

# Innovate UK

**Results of Competition: Innovation in Vehicle-to-Grid (V2G) Systems: CR&D**

**Competition Code: 1705\_CRD\_TRANS\_V2G**

**Total available funding is £4m from BEIS and OLEV**

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

<b>Participant organisation names</b>	<b>Project title</b>	<b>Proposed project costs</b>	<b>Proposed project grant</b>
<b>DYNEX SEMICONDUCTOR LIMITED</b>	Universal modular Vehicle-to-Grid bi-directional on board charger with SiC technologies	£617,777	£308,889
University of Cambridge		£211,773	£211,773
<b>Project description - provided by applicants</b>			
<p>BEV/PHEVs provide a number of advantages including superior driver comfort and lower emissions. However, there are a number of technical challenges which still impede their widespread adoption, such as the unexpected and unbalanced load on the grid, and cost and range anxiety. Therefore, power suppliers and automotive manufacturers are working towards V2G technology to reinforce the reliability and capability of the grid, enable end customers to reduce overall BEV/PHEV cost with V2G paybacks, and provide faster bi-directional charging capabilities to alleviate the range anxiety. In this project we will develop a novel universal modular on board charging system implementing the single-phase and three-phase bi-directional charging at a reasonable cost. This new technology will enable the BEV/PHEV charging systems to achieve V2G capability with reduced volume, maximised commonality while addressing concerns of reliability, fault protection and operating in the severe automotive environment with high efficiency. This will provide the vehicle manufacturers with V2G on board charger to install within their vehicle and so encourage the uptake of electric vehicles. Developing high efficient bi-directional OBC is challenging due to the new requirements of bi-directional power factor correction and soft switching, etc.. This project will develop a superior OBC by implementing advanced devices, packaging technology, and control method to push the envelope beyond the state-of-the-art.</p>			

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<b>NORTECH MANAGEMENT LIMITED</b>	Vehicle-to-Grid Intelligent control (VIGIL)	£307,105	£184,263
Aston University		£276,215	£276,215
BYTESNAP DESIGN LIMITED		£132,549	£92,784
GRID EDGE LIMITED		£209,526	£146,668

### **Project description - provided by applicants**

The UK Government recently announced it will end the sale of new conventional diesel and petrol vehicles by 2040. This implies the future of cars and vans in the UK is electric. Electric Vehicles (EVs) contain batteries that are charged to store energy and then discharged to provide energy for the cars' operation. In Vehicle-to-Grid / Vehicle-to-Building (V2G/V2B) operation, the EV batteries are discharged not to operate the vehicle but to return energy stored back to the grid or to meet the building's energy demand. This project will provide a robust communications and control platform (VIGIL: Vehicle-to-Grid Intelligent control) that supports different V2G/V2B charge-points while ensuring distribution network voltage and/or thermal limits are not breached. Our solution will achieve this by actively managing the network constraints at the connected substations, optimising assets (such as V2G charge points, EVs, buildings, car parks with V2Gs), and monetising energy flexibility via V2G/V2B. The platform will ensure fast response time required for integral grid operation and support the existing electricity distribution infrastructure for increasing low-carbon technologies such as wind turbines and solar PV. We will investigate battery-life performance and inverter power quality issues during V2G and Grid-to-Vehicle (G2V) operations. When large numbers of EVs require connection to the distribution network, the DNOs' significant network reinforcement costs are averted via the active network management component of our solution. Thereby reducing DNOs network operational costs and UK energy customers' electricity bill: ~15% of the electricity bill is paid to DNOs to operate, maintain, and upgrade the network [ENADistribution Charges Overview]. Our solution also addresses the concern of EV/charge-point infrastructure owners (via price incentives and piece-of-mind charging enhanced by a V2G mobile app). Addressing the concerns of DNOs and EV/charge-point owners is vital for V2G technology adoption. The adoption of V2G technology and increased uptake of EVs will help the UK reduce energy costs, carbon emissions, and move towards a low-carbon network with secure electricity supplies for our energy demand. By 2040, at least 5GW of additional peak demand will be required by the UK to meet EV charging demands [National Grid's Future Energy Scenario]. To meet this future requirement, the VIGIL platform will include a communications adaptor that allows seamless integration of different V2G charge-points together for aggregator services.

