Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
EDGE MOBILITY LTD	Adaptive Rapid-Charging for Li-Ion Batteries (ARC)	£181,706	£127,194

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Reducing Li-ion battery charge times through rapid-charging is proving to be essential to enable the widespread adoption of electric vehicles. However, rapid-charging accelerates the degradation of batteries by reducing both the power and capacity of individual cells, leading to shorter and more unpredictable battery lifetimes as well as higher warranty and servicing costs for vehicle OEM's. If battery management systems could more accurately track changes in the health of the cells within a battery over its lifetime, they could adapt the behaviour of the battery accordingly to slow down the rate of degradation. The goal of the ARC Project -- a feasibility study being led by Edge Mobility -- is to evaluate the potential to extend the lifetime of rapid-charged battery systems with new battery management technologies that can accurately estimate changes in the health of the cells and control the battery's performance accordingly.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
IMMATERIAL LTD	Monolithic MOFs for efficient vehicle HVAC systems	£275,850	£193,095

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
A car's heating, ventilation, and air conditioning (HVAC) system requires up to 8-10kW to run, making it the most energy-intensive auxiliary system in a passenger vehicle. The impact is especially pronounced in electric vehicles, which cannot use heat from the engine, and where energy lost cannot be recycled through regenerative breaking. The result is up to 50% reduction in electric vehicle mileage in hot/cold conditions, making HVAC the auxiliary system with the largest limiting effect on performance. Meanwhile, range anxiety remains the greatest barrier to consumer adoption. This project addresses HVAC efficiency as a critical challenge for the wider adoption of electric vehicles in the push for a cleaner transportation sector. Immaterial aims to do this through the development of a filter that enables the recirculation of cabin air, omitting the need to heat and cool fresh air as regularly as is normally required.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CITY SCIENCE CORPORATION LIMITED	Real-Time Distributed Optimisation of Dualed Transport & Electrical Networks	£187,028	£130,920
University of Exeter		£79,906	£79,906

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The introduction of electric vehicles presents extensive new challenges for infrastructure planning and operation, in particular if the grid electricity is to be powered by renewables. For example, to enable optimised, automated control of charge/discharge profiles in grid-based or private wire battery storage systems, such systems will require extensive information and predictive data drawn from the transport network. Similarly, to optimise routing of electric/zero emission vehicles, routing systems will require extensive information and predictive data drawn from the electrical or hydrogen fueling network. In some cases, both networks may need to be optimised simultaneously. Our vision is therefore to provide a fully integrated, real-time transport-electric-hydrogen network simulation and optimisation engine to enable complex optimisations to be run across these multiple networks to deliver the most cost-effective planning and operation of new transport-integrated electrical/hydrogen systems.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
EVC POWERTECH LTD	Novel high power EV charging system for fleets, HGVs and public charging	£299,951	£209,966

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
EVC PowerTech is creating a rapid electric vehicle charging solution that is focused around the needs of businesses charging entire fleets of vehicles including buses and HGVs as well as cars and vans. We are doing this by evaluating the feasibility to create a single site-wide charger that can charge up to 24 vehicles simultaneously. By centralising the charger, we streamline power management, optimise the charge time for each vehicle and provide consistency of power delivery. It also makes it easy to upgrade the site as demand grows, with battery storage, more charging points or higher performance.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CLAIRVAUX LTD	Project ZERAUD Proof of Concept Hybrid Truck Trailer Prototype	£365,036	£255,525

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The Road to Zero for heavy-duty vehicles is long and complicated, requiring significant changes to infrastructure before the whole journey can become zero emissions. Project ZERAUD was funded by Innovate UK IDP 15 to assess the feasibility of putting electric drive onto a semi-trailer to allow the tractor unit to operate as usual, but for the semi-trailer to (effectively) push the combination around town with Zero Tailpipe Emissions. Providing 75miles zero emissions range to a truck covering 500miles/day gives a net 15% reduction in CO2 - Legislation requires a 15% reduction by 2025\. This project aims to produce a prototype electrified semi-trailer that can be coupled to a tractor unit for proof of concept work and for demonstration to end users / potential investors in preparation for larger scale trials and pre-production development work. Clairvaux Ltd produced detail drawings and applied for a patent for installing an electric drive system on a chariot which provides the interface between tractor unit and semi-trailer, as part of the Feasibility Study. In this R&D project, we will work with a UK semi-trailer manufacturer to produce a complete trailer with chariot and electric drive. We will also develop the communications between tractor & semi-trailer so that the electric drive responds at the right time to the accelerator & brake signals, making the switch from diesel to electric and back again as smooth and unnoticeable as possible. By equipping specialist urban trailers with the zero emissions capability for the whole truck-trailer combination, the move to Net Zero Transport can be accelerated - by changing the shorter, lighter-weight journeys to electric sooner than long-distance, heavy haulage journeys - and an immediate improvement in Urban Air Quality. We aim to include a major supermarket and a global parcels delivery company in our demonstration programme to provide commercial credibility to the concept.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Participant organisation names	Project title	Proposed project costs	Proposed project grant
INDRA RENEWABLE TECHNOLOGIES LIMITED	CCS V2x	£499,689	£349,782

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The "CCS V2x" project is led by experts in electric vehicle supply equipment ("EVSE") innovation, Indra Renewable Technologies ("Indra"). Indra are a high growth, Malvern based company operating across EV battery and powertrain and smart energy products. The Combined Charging System (CCS) has emerged as the dominant EV Charging standard within Europe. This project builds on existing technology developed under an innovate UK backed 300-400 unit V2G trial using the competing CHAdeMO standard where Indra has successfully designed and manufactured certified hardware and is already commercially exploiting the project. The project will further develop and prototype a variation of the existing hardware using the Combined Charging System ("CCS") standard extending V2G and V2H capabilities to vehicles equipped with CCS inlets. Indra aim to commercialise CCS-V2G within 6 months of project end (2021), Indra will target cumulative sales of ~20,000 units within 5 years (2026) - which will unlock ~£70 million worth of revenues across and contribute sizeable carbon savings.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
AJE POWERTRAIN LTD	QUICK CHANGE SODIUM-ION TRACTION BATTERY FOR COMMERCIAL VEHICLE APPLICATIONS	£143,597	£100,518
FARADION LIMITED		£141,847	£99,293

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Heavy goods vehicles transport goods to businesses and consumers throughout the UK. However the majority of these vehicles are diesel powered meaning they are a huge contributor of road related greenhouse gases and Nox emissions. The UK government has set themselves a target of a 15% reduction in HGV greenhouse gases by 2025\. For medium sized HGVs (8 - 18 ton) alone there are approximately 88,000, 1 - 15 year old trucks on UK roads at any given time. Meaning the 15% by 2025 GHG reduction for all HGVs is a challenging task. Operators are slowly beginning to adopt measures that help to improve a reduction in vehicle emissions, However they still remain sceptical due to high costs combined with a lack of real world testing. Tesla, Nikola and Cummins have show cased some of their new technologies for large battery trucks but even these are some number of years away from becoming main stream. HGV emission reduction needs to be targeted in the near term. Currently a small yet successful retrofit industry concentrates on pollution reducing or fuel saving technologies for small vans and buses. The purpose of this feasibility study is to take the retro fit market one step further by helping to implement a cost effective battery solution so as electric powertrains are then not only a system adopted by new vehicle purchasers. Currently over 50% of the cost for an all electric powertrain lies within the traction battery technology. AJE Powertrain Limited a leading research and development organisation along with Faradion UK Ltd a world leader in non-aqueous sodium-ion cell technology will as part of this project conduct a feasibility study looking at the benefits of taking sodium-ion cell technology and applying it to the worlds first sodium-ion traction battery pack for a medium range HGV. As well as the technological aspect the project will also focus on a swappable battery pack system that will allow for a quick change of the depleted battery packs and the environmental benefits of sodium-ion cell technology when compared to that of the more traditional lithium-ion traction battery application. Should this feasibility study prove to be successful then the aim of the consortia is in due course to publicly introduce a lower cost sodium-ion traction battery alternative to the commercial vehicle industry.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
FETU LIMITED	Air Cooling for EV Thermal Management (AIRCOOL)	£214,450	£150,115

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The heating, ventilation and air-conditioning (HVAC) systems are an energy intensive and present a challenge to all vehicles. This is exacerbated when power electronics and motors form a key part of the propulsion system such as in EV's. The HVAC system typically consumes between 20% - 40% of an EV's range depending on the HVAC system efficiency which can differ across different vehicles. This 6-month project builds on a recent IDP-14 feasibility study aiming to validate modelling work undertaken by the University of Brunel and small-scale in-house bench tests. The objective of this study is to run FeTu's novel Air-Cycle, a refrigerant free cooling system, in a purpose-built test rig that simulates an electric vehicle thermal management system. Previous work suggests FeTu's air-cycle can compete against traditional Vapour Compression Systems whilst using an environmentally friendly working fluid in air. With the additional benefits of fewer parts, less complexity and reduced parasitic losses. Potential additional applications would be widespread in built environment, defence and other transportation sectors, strong exploitation will lead to a high Return on Investment (ROI).

