materials into the UK materials manufacturing supply chain. PV3 will investigate the use of these salts in a recycled cathode production, partnering with other parts of the equipment and materials supply chain in the UK; MSolv, (laser tools), JLR (end of life and LSA), Circa / York (green solvents), WMG (reclamation and cell remanufacture). Battery materials are at the forefront of the battery supply chain, and currently the UK manufacturing base is limited. The quality and control of these materials is essential for consistency of electrodes and inherently the good performance of a lithium ion battery. Ensuring a good quality material supply, with a good heritage, will support the move to manufacturing batteries in the UK. This project will look to demonstrate the UK's potential capability in this field, ultimately assisting to advance the UK's competitive position in battery cell technologies and production, and importantly, the transition to a low-carbon economy.

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MCLAREN AUTOMOTIVE LIMITED	Multi optimal Solutions for Energy Storage Systems	£1,349,163	£674,582
A123 SYSTEMS U.K. LIMITED		£2,976,684	£1,488,342
ILIKA TECHNOLOGIES LTD		£2,635,118	£1,844,583
University of Warwick		£2,012,870	£2,012,870

Project description - provided by applicants

A consortium led by McLaren Automotive, the pioneering British creator of luxury sportscars and supercars, along with partners including a world-class cell manufacturer, a technology company at the forefront of materials innovation and a leading university, aims to accelerate the development of electrified powertrains to help reduce vehicle mass, minimise emissions, and match traditional powertrain usability characteristics. The consortium identifies that current electric technology is not sufficiently mature for the demands of high performance cars due to high weight, range limitations and battery management challenges. Through the development of new materials for cells and a modular designed battery, the consortium aims at delivering advances needed to achieve improved levels of functionality and performance, which may one day benefit volume car buyers.

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WILLIAMS ADVANCED ENGINEERING LIMITED	WIZer Batteries	£3,318,115	£1,659,058
CODEPLAY SOFTWARE LIMITED		£588,144	£352,886
Imperial College London		£2,289,437	£2,289,437
POWEROASIS LIMITED		£705,212	£493,648
ZAPGO LTD		£777,525	£544,268

Project description - provided by applicants
The WIZer Batteries project, led by Williams Advanced Engineering, will deliver a revolutionary approach to battery management, new hybrid supercapacitor and lithium ion battery systems and a communications platform that will deliver data and capability to customers, vehicle manufacturers and infrastructure providers. Using a very high-powered processor the battery management system (BMS) will use software and hardware acceleration to run multiple complex battery models in real time. These models will build on the work of the Faraday Institution Multi-Scale Modelling Fast Start led by Imperial College. The greater fidelity allowed by the solution will allow greater exploitation of the available energy and power within the battery, resulting in many benefits including faster charging, enhanced power delivery and higher regenerative energy collection across the full range of charge states. Codeplay Software also bring a revolutionary approach to the exploitation of processor hardware, thereby increasing the performance of the system and introducing potential for accelerated machine learning and AI techniques to be introduced. The performance benefits of this technology will be tested on a hybrid battery containing both lithium ion cells and carbon ion supercapacitors, which will be developed by Williams Advanced Engineering with Zap&Go, enabled by enhanced battery management capability and new models. Further exploiting the BMS and battery technology developed through the WIZer Batteries project will be a communications and infrastructure system to be used to capture a lifetime of data from the battery. Focussed around an optimised data set, minimising the required data transmission, the system will be designed to deliver all data required to analyse battery condition, enabling the potential operational value of the battery at the end of its first and subsequent lives to be accurately mapped. The developed solution will also deliver the required functionality for vehicle-to-grid applications, including an arbitration system that will allow the controlled charging of multiple independent vehicles with a local energy grid, supporting wider adoption of electric vehicles.

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ASTON MARTIN LAGONDA LIMITED	Battery Advances for Future Transport Applications	£825,527	£412,764
DUKOSI LIMITED		£1,454,445	£1,018,112
Imperial College London		£786,845	£786,845

Project description - provided by applicants

Key challenges for effective battery pack design include increasing energy/power density and understand/mitigating degradation. Energy and power density are heavily linked to the system design with effective thermal management defining power limits as well as the rate of degradation. Thus, there is an urgent need for tools which assist engineers in the development of battery packs.

Aston Martin Lagonda has teamed up with Dukosi and Imperial College London to put together the 'Battery Advances For Future Transport Applications' (BAFTA) project. BAFTA will aim to develop a framework that enables optimised performance and system longevity for battery packs. The 3 key pillars of this project are:

1. Model-based thermal management system design that enables prolonged use of the battery system without significant performance de-rating.
2. Novel diagnostic techniques which inform more intelligent battery management system, that enables the system to be pushed to the limits of its capabilities.
3. System Packaging Modelling design that enables the efficient packaging and layout of all the system in a way that optimises weight, package size and distribution.

Imperial College London will develop physics based models of lithium-ion battery packs which are able to quantify the benefit of different thermal management systems. It will inform computational aided engineering tools to enable performance optimisation. This model will be combined with Dukosi's state-of-the-art battery monitoring system, providing additional intelligence to the system for estimating states such as State-Of-Available-Power (SOAP) and State-Of-Health (SOH) for advanced control applications. Novel diagnostic techniques will also enable control techniques which prolong battery lifetime. Aston Martin Lagonda will then implement these key innovations into their product range which has a key focus on high-performance applications and a clear pathway to commercialization. This approach is key to the realisation of high performance electric propulsion vehicles, while it will enable also application to other vehicle types via Dukosi and Imperial College.

The battery design tools that form as a result of the BAFTA project will enable optimised and intelligent battery pack performance/control, as well as a framework for accelerated development - which is essential as the demand for electric vehicle powertrains booms.

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