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<b>ROLEC SERVICES LIMITED</b>	V2G Rebound - Renewables bound for the grid.	£1,130,171	£678,102
CENEX (CENTRE OF EXCELLENCE FOR LOW CARBON AND FUEL CELL TECHNOLOGIES)		£252,865	£252,865
<b>Project description - provided by applicants</b>			
<p><b>**Did you know that owners of electric vehicles can receive an additional revenue from energy companies while reducing their own carbon footprint even further?*</b> Users of Rolec's V2G Rebound system can earn money just by allowing energy companies the use of their pre-generated, stored power, during the times that the energy company needs it and the EV owner does not. Rolec's new innovative solution is channelled through the company's already massively popular WallPod EV charging unit - allowing users to combine their energy storage and power generation systems within this one device. V2G Rebound also enables users to rest easy in the knowledge that, for example, the solar power they have generated is helping to charge their vehicle or battery storage system as required. In addition, any excess energy that they have stored can be released to the Grid as and when they have agreed to it being provided. This is a win-win situation for every end user - V2G Rebound ultimately empowers them to not only gain cheaper energy usage rates, but also provides them with a new revenue stream to boot!</p>			

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UPSIDE ENERGY LTD	V2Street	£353,492	£247,445
Durham County Council		£4,624	£4,624
E-CAR CLUB LTD		£151,191	£75,596
EDF ENERGY R&D UK CENTRE LIMITED		£111,678	£55,839
FUTURE CITIES CATAPULT		£0	£0
Imperial College London		£179,941	£179,941
Loughborough University		£185,313	£185,313
Southend on Sea Borough Council		£59,441	£59,441
ubitricity Gesellschaft für verteilte Energiesysteme mbH		£399,436	£279,605
UK POWER NETWORKS HOLDINGS LIMITED		£34,750	£0

### **Project description - provided by applicants**

40% of UK population live in urban environments without access to off-street parking, so cannot install home Electric Vehicle (EV) chargers. If these people cannot access on-street charging infrastructure, we will not hit national targets for EV uptake and electrification of transport. Charging infrastructure suffers from a chicken-and-egg problem: people won't buy EVs if they cannot see that infrastructure is available, and local authorities won't install infrastructure if they cannot see demand for EVs. V2Street explores routes to break this deadlock by developing a novel consumer value proposition that uses flexibility in V2G-enabled charging to provide demand side response (DSR) services to the energy system. We estimate V2G can provide significantly more revenue from these services than unidirectional charging. Our objectives are to use this value stream to create an integrated consumer proposition. Residual revenue from DSR services then supports investment in charging infrastructure. To develop this integrated proposition, we will define a range of consumer propositions and business models based on modelling of revenue that DSR flexibility can create. We will test these propositions with consumers, analyse their impacts on energy system and urban infrastructure, and develop prototypes of an integrated chargepoint-EV-cloud system to deliver the services. We will then undertake a second, focused phase of consumer research using these prototypes. This will provide robust data on technical performance and consumer acceptance, positioning us to develop future, larger-scale trials. V2Street's vision is to break the chicken-and-egg deadlock, triggering a virtuous circle" of infrastructure investment and EV uptake. V2Street will give confidence to energy system stakeholders (suppliers, distribution network operators (DNOs), National Grid) to develop service requirements that exploit the flexibility of V2G. This in turn will give confidence to participants in chargepoint supply chains to invest in charging infrastructure. The V2Street consortium covers two complete supply chains, from vehicle manufacturer to chargepoint operator, local authority and consumer, and from consumer to energy flexibility aggregator, DNO and supplier. It combines highly innovative SMEs at key points in the supply chains with large companies with the depth of resources needed to support exploitation at scale. Major academic institutions ensure we gather robust consumer research and solid evidence to frame transport and energy policy to address this key challenge to EV uptake.

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<b>GENGAME LTD</b>	GenDrive : Gamification for consumer engagement in V2G services	£191,885	£134,320
ECOTRICITY LIMITED		£40,200	£20,100
ENAPPSYS LTD		£70,179	£49,125
Newcastle University		£75,750	£75,750
NORTHERN POWERGRID (NORTHEAST) LIMITED		£0	£0
<b>Project description - provided by applicants</b>			
Research and development into the use of gamification (competitions, games and virtual rewards) and other methods to engage ULEV owners with V2G technology and incentivise behaviours such as the discharging/charging of their EV batteries to support the energy system.			

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