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
INVOLUTION TECHNOLOGIES LIMITED	Invo-CVT; Zero Emissions Electro/mechanical Drive train suitable for 50 t + HVG applications.	£98,510	£54,019
CONTRACT INNOVATION LIMITED		£81,410	£56,987

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
Large heavy commercial vehicles are responsible for 39% of the worlds global emissions and even more significant is the impact of heavy diesel engines in city centres on air quality. The **INVO-CVT** electric drive train will be used on the largest HGV's enabling full electric, zero emissions operation. Adopting this transmission on HGV's means that the large construction tipper lorries on building sites, vehicles delivering container freight, inter-city coaches delivering people to the city can operate 100% electrically, on zero emissions. The transmission is always connected to the vehicle wheels without interruption in drive, to give the optimum traction. Power associated with slowing the vehicle down in overdrive is fully recovered by the electric drive system. These features significantly reduce the total duty cycle energy requirements of the vehicle, by an anticipated 20%. The **Invo-CVT** is targeted to be retro fitted into the existing vehicles and to be cost competitive against diesel powertrains. **Invo-CVT** is a game changing drivetrain for very heavy vehicles that can be rapidly introduced into production for new and existing heavy vehicles to have an immediate impact on emissions. The time is right for the **INVO-CVT,** which is 100% UK manufactured and with 100% UK owned IP.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
COGNITION ENERGY LTD	Advanced Cell Test Feasibility Study	£73,473	£51,431
Imperial College London		£31,303	£31,303

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The ACT project will investigate advanced test methods to create a rapid cell chemistry characterisation tool that will allow EV developers to pick the highest performance cells for fast charge EVs, saving months or years of testing.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
WHITE MOTORCYCLE CONCEPTS LTD	Motorcycle Front Wheel Electric Drive & Regeneration	£283,016	£198,111

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project aims to develop a prototype aerodynamic electric motorcycle incorporating a front wheel kinetic energy recovery and deployment system. Whilst common in hybrid and electric four wheel vehicles, a comparable system to date hasn't been incorporated into mainstream motorcycles. The main reason for this is the limitations presented by the prevalent motorcycle design. Building upon our patent pending concept, supported by Niche Vehicle Network and Advanced Propulsion Centre, the integration of this range extender is only possible due to the front end stability benefits gained from the concept.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
INDUCTIVE POWER PROJECTION LTD	VHF rectification for fleet and HGV wireless charging solutions	£110,360	£77,252
University of Warwick		£32,858	£32,858

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project aims to develop VHF rectification as a key part of fleet and HGV wireless charging solutions. Inductive Power Projection Ltd is the project lead, and Warwick Manufacturing Group is to provide the academic support. There are wide-ranging socio-political issues concerning road transportation's greenhouse gas emissions, and the UK's strategy is to encourage broad adoption of EVs. Cable-free wireless power transfer (WPT) (also known as inductive power transfer) can potentially overcome the drawbacks of wired EV chargers, and represents a potentially transformational method for improving the EV operation and user experience. Aside from its convenience, WPT can significantly downsize the onboard EV battery, and has potential for dynamically charging EVs on the move. Although WPT solutions are being widely explored, charging rates are slow because the power density is low; and while manufacturers claim WPT is market ready, the transmission distance (reach) is poor, and angular misalignment of transmitter/receiver coils regularly results in batteries not receiving full charge. However, the greatest challenge is with heavy-duty vehicles. These require much higher charge-rates and more reach than WPT can currently offer. The only way to solve the charge-rate problem, as well as the reach and misalignment problems, is to significantly increase power density in the magnetic field. Power density can be increased in several ways, but the state-of-the-art copper-coil based WPT systems are already highly optimised. Increased operating frequency will meet the technical challenge but leads to unacceptable power losses and therefore more operating costs. There's no way out for conducting coils. The emerging 2nd-generation frequency standard for automotives is 85kHz, rising from 20kHz with 1st-generation. A "difficult region" exists above 85kHz. Nevertheless, there's a strong business need to significantly increase charging rates, reach and robustness to misalignment tolerance of WPT systems by increasing the power density, at reduced costs. To this end, we offer a completely new capability using VHF technology that transcends the "difficult region" and delivers greatly enhanced power densities. Until now, nobody has been able to formulate high-power VHF-WPT, but rectification is a major barrier and needs to be addressed before the commercial potential of our technology can be realised. Power diodes already used in WPT can't switch fast enough. VHF diodes that can switch fast enough are used in the context of smaller signals where moderate efficiency is tolerable. This project will therefore start to build a new capability for high-powered VHF rectifier solutions for VHF-WPT.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
HYPERMOTIVE LIMITED	A multi-channel battery module balancer for safe battery commissioning	£105,529	£73,870

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Hypermotive are seeking to explore the feasibility of an off-the-shelf, multi-channel battery balancer that is designed to support a wide range of battery chemistries, capacities and voltages, for use within battery manufacturing/assembly and servicing environments. To accelerate development time and reduce development costs, increasing numbers of electric vehicle manufacturers are using multiple pre-validated battery modules within their battery packs, rather than developing a custom battery pack from individual cells. Connecting multiple modules safely in parallel requires each unit to be at an equal state of charge, and therefore potential (voltage), to avoid high imbalance currents and the associated risk of damage and harm these can present. This battery balancer will automatically measure, assess and equalise, where required, the potential between battery modules prior to their connection within a pack, ensuring a fast, simple, consistent and safe process of balancing, and significantly reducing the risks and issues associated with high inrush currents. Product uses will include during battery development, vehicle manufacturing, vehicle field service, and battery second-life environments.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
QUATTRO PLANT LIMITED	QPLZEV(c) Roadsweeper Concept Feasibility	£350,000	£175,000
University of Exeter		£149,332	£119,466

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Quattro Group Ltd and The University of Exeter will develop a new Zero Emissions powertrain for a heavy road sweeping vehicle. The collaboration will focus on design of a new Zero Emissions Electric drive system for the road sweeper, with a Hydrogen fuel cell hybrid option, using the latest machine learning methods and computer simulation. The project team will then build a prototype powertrain based on this design, and test it to make sure it can deliver enough power, in the right way for the right duration, to ensure Zero Emissions road sweepers can undertake their duty cycle. There is no Zero Emissions powertrain on the market which can fitted into a road sweeper and satisfy the demands of a normal working cycle. Once proven, the powertrain will be retrofitted to all Quattro road sweepers, then offered to other sweeper manufacturers and operators of road sweepers in the UK and overseas. This new clean powertrain will satisfy another step on the UK's Road to Zero plan that will deliver a clean, Zero Emissions future for all vehicles in the UK.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
D2H ENGINEERING SERVICES LTD	Accelerated Multiscale Modelling of Batteries (AMMBa)	£167,378	£117,165
University of Hertfordshire		£22,456	£17,965

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The aim of the AMMBA project is to improve our ability to simulate the performance of batteries quickly and accurately, thereby enabling better designs to be delivered in less time and for lower costs. The need to reduce carbon emissions from transport is clear and pressing, as part of a strategy to keep global temperature rises below 2degC and minimise the effects of climate change. The key contributor to this within the mobility sector is the electrification of vehicles, enabling the motive power to come directly from low-carbon, grid-generated sources. The most fundamental part of new vehicles is the battery, the storage medium of this renewable energy -- but the current performance of batteries in terms of energy density and cost makes ZEVs lower range and more expensive than the vehicles we wish them to replace. To increase the uptake of ZEVs we need to make them cheaper and with greater range -- both issues which largely stem from the capability of the battery. Simulation and modelling can play a pivotal role in this by providing the engineers and designers with the tools required to understand the performance of the battery pack in a virtual environment, which allows faster, cheaper development to take place. Currently we rely on significant amounts of physical testing which, whilst delivering accurate results, is costly and only provides data for the cell and battery configuration in question. Simulation tools are available and heavily used, but the inbuilt models do not typically link the cell level electro-chemistry to the thermodynamic responses which leads to lower accuracy than is required. Improving simulation and modelling capabilities by coupling these phenomena will allow determination of pack level performance from a simple cell characterisation -- a more accurate method than is currently available. In addition, through the use of machine learning techniques, the AMMBa project aims to develop simulation tools that run far faster than is currently possible, enabling designers and engineers to compare far more designs, in less time than they do now. In doing so this will allow better battery designs to be delivered faster and for lower costs than is currently possible, leading to improved, cheaper ZEVs.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
iCOMAT	Rapid Automotive Composites Engineering (RACE)	£154,748	£108,324
NCC OPERATIONS LIMITED		£66,320	£66,320

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
RACE forms a partnership between iCOMAT, the NCC and a UK OEM to develop and commercialise manufacturing methods for hybrid metal-composite parts, aiming at introducing the light-weighting benefits of composites, in a cost-efficient way. Building upon iCOMAT's novel manufacturing technology of Continuous Tow Shearing, the team will test the design and manufacture freedoms of this process by applying it to a representative automotive component. Typical automotive parts are reinforced through multiple internal components. These internal structures can be replaced through the direct deposition of composite tapes that are consolidated in-situ through the iCOMAT technology. This eliminates the need for multiple parts, secondary processes and expensive tooling, improving overall equipment efficiency through reducing downtime.

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Innovate UK

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MINA DIGITAL LIMITED	Apartment Block EV Charging Feasibility	£56,886	£39,820
EVERGREEN SMART POWER LTD		£54,305	£38,014

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Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Mina and Evergreen Smart Power want to make home electric vehicle charging as widely available as possible to encourage uptake of zero-emission vehicles. Home charging is much the best way to keep an electric car topped up - it's cheap, it's clean, it's convenient - but this means that today it is overwhelmingly homeowners with off-street parking who are considering purchasing an EV. On-street charging for those with terraced housing has been a major focus of research over the last few years with new business models gradually emerging, but there has been comparatively little attention paid to apartment blocks - and with 9 million people living in flats in the UK this is a demographic we cannot ignore. Charging in an apartment block is full of challenges: residents do not own their parking space, and even if an EV charger is installed (an expensive process today) it is the building management who pay for its electricity and recharging the cost of electricity is a logistical challenge most are shying away from. Also, many (~40%) of residents are tenants, and naturally have no interest in funding an expensive chargepoint asset for a car park they may only spend a short period of time using. Landlords are similarly reluctant to fund the asset while there is no great demand because tenants do not have EVs: it is a chicken-and-egg problem. Mina and Evergreen Smart Power are developing a revolutionary new business which will enable people to rent a chargepoint for their parking space for as long as they need it, providing them with access to cheaper, more convenient charging than public infrastructure, automatically performing smart charging to balance the wider network and use renewable energy as much as possible, and handling all the payments and settlement with the building manager. We believe this can be done, and done soon, but it requires further modelling, evaluation, and prototyping to persuade funders and facilities managers that there is a sustainable business case that meets each party's needs and will work in the long-term. The objective of this feasibility study is to build the business case and prototype the necessary smart hardware and software integrations to persuade buildings to invest in this technology and remove one of the barriers preventing their residents from considering an EV.

Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
ECHION TECHNOLOGIES LTD	Commercialisation Roadmap for Niobium xEv Anodes (CORNEA)	£208,384	£145,869
JOHNSON MATTHEY PLC		£59,461	£29,730

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Project CORNEA brings together Echion Technologies ('Echion') and Johnson Matthey ('JM') in order to accelerate the commercialisation of a next-generation fast-charging battery material for automotive applications. Echion is a high-growth company who spun-out of Cambridge University in 2017 to commercialise proprietary fast-charging battery materials. JM is a FTSE 100 company and a global leader in the field of advanced battery materials. The speed of charge of standard commercial batteries is severely limited by the negative terminal material which they use to store the electricity upon charge, called the anode. Echion has developed a new anode material called Mixed Niobium Oxide (MNO) which enables a unique combination of safe fast charge (down to 6 min for a full charge), high energy and power density, long cycle life and low cost. This technology has the potential to enable more efficient and cost-effective hybrid vehicles benefiting from improved regenerative braking, and full electric vehicles with decreased battery size and cost who benefit from the convenience of fast-charging. This will accelerate the adoption of mass-market electric vehicles, which is in line with the government Road to Zero strategy and will provide significant environmental and public health benefits in terms of reduction of CO2 emissions and harmful particulates from the transport sector. Echion and JM are partnering to assess the business case for a joint commercialisation of the technology for automotive applications. This will include understanding detailed market requirements and matching these with actual and modelled product performance, and building a strategic roadmap to accelerate market entry. By bringing together two UK companies at the forefront of the advanced battery materials industry, this project is leveraging the opportunity to kick-start a UK supply chain to supply a unique high-added value technology to our automotive industry, thereby securing the UK's international competitiveness in the field.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 million

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
YOU. SMART. THING. LIMITED	EV ASSIST – Feasibility Study of Vehicle-User-Network Optimisation	£209,568	£146,698
West Midlands Combined Authority		£49,551	£49,551

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants

EV Assist -- Feasibility Study of Vehicle-User-Network Optimisation

The aim of the project is to assess the technical feasibility and commercial potential of "EV Assist", a personalised travel assistant that will use artificial intelligence and machine learning to increase use of electric vehicles and infrastructure.

