Innovate UK

Results of Competition: SBRI: Tackling Non-Exhaust and Non-Road Vehicle Air Pollution

Competition Code: 1811_SBRI_AIR_POLLUTION_P1

Total available funding is £300,000

Participant organisation names	Project title	Proposed project costs	Proposed project grant
ENSO Tyres Ltd	ENSO - Sustainable, Low-Emission Tyres for Improved Air Quality	£49,555	£49,555

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
ENSO Tyres Ltd (ENSO), hosted by the Jaguar Land Rover InMotion Ventures Incubator in London, is spearheading a consortium of industry leading organisations including Renault, ARRIVAL, Gnewt, E-Car Club, Heathrow Airport, TARRC, Gnosys and Emissions Analytics, seeking to disrupt the tyre manufacturing industry. The consortium proposes to develop an innovative range of tyres that align with the unique characteristics of Electric Vehicles (EVs) to deliver improved EV performance whilst simultaneously reducing the environmental and air quality impact of tyre wear. ENSO's tyres will be made from advanced raw materials that are environmentally friendly, greatly reducing the quantity and toxicity of harmful particulate matter (PM) emissions that current tyres release. This two-stage project (Phase 1 & 2) will directly target tyre emissions, one of the four non-exhaust emission sources of PM (others being: brake wear, re-suspension and road surface wear), utilising innovative compound development techniques and sustainable materials. Tyres are one of the largest contributors to traffic emissions, releasing significant quantities of toxic PM, causing harm to both the environment and human health. In addition, the project will deliver methodology for measuring tyre wear under real-world conditions addressing the shortcomings of laboratory-only approaches and delivering a standard for measuring tyre emissions. ENSO's mission is to significantly reduce harmful chemicals in the environment by delivering cleaner and more energy-efficient mobility. The company was founded to drive innovation in the tyre industry by developing disruptive products to fill underserved market niches. ENSO's tyres have been developed following extensive research, development and testing of novel materials leading to successful prototype testing with Renault. The proposed project will build on this development to refine ENSO's innovative tyre technology with a focus on increasing tyre durability to reduce PM emissions and improve air quality. ENSO's unique business model, supports this innovation and incentivises wide scale adoption of its tyres, providing a strong value proposition and minimising the environmental impacts. This Phase 1 feasibility study will deliver outputs required to implement a Phase 2 project, including finalising testing methodology to measure tyre emissions. The Phase 2 project will see the further development and real-world testing of ENSO's high-durability tyres with numerous leading EV partners, delivering tyres with significantly reduced emissions, both in terms of PM volume and toxicity. The EV market is the fastest growing automotive niche; forecast to reach ~10m plug-in vehicles worldwide by 2021, creating an addressable tyre market worth £5bn; a significant opportunity for suppliers who can dynamically react to the market opportunity.

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University of South Wales	Food Transport Refrigeration with Engine Exhaust and Metal Hydride Reactors	£46,639	£46,639