Every car that is replaced with an electric vehicle contributes a CO2 saving of around 133.1g/km. Lower running costs, less maintenance, a lower carbon footprint and cleaner air all add up to significant social, economic, and environmental benefits. But the EV industry is struggling to achieve the necessary adoption to realise these benefits.

'Range anxiety' is at the route of the EV paradox. A perceived lack of access to charge points among would-be EV users, discourages them from switching from traditional combustion engine vehicles, with their established fuel supply chain. This could be overcome with additional charge-point infrastructure but currently operators have no means of capturing granular demand, which is key to calculating return on investment.

The UK Government is currently picking up the bill, offering tax incentives, congestion and clean air zone concessions to drive EV adoption. This is costly and unsustainable.

EV ASSIST will be designed to enable real-time information exchanges between electric vehicle owners and charge point infrastructure operators regarding near-term charging requirements and the availability of charging infrastructure at any given time.

The successful realisation of EV ASSIST can improve the overall customer experience of travelling by EV, directly addressing range anxiety, and helping operators extract maximum value from their charging assets by optimising utilisation per customer. In combination, these EV ASSIST enabled outcomes can make a significant contribution to supporting the UK's electric transition over the next decade.

A 6-month research programme has been put together by partners to investigate vehicle-user-network optimisation through desktop research, EV community engagement, and Proof-of-Concept test exercises asking:

* How can information be most efficiently captured and shared by EV ASSIST?
* How to incentivise end-users to share their EV travel requirements with operators?
* How can operators most effectively exploit EV ASSIST generated demand forecasts?
* How to scale and commercially exploit EV ASSIST to best effect?
* What is the precise impact EV ASSIST can have on the UK government's "Road to Zero" strategy?

The project is led by Birmingham-based travel demand and route optimisation platform 'You. Smart. Thing.' (YST) and supported by Transport for West Midlands ("TfWM"), owner and operator of charge point assets across the region.

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Total available funding is £10.4 million

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
BRACE TECHNOLOGY LTD	Electric Motorcycle with Modular, Configurable Battery System	£222,956	£156,069
TIRIUS LIMITED		£157,257	£110,080

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The project is to design & develop a dual-sport e-motorcycle. It utilises modular, quick change, off-board charging energy storage plus a bespoke electrified powertrain developed in 2 prior Niche Vehicle Network projects on a mule motorcycle. The dual-sport motorcycle segment, is a street legal motorcycle designed for on and off-road use, typically with an engine size of 250 or 450cc. This is a rapidly growing sector both in the UK and globally. The project will consist, design & detail, procurement of all components, assembly of 2 demonstrator vehicles, basic functional & performance tests. The main focus is to develop an integrated unique solution for an e-motorcycle, with a motorcycle frame & suspension that meets all the required vehicle characteristics, performance and durability targets for a dual-sport motorcycle, while utilising the innovative technology of the EV powertrain and energy storage. It has the added benefit of being a flexible commuter motorcycle, with the ability to have a PowerPOD at both work and home and charged at each location.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DZP TECHNOLOGIES LIMITED	Graphene sensor for battery cell predictive monitoring (GENSOR)	£76,428	£53,500
University of Warwick		£29,950	£29,950

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
This collaborative project will investigate the technical feasibility of novel graphene sensors for predictive monitoring and improved safety of lithium ion batteries in fully electric, zero emission vehicles. The project has two partners: DZP Technologies Ltd (DZP), and the University of Warwick represented by WMG. The vision for the project is to establish the graphene sensor as a key, state-of-the-art tool for battery monitoring and predictability in fully electric, zero-emission vehicles. In the future, the sensor will become an integral part of the Battery Management System (BMS). To realise this vision, the project will design and produce graphene sensor systems, and it will create and validate a mathematical model to correlate sensor data with battery cell performance characteristics.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CDO2 LIMITED	SmartBat: Smart busbars for flexible battery pack design	£73,953	£51,767
DZP TECHNOLOGIES LIMITED		£71,406	£49,984

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The SmartBat project will demonstrate a new technology for flexible battery pack design and assembly, which allows the integration of sensor and switch components to optimise pack energy density and safety. The vision for the project is that the SmartBat technology will become the industry standard for the assembly of "smart" battery packs with cell-level battery management systems (BMS), suitable for a wide range of pack designs with different cell formats. This is a collaborative 6-month project with two research-intensive SME partners, CDO2 Limited (CDO2) and DZP Technologies Ltd (DZP). The project will produce a prototype of the SmartBat concept, which will demonstrate the benefits and promises of the new technology.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ALP TECHNOLOGIES LTD	Lightweight Battery System with Thermal Control and Thermal Run-Away Prevention Features	£152,735	£106,914

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Alp has designed and tested BRIC, a low-cost and easy to maintain li-ion battery pack using unconventional architecture, innovative electronics and sensors, and predictive maintenance AI, which allows used Li-Ion batteries to be reused for distributed generation based on renewable energy. This project will benefit from ALP's existing BRIC technology for energy storage and directly address the thermal runaway safety risk of Li-ion battery in EV thanks to the development of advanced thermal management features to meet the vehicle high performance needs. Two primary areas of technical and business challenges will be tackled: 1\. A low-cost and lightweight battery system with thermal control and thermal runaway prevention features for EV applications; 2\. An engineering and electrical design that incorporates end-of-life repurposing of battery module for other applications such as renewable energy storage. The proposed physical design of battery cooling system using phase change material and complementary electronics eliminate thermal runaway and thermal cascading risk of a lightweight battery module for skateboard EV platforms. Alp is proposing this feasibility research project in order to bring its innovation from TRL3 to TRL4-5 with the aim of elaborating a detailed business innovation to continue the technology development in future research and development competitions and take the project outcome to market.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
FIBA TECH INDUSTRIES LIMITED	ENABLE	£119,934	£83,954
NCC OPERATIONS LIMITED		£51,399	£51,399

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Project ENABLE - phENolic bAttery Box eLectric vEhicle Led by FTI and supported by the National Composites Centre is investigating the development of novel phenolic sheet moulding compounds for use within the automotive & wider composite industry sectors. The products developed will ultimately improve the strength to weight ratio over the nearest state of art and deliver the safest products for composite applications in terms of fire, smoke and toxicity characteristics. The project outcomes of lighter stronger sheet moulding compounds will facilitate the drive of the wider composites industry towards the delivery of zero emissions, as well as establishing a UK lead supply chain and UK manufacturing capability.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SUNSWAP LTD	High-Efficiency, Low-GWP Transport Refrigeration (HELGTRe)	£112,737	£78,916
Imperial College London		£44,572	£44,572

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project is a collaboration between Sunswap and the Clean Energy Processes (CEP) Laboratory of Imperial College London to develop a high-efficiency transport refrigeration unit (TRU) using a low Global Warming Potential (GWP) working fluid. The project, called "High-Efficiency, Low-GWP Transport Refrigeration" (HELGTRe), will focus on delivering an innovative refrigeration system that is optimised for a solar and battery electric system where even small efficiency improvements provide significant financial and environmental benefits. The majority of TRUs rely on secondary diesel engines to provide power for cooling. They are responsible for large amounts of pollution due to the looser restrictions on secondary engines. However, pushed by tightening legislation and increasing corporate social responsibility, customers require a clean and economical alternative. Developing a high-efficiency, low-GWP system offers multiple benefits for zero-emission vehicles. Firstly, the improvement in competitiveness amplifies the incentive for customers to switch from diesel to electric. Secondly, the increase in efficiency and reduction in on-board energy storage will lead to faster charging times or a reduction in required charger size. Imperial College London will bring expertise to expedite the research activities, performing system design optimisation, system modelling, and technical performance assessment. The Imperial team has proven experience designing, modelling, and optimising advanced compressor-driven refrigeration systems and this combines well with Sunswap's background in the TRU market and product development. Environmental benefits of this project will be significant, particularly as a reduction in GWP will mean that any refrigerant leaks have a much lower environmental impact. Additionally, economic benefits are widespread through job creation and safeguarding. Social benefits will result in better air quality in cities with many TRUs emitting large quantities of NOx and there is a huge potential to clean up the air by displacing diesel TRUs with Sunswap's proposal.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 million

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
PETALITE LIMITED	SDC Power Core - Novel ZEV supercharging hardware	£455,465	£318,826

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Answer The SDC Power Core project will impact the ZEV industry by enabling faster roll-out of efficient, affordable and reliable charging infrastructure. Thus, increasing the speed of adoption of EVs which catalyses widespread benefits from reduced greenhouse gas and exhaust pollutant emissions. This solution will help increase availability of charging mobility across the population and improve quality of life. Electric vehicles (EVs) are central to UK Government plans to reduce Greenhouse gas emissions to almost zero by 2050\. The UK government will ban the sale of new petrol, diesel or hybrid cars in 2035\. In the UK, the EV market stood at $2.4bn in 2018 and is projected to grow at a robust CAGR \>14% to reach $5.4bn by 2024 (TechSci Research, 2019). The Department for Transport (2018) state that to meet EV rapid charging requirements, the number of rapid chargers located near major roads network needs to expand to 1,170 (from 460) and 27,000 (from 2,700) around towns and local areas by 2030\. To achieve this, it is essential that viable commercial models are in place to ensure continued maintenance and improvements to the network and charging infrastructure is affordable, efficient and reliable. All existing EV Charging Manufacturers will struggle to achieve this, as they all utilise the traditional Full-Bridge topology as the basis for their chargers, resulting in short product lifetime warranties (5 years), with inherently high upfront and on-going costs. These factors limit Return on Investment (ROI) for the customer (Charging Service Providers), thus slowing charging station deployment by up to 2x. Petalites Charging as a Service (CAS) business model reduces associated costs and simplifies operations and maintenance. To address this problem Petalite has invented a patent pending charging platform for an innovative new way of charging EVs, "SDC". **A true single stage topology, which has 50% less components_,_** **higher reliability**, **longer working lifetime (up to 4**x**MTBF**) compared to existing Full-Bridge topologies. **AIM** This industrial research project will develop the outputs from a successful 1-phase SDC Innovate UK (IUK) project (2019) in the rail industry. With existing rail industry tenders and timelines rail product roll-out is forecast for 2024/25\. This project will prototype the SDC Power Core in a laboratory environment and develop (TRL4-6) to comply with IEC 61851-23:2014 power standards and charge the 120m EVs produced over the next 10 years (McKinsey, 2018).

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
CODESMITH TECHNOLOGY LTD	Battery Passport	£212,861	£95,787
ELECTRA COMMERCIAL VEHICLES LTD		£127,095	£57,193

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Electric vehicle batteries need replacing when the usable capacity decreases to a level where the range is significantly impacted, this typically happens when only 80% of the original capacity remains. At this point the lithium batteries can be recycled or re-purposed to another industrial application. The problem when attempting to reuse a battery is determine its suitability for another energy storage use. The Battery Passport is equivalent of an odometer for the electric vehicle batteries. It provides a robust mechanism that records battery usage over its life and assures future buyers of their worth, thus reducing the net cost and CO2 footprint of an electric vehicle. Battery Passport works across all battery manufacturers, BMS providers and OEMs. It offers live monitoring of the battery, making information easily accessible to the vehicle owner and manufacturer. In building up this passport of battery data the system learns the regular usage patterns, then offers recommendations to the vehicle owner towards extending in-vehicle battery life by changing behaviour in areas such as maintenance and charging. One unique feature of the Battery Passport is that the integrity of data collected from the vehicle is protected by several cybersecurity mechanisms. Electric Vehicle manufacturers are responsible for the disposal of a battery when it reaches its end-of-vehicle life, recycling is another expense for the manufacturer, where as the transfer of that battery into the second-life market releases the manufacturer from their recycling obligations. Reusing a battery has a number of other benefits, for the battery owner they would receive the income from selling their battery into a secondary market, it would extend the useful life of the battery maximising its potential and by delaying when it has to be recycled it gives the recycling industry time to improve their efficiency rates when processing these lithium batteries.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
QDOT TECHNOLOGY LTD	Pouch cell architectures for extremely fast charging	£87,131	£60,992
AMTE POWER LTD.		£145,243	£101,670

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The UK's stated objective to emit zero carbon emissions by 2050 means that future cars and commercial vehicles will need to be driven by electric motors powered by compact batteries. The battery technology of the future is expected to be a descendant of existing Lithium ion (Li-ion) batteries used in existing Electric Vehicles (EVs) - such as the Toyota Prius and the Tesla range of EVs. To optimise the cycle life (running cost) and performance (range and power) of Li-ion devices, the battery temperature must be maintained within a narrow window of operation - typically 15-50 degC (Wang, 2016). It is therefore not surprising that advancing battery thermal management technology is recognised as key to facilitating the widespread adoption of EVs. One of the main challenges for future Battery Thermal Management Systems (BTMS) will be the facilitation of Extremely Fast Charging (XFC). XFC would enable a battery pack with a 200-mile range to be re-charged on a time-scale like that for refueling a conventional petrol or diesel car. However, XFC is challenging from a BTMS perspective as it leads to the generation of considerable amounts of heat in the batteries. Being able to maintain the batteries within their operational temperature envelope during XFC, particularly in hotter climates, is currently an un-solved problem in the automotive sector. The aim of this project is to assess the feasibility of optimising current pouch-cell architectures for heat extraction; combining the result with Qdot's battery cooling technology to enable XFC.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
HIETA TECHNOLOGIES LTD	ALLOWS (Advanced Liquid cooLing Of poWer electronicS)	£183,580	£91,790
COMPOUND SEMICONDUCTOR APPLICATIONS CATAPULT LIMITED		£62,304	£62,304

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Project ALLOWS is a feasibility study into the Advanced Liquid Cooling of Power Electronics in relation to next generation Electric Vehicle Powertrains. HiETA Technologies Ltd, and the Compound Semi-conductor Applications Catapult (CSAC) are leaders within their fields of the development and production of Metal Additive Manufacture (MAM) components for thermal management and light-weighting, and compound semi-conductor technologies respectively. They have identified the building blocks for highly integrated cooling of the power electronics, mainly inverters, needed for e-powertrains in the electric vehicle (EV) market. Mass deployment of EVs requires smaller, lighter, higher speed, more efficient and more power-dense e-powertrains, which in turn require innovative cooling solutions for all components, particularly the inverters. CSAC and HiETA are combining to develop more efficient cooling systems that reduce or even eliminate some of the thermal barriers between electronic components and coolant, while making more efficient use of the coolant available, to meet the packaging and temperature control requirements of the e-motor. After assessing state-of-the-art Automotive Power Electronics Modules and their technical, commercial and environmental challenges and opportunities, CSAC will acquire a current power electronics unit and test its performance to provide a benchmark for subsequent improvement. CSAC & HiETA will then assess the feasibility of innovative cooling methods, from optimisation of current packages, to complete redesign of chipset modules and the use of HiETA's most innovative single or 2-phase heat exchange surfaces and geometries. After detailed analysis of thermally optimised concepts, a selection of technology demonstrator units will be manufactured at HiETA's state-of-the-art MAM facility in Bristol, and then performance tested against current technology at CASC's test and development centre in Newport. An investigation into commercialisation and volume production within a complex supply chain will be investigated. Successfully completing Project ALLOWS will give the foundation for the realisation and improvement of next generation Power Electronics within EV. The primary focus in enabling chipset modules to become more power dense, efficient and more integrated will ensure the evolution of next generation electric motor technology in the UK. In particular, it will enable the development of e-motors with power densities of over 20 kWe/kg compared with the state-of-the-art 12%, resulting in a decrease in typical EV mass of ~3% and an increase in range of up to 10%. Not only will this allow the development of next generation EV's but it will directly create design, manufacturing and supply chain opportunities in a rapidly increasing global market.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
HYPERVOLT LIMITED	AC charging with EV metadata and State-of-Charge (ACES): for truly smart charging and V2G	£114,370	£80,059

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
With the Paris Agreement and Net Zero 2050, the UK is on-track to meet renewable electricity targets, 100% ZEVs by 2035, and smart chargers (EVSE) in all new homes, but faces two consequent challenges: A) curtailment costs from variable supply with demand inflexibility increased from £165m in 2010 to £636m in 2019, with an additional £500m due to oversupply during Covid-19\. B) peak demand increases from electric transport and heat will require infrastructure upgrades, including 30% of low voltage networks at 40% EV penetration. BEIS' Smart Systems and Flexibility plan asserts that flexibility can save £40bn by 2050, but the ENA and Element Energy find that residential flexibility in particular is needed to unlock the full scope of these savings in grid-edge low voltage networks. Optimised networks of residential smart EVSE and V2G present the leading viable mass-market technology option for alleviating grid-edge constraints, with a charger planned for every home, and experts predict they can reduce peak demand by 50% and save £3.5bn p.a. by 2050\. However, the smart charging network technology required to unlock these savings is not yet available. Hypervolt provides the UK's most advanced smart charger, Hypervolt Home 2.0, specifically designed to accelerate EV uptake at zero marginal infrastructure cost by providing energy system services. Hypervolt proposes a 6-month feasibility study into enhanced optimisation technologies for smart charging and V2G in residential charging. This project will establish a technology route for follow-on R&D, unlocking the full potential of smart charging and V2G in residential charging. Success will be followed by immediate implementation, giving Hypervolt and the UK a unique leading position globally. It will outline the only viable mass-market technology for alleviating grid-edge constraints in rapidly expanding constraint management zones (4,527MW of constrained distribution network, covering ~750,000 homes, 3.5% of the home charging market and counting).

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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
GREEN SOLUTION ENGINEERING LIMITED	Feasibility assessment of a novel light-weight ultra-efficient Gallium Nitride (GaN) traction inverter for ultra-low emission vehicles	£142,551	£99,786

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
GSE Ltd have developed a novel traction inverter technology, GaNDrive, based on Gallium Nitride (GaN) incorporating a disruptive gate drive design and an ultra-efficient, light-weight, integrated inverter design with patented thermal management that eliminates the need for a second cooling loop. The technology is proven on laboratory prototypes, showing attractive technical performance and economics. This project aims to prove the feasibility and quantify the economics of GaNDrive technology through design, build and testing of a 10 kW traction inverter for ultra-low emission electric vehicles.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
MAHLE POWERTRAIN LIMITED	Ultra fast charging battery system for electrification of urban delivery vehicles	£146,918	£73,459
ALLOTROPE ENERGY LTD		£39,913	£27,939

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project will develop a new type of battery pack, which can be recharged at a rate of 1000 km/h, to enable aggressive downsizing of battery packs for urban delivery vehicles. This will enable the right-sizing of battery packs for these vehicles to the optimal size required, which will bring advantages in terms of weight, vehicle purchase cost, load capacity and overall vehicle carbon footprint. To enable this to happen, the battery will make use of Allotrope Energy's patented lithium-carbon cell technology and MAHLE Powertrain's expertise in battery pack design, development and manufacture. As well as enabling ultra-fast charging, Allotrope Energy's lithium-carbon cell technology brings with it other advantages over conventional lithium-ion battery cells. It does not use any rare earth materials, and can be readily recycled. Additionally, the lithium-carbon cell is also much more thermally stable than common lithium-ion cells, making them safer to store, transport and use. The project will determine the infrastructure required to facilitate the ultra-fast charging to support this next generation of urban delivery vehicle. As an added advantage, it is expected that the resulting technology combinations will also enable improvements in urban mobility through improved vehicle-sharing and on-demand transport solutions for commuters and recreational users.

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Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
ELECTRIC ASSISTED VEHICLES LIMITED	EAVmove – Feasibility Study into the expansion of zero-emission EAV products into the Passenger Transport market (PHV)	£223,588	£156,512

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The vision of Electric Assisted Vehicles (EAV) is to produce world-beating solutions to mobility and urban challenges, with the aim of benefiting the environment and people's quality of life. EAV's existing product lineup specifically targets urban commercial fleets - successfully addressing the "last mile" challenge for urban deliveries by using a design ethos to conceptually 'engineer down' from Light Commercial Vehicles (LCVs) rather than 'engineer up' from the bicycle. EAV has been able to develop the most ergonomic eCargo bike on the market, with approval from market partners to prove it. EAV have developed a strong pipeline of interest in their cargo bikes (50 EAV from DPD (£550k)); customer pipeline sales include Amazon, Royal Mail, Asda/Walmart, Postnord, Co-op, EDF energy, Toyota Kinto and Faxi resulting in opportunities worth in excess of £5m by 2021\. To capitalise, EAV are currently scaling up through an Innovate Loan, developing a production line to manufacture 100 units/month. This project is the EAVmove, a four-wheeled electric-assisted pedal-powered passenger vehicle capable of carrying up to 3 passengers (a Pedicab). Currently, no suitable zero-emissions alternative to Private Hire Vehicles (PHV) exists with regard to meeting urban environmental restrictions and PHV functional requirements (luggage capacity, passenger experience. Utilising the EAV ethos, the purpose of this project is to test the feasibility of expanding the current EAV product line into the passenger mobility market. EAVmove will be a zero-emission Taxi or PHV suitable for modern app-based ride-hailing services (E-hailing). EAV vehicles do not require dedicated fast-charge 3-phase networks, vastly reducing demand on the network over electric vehicles, can operate efficiently in congested urban environments by utilising cycle networks, and with greater flexibility/access to parking are able to get closer to destinations. They are environmentally friendly, with zero carbon emissions during transit, incredibly light on-road infrastructure wear, and much reduced particulate emissions, providing true ULEZ/ZEZ compatibility. Part-sharing with the existing EAV range will reduce work, accelerate development and minimise risk. This project will enable EAV to utilise its existing technology, experience and manufacturing capability to respond to an emerging market gap. Developing a true Zero Emission Vehicle (ZEV) that can meet the demands of passenger transport in today's urban mobility systems. Furthermore, EAVmove will support society's need to fast-track the introduction of zero-emission passenger transport into urban environments, promote healthier lifestyles, increase accessibility to cycle/zero-emission transport, and provide market options for an increasingly de-carbonised future.

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Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
ULTIMA FORMA LTD	Assessment of electroformed hydrogen tank liner	£118,095	£82,666
NCC OPERATIONS LIMITED		£50,611	£50,611

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The market for hydrogen powered vehicles now has greater emphasis due to its low carbon potential and is predicted to grow substantially by 2040\. The recent launch of advanced hydrogen fuel cell powered vehicles from Toyota and Hyundai have showcased the potential of the technology and refuelling infrastructure is gradually being rolled out especially in Germany, Japan, California and the UK. The UK government has recently announced a £73.5m grant to JaguarLandrover to develop a fuel cell powered SUV which demonstrates a significant belief in the technology as a future solution for mobility applications. BMW are also actively working with Toyota on Hydrogen vehicle development. Compared with IC engines and electric powertrains, Hydrogen technology for vehicles is still in its infancy. Opportunities exist with the pressurised storage of hydrogen to reduce costs, leakage, the user experience during refilling, and weight, all of which would improve hydrogens viability as a low carbon alternative fuel. The National Composites Centre in Bristol has been conducting research into hydrogen storage and have identified a variety of areas for improvement as well as how the UK should develop its supply chain in order to serve this emerging new technology area. Ultima Forma is a specialist manufacturer of advanced metal parts using their patented electroforming process. This process we believe has the potential to address a number of the issues identified by the NCC and this feasibility study is designed to assess by testing new electroformed material solutions for strength and hydrogen permeability. The National Composites Centre will work with Ultima Forma to conduct computer based structural analysis of high-pressure (700 bar) tanks to make an assessment for how the overall structure could be designed in a lighter more cost effective way that incorporates Ultima Forma technology. A performance / cost assessment will be made together with other benefits such as improvements to the user experience.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 million

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SPARK EV TECHNOLOGY LIMITED	Precision range estimation for EVs utilising advanced battery modelling	£118,468	£82,928
University of Warwick		£50,771	£50,771

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Barriers to ZEV adoption include, range anxiety (concern over running out of battery charge), charger anxiety (concern over charging time, cost, availability), and inaccurate onboard range displays. Errors in range prediction can be as much as 45km per journey, discouraging adoption in potential customers and impacting negatively on wider investment in zero emission vehicles (ZEVs) and the environment. Spark EV Technology (Spark) has developed a patented software system called 'Spark Assure'. The product creates a personalised journey prediction using artificial intelligence combined with real-time data collection, not usually available in current range prediction software. Spark Assure learns about driver characteristics and uses complementary datasets such as weather, topography, traffic levels and charge percentage to predict the energy required for that journey. When the journey is complete, Spark Assure compares the predicted energy use against the actual expenditure and applies a machine learning algorithm to refine and improve prediction over time. Spark has completed revenue generating proof of concept projects with Hyundai and three other OEM customers. The software has shown a significant improvement in comparison with the usual 45km errors in range prediction from OEM in-vehicle systems conducted in customer research trials. Despite the improvements, the battery model is relatively simple and needs further refinement and development to ensure we maintain a market leading position in this field and continue to innovate and support our customers. Spark and Warwick Manufacturing Group (WMG) with support from Eatron Technologies (Eatron), are seeking innovation funding to support the design, development and testing of a predictive battery model. The model will be optimised to adjust capacity based on predictions of real world energy demands and rate of discharge as well as total energy requirements, predictive thermal modelling affecting capacity over a journey, ability to accept regenerative energy when full, and recovery times. Machine learning will be applied to this predictive battery model to allow it to adapt to the tolerances between individual batteries and how the battery ages for each vehicles unique drive and charge cycles. This model will be integrated via a new application programming interface (API) defined and developed by Eatron. The enhanced battery model will be integrated into Spark Assure and tested on a Nissan Leaf in real world conditions to prove an enhanced accuracy of range prediction for a set of journeys.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
JOHNSON MATTHEY PLC	Cold Sintering of Composites and Solid Electrolytes (CSi CASE)	£138,913	£69,456
University of Sheffield		£58,631	£58,631

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Solid state batteries have the potential to realise significant improvements in energy density, cycle life, and reduced harware/controls while enabling faster charging and ideal safety. Whilst numerous automotive manufacturers are known to be researching solid state batteries, thus far the technology remains at low technology readiness level and is considered to be several years from commercialisation. Handling, processing, and scaled production of the electrolyte materials, are critical to enable manufacturability of solid state batteries. This project will leverage an enabling low energy processing technology to achieve a multilayered all solid state battery with relevant layer dimensions. This project aims to address these industrial challenges by bringing together two leading organisations that are at the forefront of battery materials and ceramic processing innovation; Johnson Matthey (one of UKs largest battery companies and a leading global cathode material manufacturer) and University of Sheffield (ceramics group with advanced ceramics processing capability).

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
BRILL POWER LIMITED	REVEL (Retrofitting Electric Vehicles to Extend Lifetime)	£106,916	£74,841
AMTE POWER LTD.		£164,996	£115,497

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Brill Power and AMTE Power have identified a market opportunity for a modular, long-life battery system to electrify commercial vehicles with internal combustion engines, particularly medium and heavy goods vehicles. Commercial vehicles typically have high utilisation rates, which can cause lithium-ion batteries to lose more than 20% of their driving range within a few years, at which point the battery needs to be replaced. Brill Power has developed a novel type of battery management system (BMS), which can extend the lifetime of batteries by up to 60%. This is particularly valuable for commercial vehicles and will avoid the need for battery replacements. AMTE Power are the UK's only powder-to-cell manufacturer of lithium-ion battery cells and are planning to ramp up their battery production in the UK's first domestically owned gigafactories. Combining AMTE Power's high-energy-density battery cells with Brill Power's novel BMS enables the companies to create a highly competitive product for the automotive market. Their decision to target the retrofitting market is based on market pull, as well as the faster access to this market compared to the manufacturing lines of new vehicles. This project will enable Brill Power and AMTE Power to create a demonstrator for a new and competitive product to showcase their technologies. It will also allow the partners to start a commercial collaboration and create the foundation for a UK-based powder-to-power supply chain for automotive battery systems.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
WESTFIELD SPORTS CARS LIMITED	Cargo POD	£297,103	£207,972
Cranfield University		£89,006	£89,006

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Following a commercial feasibility study with Emirates Airline and Dnata,Westfield have created,with Ha specification/design for an electric inwheel powered autonomous cargo pod that is able to take aircraft akes(baggage containers) and ULDs (Unit Loading Device containers)all using the same self powered platform from the terminal/warehouse to the aircraft and back using driverless technology.This will decrease the emissions airside, reduce delays at airports by automating the landside to airside security check and increase utilisation of vehicles by minimising charging time using an advanced carbon ion hybrid power plant and fast charge system.The vehicle will be equipped with an AI control system that will optimise the use of Lithium and Carbon Ion power.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
RICARDO UK LIMITED	Connected BMS: Virtual Fleet Data for Battery Life Management	£224,961	£112,480

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Digital services and offerings that can extract insights from the large datasets that are generated by connected vehicle fleets. The Ricardo vision is for advanced monitoring and prognostics services to reduce electric vehicle battery failures in the field and extended battery life. The key objective of this project is to develop a test platform for monitoring and prognostics of battery health. Such monitoring management is part of a connected Battery Management System (BMS). A secondary objective is to investigate novel hybrid physics-based/data-driven prognostics algorithms for battery health management. A tertiary objective is to derive BMS calibration updates from the physics based/data-drive prognostics algorithm, that can then be applied via Software-over-the-Air (SOTA). There will be four focus areas in this project. Firstly, we will develop tools to virtually represent vehicle fleets. These virtual fleets will provide data to be ingested by the Connected BMS test platform. Secondly, we will address information flow from a CBMS to the test platform (Data-over-the-Air) Thirdly, we will focus on battery monitoring and prognostics algorithm development. Lastly, we will address information flow from the test platform back to the CBMS (Software-over-the-Air). There are three main innovations in this project. We will propose novel data storage methods on a Connected BMS, exploring techniques for data compression without degrading fidelity. We will develop innovative algorithms, combining physics-based modelling and data driven techniques, to generate insight into the battery health through statistical inference. We will derive from these algorithms techniques to automatically update the BMS calibrations (in the form of de-ratings) that will be provided, over the air, to the CBMS.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
UPS LIMITED	Autonomous Robotic Arm charging solution trial.	£79,634	£39,817
POWERHYDRANT EUROPE LIMITED		£235,075	£164,552

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
UPS and PowerHydrant are embarking on an innovative trial of automated robotic arm charging at the UPS Camden centre. This technology has the potential to facilitate charging of autonomous vehicles, and high-power trucks, and is a key part of the EV charging system of the future. The trial will be the first of its kind in the world. The technology utilises low cost cameras and advanced image recognition to automatically identify, navigate to, connect, and disconnect from an electric vehicle, without any human intervention. This ability allows the technology to ceiling mounted, and so clears out the centre floor of charging equipment. For a busy centre with almost 200 vehicles, this removes hazards as well as improving centre utilisation. UPS will bring in UK Power Networks Services to support the project continue a successful partnership in innovating for EV fleets.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MIRALIS DATA LIMITED	Connected Smart Charging	£256,096	£179,267
ENVISIJ LIMITED		£112,214	£78,550

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
In 2018 Miralis successfully gained Innovate UK funding through the Faraday Battery Challenge for our Smart Automotive Managed Battery Algorithms (SAMBA) project. SAMBA investigated whether managing EV charging schedules could extend long term health of batteries. While we successfully proved this, the potential savings made through optimising charge schedules to take advantage of fluctuating electricity costs were more compelling. In SAMBA we developed algorithms that created these schedules to prove the feasibility of electric vehicle smart charging. Since SAMBA concluded in 2019, we have extended our smart charging algorithms as part of an exploration in how best to commercialise them. While current state-of-the-art works only for individual vehicles we wanted to extend it to the charging of whole fleets. This isn't just charging a larger number of vehicles individually (as is currently offered by a number of organisations under the description of "fleet smart charging"), this is taking in to account the make-up and requirements of the fleet as a whole, the electricity grid and the building to which the electric vehicle chargers are also connected and other priorities unique to the scenario. This new project partners Miralis with Envisij, a UK based energy management solution with an established customer base, to commercialise that research through the following developments: * Tariff optimisation. Automating the charging of a whole fleet at the optimum time and pricing to minimise cost. * Charge level optimisation. Using the vehicle's history to charge the battery to the level it needs and not to 100%. * Load balancing. Taking into account the impact of vehicle charging on a whole site's energy usage, including buildings and machinery. * Prioritisation. Ensure the right vehicles receive the right amount of charge in the most cost effective way while making sure the energy requested doesn't affect the energy requirements of the site as a whole. * Demand side response. The ability to manage high draw assets like charge points in real time allows sites to participate in Demand Side Response agreements meaning that they can be responsive to requests to reduce energy draw when demand peaks. This gives the company the opportunity to generate revenue while still optimising charging. The potential benefits to companies with multiple electric vehicles are significant - saving money, spreading cost, protecting its energy supply and generating new revenues to offset costs.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
AGILE CHARGING LTD	ABOVE (Applying Battery Optimised Vehicle charging Environments).	£159,822	£111,875
SUSTAINABLE VENTURE DEVELOPMENT PARTNERS LTD		£38,026	£26,618

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Project description - provided by applicants
The UK will ban all sales of new diesel and petrol cars by 2040 (DEFRA,2017). The adoption of Electric Vehicles (EVs) could add c.30GW to UK peak demand by 2050 (National Grid, 2017), requiring significant upgrades to the UK's electricity grid, costing 'tens of billions' (ESC, 2018). This can be reduced to around 8GW with smart charging technologies, including the integration of charging and battery storage (National Grid, 2018). Vehicle-to-grid offers potential revenue streams to boost the business case for chargers. Limiting factors in accessing grid services are unpredictability of vehicle plug-in at optimum times for grid services. Required charger response times to access the most valuable markets (FFR) limit are unlikely to be met with existing products due to the need for communications between the market signal, charger and car before the energy flow can commence. This risk limits the applicability of the V2G model in the market. In this project, Agile intend to overcome many of those issues through testing the feasibility of new V2G developments with battery-enhanced chargers. It will explore the development of optimisation algorithms which improve the response times for key markets and mitigate potential unavailability of vehicles for charging without impacting the grid services.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
THE GLOBAL VEHICLE TRUST	Feasibility study into electric powertrain for the OX developing market utility truck	£120,798	£84,559
POTENZA TECHNOLOGY LIMITED		£38,123	£19,062

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Billions of people live in developing countries that suffer from a lack of affordable transport, this stifles economic growth and prevents access to healthcare, education and opportunity. The Global Vehicle Trust (GVT) was founded by a UK charity to tackle this transport shortage. GVT's strategy is to dramatically reduce the price of motorised transport by creating an innovative pay-as-you-go shared transport service, the "OX Ecosystem". Due to a lack of suitable vehicles to enable this ecosystem GVT have worked with renowned automotive designer Prof. Gordon Murray to develop the unique OX truck which is the only vehicle purpose designed for the developing world conditions -- poor roads, heavy loads, minimal service infrastructure. 4 OX prototypes have been built and tested using a diesel powertrain. Our vision for this project is to demonstrate the commercial and technical feasibility of a zero emissions electric powertrain for the OX. This "eOX" will be the worlds' first electric vehicle (BEV) purpose designed for the developing world.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
MAGNOMATICS LIMITED	Vaircon - Continuously variable air-conditioning drive for PSV	£230,741	£161,519
EMINOX LIMITED		£63,333	£31,666

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project is focussed on the development of a Magnetic Continuously Variable Transmission (mCVT) system that is optimised for automotive ancillary drive applications. CVT systems have benefits in hybrid vehicle drive trains where they are used to ensure that the engine is always operating at maximum efficiency. By exploiting this flexibility, significant fuel/emissions benefits can be achieved. mCVTs can also be used to drive ancillaries (e.g. air-conditioning (AC) compressors, pumps, etc). In such applications the mCVT fits onto the engine belt driving the ancillary with engine power, but at an optimum speed, independent of engine speed. By doing this the AC compressor can be operated at the speed required by the cooling requirements, rather than that dictated by the engine speed via a fixed ratio. This leads to significant reduction in engine parasitic loss with consequent benefits in terms of CO2 and fuel consumption. The flexibility of the system can be extended to give AC function even when the engine is off. This important feature allows continued AC while the engine stop/start feature is enabled, preventing the driver from disabling the system to maintain AC and thereby negating all fuel and emissions benefits provided. Furthermore, the engine-off function allows the system to act as a "parking cooler" for commercial vehicles, deleting the secondary cooling loop on the roof of the cabin. Magnomatics is developing a much larger, main powertrain, mCVT system for hybrid vehicles. This ongoing development of the main powertrain system is being used to accelerate this smaller spin-off product where knowledge will be transferred to the technical development. A key differentiator for this system is that in order to be competitive it must have reduced cost and therefore function. This is achieved by combining two electrical machines present in the existing Magnomatics mCVT systems into a single unit using innovative magnetic field superposition techniques. This is a patent pending key innovation, which provides a more compact, more efficient, simpler and cheaper machine than any competing power-split system. This project will provide a working, tested prototype. The system will be vehicle fit ready for evaluation on a fleet of buses that are currently awaiting retro-fitment of emissions reduction technology by Eminox. Ultimately the entire project will see the UK manufacture and retro-fitment of the systems, with export opportunities (thousands off) to an existing transport provider already being established.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
DEREGALLERA LTD	Feasibility Project to Significantly Extend Range of ZEVs via Novel Ultra-high Efficiency Direct Drive System	£307,151	£215,006

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project will develop and demonstrate via simulation and laboratory testing, an ultra-high efficiency direct drive system that can be retrofitted to a current production zero emission vehicle (ZEV). The innovation is expected to offer numerous benefits to the target ZEV, including extended range, enhanced efficiency, reliability improvements, cost savings, and other new vehicle design possibilities. This project has the potential to provide a technically and economically viable product for catalysing the adoption of ZEVs, and research outcomes that will directly lead towards an increasingly electrified transport sector.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
RICARDO UK LIMITED	Disruptive cooling systems for electrification sub-systems	£380,462	£190,231

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project will develop an electric motor concept embodying novel rotor, stator and distributed power electronics cooling technologies to yield a 15 to 20% improvement in performance over public domain automotive approaches. This will allow the achievement of the 2030 Automotive Council UK motor and power electronics specific power targets by 2021\. As a result, the concept will deliver 10-20% motor downsizing and weight reduction, improved vehicle packaging as well as total vehicle cost reduction. It will support the Government's drive to increase the rate of electrification across a range of transport sectors and is applicable to BEV, HEV, PHEV and Fuel Cell drivelines. _Ricardo will develop the concept using our advanced thermal and electromagnetic digital design and analysis tools, which will be updated to cover the novel solutions focused on in this project. These will also be used to assess the concept in a relevant automotive environment over legislative drive cycles and Ricardo's real-world driving cycles. These updated tools support Ricardo's goal of halving the development time of motors and drives._ _The final output from the project will be a well-developed 3D CAD concept design with manufacturing considerations which, supported by the analysis output, will be used to communicate the vison to our UK and global customer base. This advancement will allow us to accelerate our customers' developments to market in the competitive space of electrification. The robust concept design will also form the basis of subsequent programmes to move the technology towards production intent._

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Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
EVPARTS UK LTD	Connected Secure In Cable Control and Protection Device for Electric Vehicle charging supporting mode 2 and 3 use	£159,854	£111,898
University of Exeter		£67,118	£53,694

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
EVParts and The University of Exeter will combine their expertise to create a new connected secure In Cable Control and Protection Device for Electric Vehicles, ranging from passenger cars through to HGVs. The project will focus on creating a reliable, connected, sustainable and secure device at a competitive price point, aimed at increasing the wider adoption of EVs.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
BRAMBLE ENERGY LIMITED	The Integrated Hydrogen Fuel Cell – Lithium-ion Battery Module (Hydrium)	£449,916	£314,941

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
We are currently entering the 'age of electrochemical power', displacing fossil fuels and the internal combustion engine. The critical need to decarbonise the transport sector has led to major improvements in battery technology and the rapidly growing uptake of electric vehicles. Li-ion battery technology has led the way and resulted in massively improved performance and reduced cost. However, the weight/size, recharging time and cost of batteries are a challenge for medium- and heavy-duty commercial vehicles. Hybridising fuel cells with batteries deliveries a 'best of both worlds' scenario that can deliver the needs of this sector. Fuel cells are an electrochemical energy technology that has the highest know efficiency for conversion of chemical fuel into electricity. They work by electrochemically splitting fuel molecules (e.g. hydrogen), with the consequent passage of electrical current. There is no combustion or moving parts involved, and the polymer electrolyte fuel cell (PEFC), which operates on hydrogen fuel at a temperature of 50-80C, is considered to be the most promising fuel cell type for automotive applications. While the PEFC shows great promise and delivers in terms of performance (efficiency, power density, etc.) it still requires cost reduction, a means of large-scale manufacture and improvements to longevity. Bramble Energy's technology uses printed circuit board (PCB) materials and manufacturing techniques to realise a low-cost, light-weight, rugged system with fundamental advantages that make it highly design flexible and durable. The Bramble Energy approach thinks about the structure of a fuel cell in a different way. A traditional fuel cell needs capital intensive, bespoke manufacturing techniques tailored specifically to each application. A Bramble Energy fuel cell uses only standard PCB materials and manufacturing techniques such that its production can be done, in principle, at any PCB production plant worldwide. The global commercial road vehicle market was valued at USD 1.32 trillion in 2017 and is a major source of CO2 emissions. Hydrogen fuel cells offer the opportunity to decarbonise this sector, which, due to weight and range requirements, is exceedingly difficult to electrify using lithium-ion batteries alone. This project will demonstrate how fuel cells can be incorporated within conventional lithium-ion battery modules such that the fuel cell effectively becomes part of the battery pack space within a vehicle. This will significantly improve the ability of fuel cells to be integrated within electric vehicles, improve manufacturability, system weight/volume performance and cost.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
TEER COATINGS LIMITED	High-Performance Electrode Plate Coatings for Lightweight Fuel Cell Stacks (HiPerEPC)	£100,468	£60,281

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Air-cooled fuel cells are particularly suitable for lower power automotive applications such as primary and range extender drives for lightweight vehicles. Their rapid refuelling capabilities, combined with significantly reduced balance-of-plant complexity, hence minimising weight (and cost), provide a clear differentiator from pure battery-powered solutions. HiPerEPC exploits previous feasibility research on high-performance coatings for Proton Exchange Membrane fuel cell (PEMFC) electrodes based on lightweight alloy substrates. PEMFCs display the highest power densities of any of the fuel cell types, which makes them particularly attractive for transportation & portable applications where minimum size and weight are required. Conventional PEMFCs utilise electrode plates which are made from graphite (bulky and expensive to machine) or stainless steel. For automotive applications, hundreds of cells are needed within a multi-kW stack, hence a relatively small weight saving per plate will be significant for the whole system. Specific power densities delivered by aluminium-based fuel cell systems can be double that of stainless steel-based systems. However, challenges remain in developing suitable high-conductivity coatings which protect aluminium electrode plates against corrosion. HiPerEPC will refine the novel coatings identified in CAEPAC, facilitating the use of aluminium electrodes in fuel cell stacks.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ZETA SPECIALIST LIGHTING LIMITED	EV infrastructure investment calculator (EVIC)	£107,704	£75,393
URBAN INTEGRATED LTD		£87,965	£61,576

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The planned expansion of EV's throughout the UK relies on a backbone of EV charging infrastructure being in place to support the switch from ICE to EV. This infrastructure requires significant investment that will secure future returns as and when the EV uptake expands. In order to secure investment for this infrastructure there needs to be a clearly identified business case. This project harmonises the results from previous IUK projects (Park and Charge feasibility and Electra) and develops the site locator and business case investment tools resulting from these projects into an investment calculator which will clearly demonstrate to investors the likely return on investment from infrastructure deployment. This will enable a rapid expansion in the deployment of EV chargers in the right places at the right times, matching supply to demand, matching investor to returns. It is essential that the best locations can be identified which match local demand from EV users for hubs and overnight charging as this will ensure best usage uptake and hence best returns for investment. Data to support the identification of sites and the returns has already been identified by previous successful IUK projects, it is this project's aim to further enhance this data with modelling and new data sets from existing EV chargers that will prove the case for investment into EV charging infrastructure.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
AVL POWERTRAIN UK LIMITED	Design of Battery Packs for Reuse, Remanufacture and Recycling	£137,992	£68,996

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
With the growing concern over global warming and pollution from vehicle emissions, regulations and government policies are becoming more stringent. In line with this trend, more and more zero emission and low emission vehicles are being introduced in the market across all segments. In the passenger car segment, most established OEMs are already offering several electric and hybrid models, with the commercial vehicle segment also following the trend. Lithium-ion batteries are almost exclusively used as electrical energy storage system for these electric and hybrid vehicles. With the accelerated growth in uptake of zero and low emission vehicles, a large quantity of lithium-ion batteries will be introduced in the market. At the vehicle end of life, there will be a significant waste management challenge as lithium-ion batteries pose serious environmental risks when used as landfill or exposed to ground water. Consequently, there will be a growing demand of automotive battery pack design which will enables sustainable end of life processes - reuse, remanufacture and recycling. In this project, existing battery pack design processes will be assessed in terms of suitability for end of life processes. Based on this assessment new battery pack design guidelines will be developed to facilitate efficient reuse, remanufacture and recycling processes. Generalised guidelines for sustainable battery pack design using other battery chemistries (e.g. solid state) will also be developed to address potential future technological shifts. Using an assessment metric a battery pack design, an end of life impact assessment tool will be developed to evaluate the suitability of any given design in terms of recycle, reuse and remanufacturing. The project outcomes will enable OEMs to use these already developed sustainable battery pack design process in their product development cycle while meeting end of life battery packs management legislative requirements. This project will help the UK to be at the forefront of the sustainable battery pack development for automotive applications.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
J.C.B.EARTHMOVERS LIMITED	Project HYDRO (HYdraulic Design to Revolutionise Off-highway)	£183,710	£91,855

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Project HYDRO (Hydraulic Design to Revolutionise Off-highway) is an industrial research project that aims to improve the efficiency and optimisation of hydraulic systems for zero emission machines. A range of technologies will be explored and applied to heavy-duty off-highway machinery as a necessary part of the "road to zero" initiative.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Innovate UK

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 million

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
EDF ENERGY R&D UK CENTRE LIMITED	Hy4Fleets	£102,090	£51,045

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Hy4Fleets is a feasibility study project that will develop and test the value for an assessment tool to support decision making and encourage the transition of diesel-powered heavy-goods vehicles (HGVs) & bus fleets to hydrogen fuel cell fleets. In the UK, the transport sector is the largest greenhouse gases emitting sector, accounting for 27% of total emissions. While battery electric vehicles (BEVs) have emerged as the likely low carbon option for light passenger transport, the path to decarbonising heavy-goods and large passenger carrying vehicles is unclear. The recent reductions in low carbon hydrogen production costs (about 20% in the last 10 years, with rapid further reductions expected) and the growth in hydrogen vehicle model types and utilisation, presents an opportunity for hydrogen to be deployed at scale as the alternative zero emissions fuel to decarbonise HGVs and buses. However, the gap in technical and economic insights on the hydrogen switching process presents a barrier to the uptake of hydrogen vehicles for fleet owners and bus operators. The Hy4Fleets project will address this knowledge gap and provide fleet managers with a detailed and tailored strategy for the decarbonisation of their HGV and bus fleets, specifically focussing on use cases that are better suited to hydrogen fuel cell vehicles.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Innovate UK

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
ARCOLA ENERGY LIMITED	Powertrain for zero emission HGVs	£495,372	£346,760

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Arcola Energy has developed hydrogen fuel cell electric (FCEV) powertrains for buses, and integrated and tested on a double deck bus with manufacturer Alexander Dennis (ADL). We have demonstrated the target zero-emissions range of over 200 miles with vehicle mass lower than diesel hybrid buses and well-to-wheel CO2 emissions 30% lower than diesel even on fossil fuel-derived hydrogen. We have established a co-development partnership with Optare and now taking orders for significant numbers of buses in the UK and internationally. The project follows on from this previous R&D and adds value by transferring the technology to an additional vehicle type, opening up the heavy good vehicle sector starting at 18t and upwards for wide market opportunities. The initial vehicle is an 18t gritter, directly addressing a customer need for winter resilience vehicles where payload and non-stop operation are critical. We expect this to be a global first fuel cell electric vehicle for this application, and to enable rapid adaptation of 18t truck chassis to other body variants and to demonstrate the potential for the technology for other heavy vehicles.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
URBAN ELECTRIC NETWORKS LTD	Expanding Urban E-mobility	£72,276	£50,593
ALBRIGHT PRODUCT DESIGN LIMITED		£121,167	£84,817

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project builds on two previous IUK projects to further develop the unique UEone pop-up charge point, designed to accelerate electric vehicle (EV) adoption in urban areas by solving the problem of charging for the 43% of UK households without off-street parking for charging, vital for The Department for Transport to achieve the objectives set out in the 'Road to Zero' strategy. Learnings from current trials in Dundee and Plymouth indicate that if the UEone could be developed to operate on sloping streets as well as flat or nearly flat streets, then it is estimated that this could double the number of hubs that could be deployed and accelerate the rollout of infrastructure in dozens of towns and cities across the UK. As market adoption of EVs begins to accelerate in the UK, it is projected that the UK's current public infrastructure total of 33,000 chargepoints needs to be expanded to over 500,000 chargepoints by 2030, to serve what is estimated could be 11 million plug-in electric vehicles. It is essential therefore, that all charging use cases are developed. And with 130 million on-street parking spaces in Europe (Qpark) there is strong export potential. Globally, the global electric vehicle (EV) charging infrastructure market, is estimated to be as high as $2.7 trillion to facilitate EV adoption by 2040 (Morgan Stanley). This project therefore is to take our innovative further by designing, prototyping, testing and costing for manufacturing a modified version of the UEone that will achieve this goal.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
EV DOT ENERGY LTD	Advanced grid, billing and asset metering services for home EV charging	£150,405	£105,284
INDRA RENEWABLE TECHNOLOGIES LIMITED		£96,385	£57,831

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
EVs are critical aspect of meeting the UK's carbon budget and will become a highly influential component of the future energy system. National Grid predicts that there will be 11 million EVs in the UK by 2030 and 36 million by 2040, but if EVs are left unmanaged they will cause significant disruption to distribution networks, and inefficient use of green energy sources. Peak demand increases caused by EVs and system stability are also concerns at a national level, however National Grid has stipulated that through 'smart charging technologies, consumers charging at off-peak times and V2G technology, the increase in electricity peak demand could be as little as 8GW in 2040'. ev.energy is partnering with Indra Renewable Technologies to build upon its existing smart charging software platform and smart chargers, and test the feasibility of delivering advanced grid and billing services, and provide services back to energy utilities and system operators.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
RICARDO UK LIMITED	Electrified Propulsion Systems: Digital Twin Based Design and Optimisation	£227,496	£113,748

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Digitalisation is revolutionising the complete product lifecycle: from development and production to testing, in-service maintenance and recycling. "Digital Twin" (DT) technology will bring a significant reduction in electric powertrain development time, cost and risk: through up-front design analysis, optimisation and testing in a virtual environment, without the need for multiple prototypes. At its core, a DT is a representation of any physical product that can be used as testing grounds for monitoring, simulating and optimizing design and operational performance. Ricardo has a vision of a world where we can all live sustainable lives. To realise this, we create products and services enabled by digitalisation and supported by applied innovation.The key objective of this project is to assess the impact of DT techniques on product development. A secondary objective is to evaluate the application of DT to product maintenance in this field. Ricardo will build upon its expertise in powertrain reduced order modelling for real time applications and propose innovative business models for virtual product maintenance. A Digital Twin can consist of three types of sub-models; CAD, Analytical and IoT. In this project, the first focus will be to define DT requirements for each of the key sub-systems within an electrified powertrain. The second focus will be developing Digital Twins for each sub-system that meet these requirements. The third focus is the integration of each sub-system, to create an Electrified Powertrain Digital Twin. This system level Digital Twin will be used, as part of the virtual product development process, in the design and optimisation of the electrified powertrain. Ricardo believe this project will yield three innovations. Firstly, the definition of a Digital Twin for electrified powertrain sub-systems, including model hierarchy, data exchange, historical data management and standardised interfaces. Secondly, simplified models using automatic model reduction, that allow faster interactions when results are required at small time scales. Lastly, the use of Digital Twins as part of a virtual product development process.

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
SNRG LIMITED	Advanced Grid Services Provided by Optimised EV Community and Fleet Charging	£140,660	£98,462
Cranfield University		£59,935	£59,935

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants

* Zero emission cars, vans and fleet vehicles are the future for transport and mobility.
* However, the installation of EV chargers is being severely limited by a roadblock - the risk that widespread EV charging could place excess electricity demand on the grid at certain times causing instability and blackouts.
* SNRG envisions an EV charging solution that dynamically integrates and responds to vehicle, electricity network and third-party input signals to provide a green, low cost and convenient charging system that automatically balances EV charging loads with grid needs.
* The MyMobility platform will integrate a whole-place approach engaging consumers, suppliers and electricity network operators in a sustainable, scalable, business model.
* This feasibility study will identify the technical requirements for a software platform/app for owners and drivers of fleet vehicles (e.g. councils, residential car-shares, rental companies). Fleets represent the majority of vehicles on UK roads (50,000 council vehicles; 585,000 fleet vans; top-10 rental companies manage 365,000 cars) and 50-70% vehicles are expected to be electric by 2030\.
* MyMobility will enable and encourage the electrification of fleets by allowing:
  * More chargers to be installed at fleet sites
  * Fleet operators to use the combined storage capacity of their EV fleets to provide services to the grid - making the grid more resilient.
* By managing and aggregating EV fleet battery capacity it is possible to control a population of EVs with significant storage capacity and predictable charging profiles.
* Fleets will be incentivised to charge at times when renewable energy is abundant and rewarded for shifting their charging patterns away from periods of high grid demand.
* Grid services will be based on the commercial needs of fleet EVs (e.g. delivery schedules, cleaning/maintenance schedules, operator route and rental bookings) and the MyMobility predictive energy management and load balancing tools will ensure that vehicles have suitable charge when they are needed.
* This study will also look at the role MyMobility and EV fleets can play within communities e.g. it will benefit electrification of last mile delivery fleets serving zero emission urban zones and contribute to policy objectives on congestion, CO2 and emissions.
* MyMobility could encourage the emergence of residential EV fleets providing a Covid19 community-based alternative to car ownership now home working is more prevalent. Residential fleets can improve mobility access in urban areas where transport funding has been reduced, and include younger drivers excluded from driving by the cost of insurance.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Innovate UK

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Competition Code: 2006_ISCF_CRD_MMM_DER_S2

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
OXFORD DIRECT SERVICES TRADING LIMITED	Ox Gul-E	£142,362	£99,653
Oxfordshire County Council		£60,580	£60,580

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
Over eight million households in the UK (30%) are unable to access the governments Electric Vehicle Home-Charging Scheme as they do not have access to private off-road parking. Providing alternative access to EV charging for people who must park their car on the street is critical to the UK's transition to electric vehicles (EV). Current on-street EV charging infrastructure is complex, time consuming and costly to install and manage; street clutter, costly electrical and data connections and maintenance create a weak business case for investment and limited choice for local authorities and consumers. Our project seeks to radically depart from the existing market offering with a disruptive and simple approach which has not been deployed before. Our experienced team will build on a concept piloted in the Go Ultra Low Oxford Project to develop a design and prototype for a purpose built 'cable gully', which can be used to safely transit an EV charging cable from a home charger to EV an parked at the kerb, allowing the user to use their home energy supply to charge their car. We are not aware of this approach being pursued elsewhere in the UK or internationally. The proposed solution is an example of disruptive frugal innovation; requiring reduced capital outlay and on-going revenue for maintenance while simultaneously enabling more households to be part of future the future smart energy system through allowing EVs to act as home energy storage when bi-directional charging is available. Our solution empowers those who park on the street with greater choice by providing access to the healthy home charger market, and supports local authorities with a sustainable option for providing on-street EV charging access. The project team will also explore a novel sustainable business models together with developing the processes and policies to allow for providing this solution across Oxfordshire and further afield, whether through local authorities; or in partnership with the home charger market. Oxford Direct Services (ODS) will take the lead on gully design and installation together with business model development. Oxfordshire County Council (OCC) will examine how the solution can be offered to residents as efficiently as possible and the policies/processes required to achieve this. This project will move the cable gully solution from 'proof of concept' stage into a position where deployment can be piloted on a larger scale; either with the support of further innovation funding, or through private investment.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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Total available funding is £10.4 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
SAMUEL TAYLOR,LIMITED	Innovative EV bus bars (EVBus)	£94,917	£56,950
TWI LIMITED		£39,916	£39,916

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project aims to establish the feasibility of developing a process that STL can use to manufacture multi-material connectors for both the electrification and power supply markets. Currently these materials or connectors are not available from any UK source and it is doubtful if they are available from any European producer at the sizes and volumes STL hopes to make. In the ZEV sector, material circa 2mm thick is required and this technique could also allow for different thicknesses to be developed. Aluminium is considerably lighter than copper and sufficiently conductive for major parts of the circuit. Copper generally is needed for cell battery terminations but not for bulk current carrying. EVs have up 7000 cells per unit, the halving of the number of welds needed by the use of pre-bonded material would give considerable reliability and cost benefits when considering the alternatives. Laser welding and wire bonding are used in the EV sector and known to have a number of constraints including poor reliability, the less joints there are the more reliable the product, and the lighter the better. As far as is known this technique is not practiced by any competitor in this specific field. Variations of the technique are known of in the USA and Europe but this proposal of integral bonding and further processing within one facility is believed to be unique. TWI have some experience in this field but have not yet bonded aluminium to copper and are not the producer of end products. If feasibility can be proven and that a real market exists then STL will be able to invest in facilities and development of a more hygienic industrial scale process. STL has actual business within the ZEV sector with a customer using stamped mono-metal busbars for a hypercar project and serious interest from others within the startup and prototype market. From there leverage can be used to address the market for mainstream applications within Europe.

Results of Competition: Catalysing Green Innovation: Strand 2: Securing the Future of ZEV

Competition Code: 2006_ISCF_CRD_MMM_DER_S2

Total available funding is £10.4 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
HYPERVOLT LIMITED	Feasibility Study: The Smart EVSE Franchise (Em)powering Global Charge Networks	£108,052	£75,636

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The global EV market is at a tipping point, expected to be worth $602.8bn by 2025 (Markets&Markets). From 7.2m vehicles and 2m sales in 2019, IEA (2020) forecasts 11-22x growth to 23-43m sales and 130-250m cumulatively in 2030\. There were 7.3m charging points globally in 2019, expected to reach 15m by 2022 (Markets&Markets 2019). UBS (2018) estimates £280bn will be spent by 2025 to build global charging infrastructure and, critically, that to do this cost-effectively the range of technologies must be limited and standardised for user experience and avoided redundant/recurring R&D spend. Hypervolt launched in 2018 and deploys the UK's most advanced smart home charger specifically designed for energy system services. Hypervolt now plans 6-month feasibility study into a technology to create substantial efficiencies in the global EVSE value chain, helping the business expand globally without requiring a physical presence. In terms of impact on ZEV, the technology could monetise supply chain efficiencies worth an estimated £11.2bn globally by 2025 at full market penetration, and will facilitate truly smart EV charging and V2G networks that could save £3.5bn annually in the UK alone by 2050\. Smart charging networks will unlock the cost-effective addition of 80GW wind and 54GW solar to achieve 56% renewable penetration while decreasing electricity costs and accelerate EV adoption towards Government's 100% by 2035 target. Key challenges warranting investigation in a feasibility study are: implementation cost, software requirements (scalability), supply-chain logistics, viability (profitability, competition), and commercial model.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SUNAMP LIMITED	HEV waste heat recovery system	£176,368	£123,458

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Project description - provided by applicants
Sunamp designs, develops and manufactures phase change material (PCM) based thermal energy storage devices that can store heat and coolth for many days. We call these devices heat batteries. They have been successfully deployed on residential and commercial housing schemes for more than five years and are now being used to address thermal management challenges on vehicles. Battery electric (BEV) and hybrid electric vehicle (HEV - in electric mode) range is comprised in cold conditions, up to 50% in temperatures down to -30ºC. Typical best in class HEVs (cars and vans) only achieve between 29-35 miles (NEDC), winter will significantly impact that range. This application looks at the challenge of maintaining HEV cabin heating when the engine is off. Doing so will extend range but also reduce emissions in this mode, as the IC engine is off, and the cabin heating is only powered by the HV battery, quickly depleting the limited stored energy. When this happens and the IC engine has cooled off below the stop start threshold, the IC engine restarts, giving an emissions spike as it slowly warms up. The emissions are less the quicker the engine gets back to optimal temperature, and this was proven in two NVN funded projects completed in 2017 and 2019\. Both these projects showed that we could significantly reduce hybrid electric double decker bus cold start emissions (around 50%) and maintain engine temperature and cabin heating throughout the TfL low emission bus test cycle. Waste heat was captured from the engine coolant, in this feasibility study we will investigate the improvement by capturing high grade heat from the engine exhaust gas stream. Sunamp has teamed up with IAV, a leading automotive engineering consultancy, to stabilise the high temperature PCM needed for this application; simulate the impact of adding heat battery sub system into the vehicle cabin heating system; designing a concept that could feature in a future R&D programmes and develop the business model to best maximise the market opportunity.