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Project description - provided by applicants
Title: Food Transport Refrigeration with Engine Exhaust and Metal Hydride Reactors. Abstract: Conventionally, food transport refrigeration is driven by the vehicle's engine itself or by a diesel genset; the refrigeration cycle almost universally used is the vapour compression system (VCS), with the working fluid usually a HFC (eg R404a) with a relatively high global warming potential. VCS needs electrical power, which increases vehicle fuel consumption, and CO2, NOx and PM emissions, significantly. In the face of higher fuel costs (reductions in the tax rebate on the "red" diesel used in gensets are anticipated) and increasingly strict regulations on NOx and PM emissions, particularly in urban areas, a more efficient, lower emissions food transport refrigeration system is therefore needed. In this feasibility study, a new, largely heat driven refrigeration technology will be designed, simulated and optimised, for prototype development manufacture and tests in the next stage. As the efficiency of the diesel genset is about 30%, about 50% of the waste heat will meet the typical semi-trailer refrigeration demand. The technology is a metal hydride system (MHS), with two pairs of metal hydride (MH) reactors, one pair with high temperature hydride and the other with low temperature hydride. The MHS operates in two half cycles. In each, heat from the genset or vehicle engine exhaust heats one of the high temperature MH reactors, which desorbs hydrogen (H2) from the hydride, at high pressure and temperature. The H2 flows to one of the low temperature reactors, where it is absorbed at lower pressure and temperature, and heat is released to ambient. Meanwhile, heat is absorbed from the refrigerated space by the second low temperature reactor to produce coolth, and H2 is desorbed at low pressure and temperature. The desorbed hydrogen is then absorbed by the second high temperature reactor at reduced pressure and medium temperature, and releases heat to the ambient. In the second half cycle the roles of each reactor are reversed, and continuous refrigeration is produced on a 10-20 minute cycle. Compared to the VCS, the MHS will reduce fuel consumption and the associated CO2, NOx and PM emissions by a targetted minimum of 50%, use a low global warming potential working fluid (H2), have fewer moving parts and lower maintenance costs, and be lighter and smaller. H2 is stable at high temperature, non-toxic, cheap, inert to materials of construction and can be handled safely. The challenges of developing a commercially viable MHS include choice of metal hydride, low heat transfer coefficients during metal hydration and dehydration processes, and complicated controls for continuous system operation. These challenges will be addressed in this project, particularly by the use of metal additive manufacture (MAM) in the design and close integration of the reactor components, including heat pipes for the high temperature reactors, and in the optimisation of geometries and dimensions of the heat transfer components. . Some essential design and operating conditions for conventional food transport refrigeration will be obtained from industrial partners so that the prototype to be developed in Phase 2 can be applied in practice. With the support from industrial partners, the product route to market will be defined and demonstrated.

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RL Capital Limited	Auto-Align - Reduction of tyre and road wear through wheel alignment monitoring	£49,174	£49,174

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Project description - provided by applicants
Auto-Align delivers real time on-board wheel alignment monitoring for road vehicles. More than 1/3 of all vehicles on today's roads are misaligned. Without the current delay in correction, owners and operators will enjoy more than 10% in fuel savings and 15% extended tyre life, with a consequential 7-17% annual reduction in damaging plastic (organic and inorganic) airborne particulates emitted from their vehicles.

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Oak Technical Services (OakTec)	CAGE Clean Air Gas Engine	£47,640	£47,640

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Project description - provided by applicants
The CAGE project (Clean Air Gas Engine) brings together the gas engine development expertise of project lead OakTec with leading industrial partners Jaguar LandRover (JLR) and Autocraft Drivetrain Solutions. With further support from Calor/SHV Energy, who will provide innovative bioLPG fuelling solutions, industrial engine supplier EP Barrus, and Kings College London (KCL) to assess and monitor air quality benefits, the project builds on five years dedicated research into efficient, low emission industrial gas engines by OakTec. The project applies Oaktec's IP in low emission gas engine combustion and control to JLR's state of the art Ingenium automotive engine platform, and optimises its performance to suit a range of industrial applications used in the construction industry. The CAGE product will be integrated into Non Road Mobile Machinery (NRMM) typically powered by red diesel engines on construction and demolition sites. Its benefits will be demonstrated in these working environments with a focus on use in dedicated low emission areas such as London's Ultra Low Emission Zone. The demonstration will include a bioLPG generator manufactured by UK OEM Sutton Power Engineering, to provide energy for construction site welfare cabins and a bioLPG fuelled dumper truck.(TBC) The inherent low emission benefits of gas fuels are well documented with natural advantages in output of NOx, and harmful particulates when compared with diesel engines. Diesel engines however have perceived advantages in ease of refuelling with low cost fuel, and fuel efficiency when compared to other engine types, making them very attractive to the construction sector. The CAGE project fully addresses these issues to offer a cost competitive, ultra low emission gas engine product with easy refuelling and competitive fuel costs. Fuel efficiency and emissions are addressed by harnessing the many inherent benefits and technologies in the JLR Ingenium engine that give it class leading automotive performance, and introduces the OakTec innovations in industrial gas engine fuelling, operational control and combustion, including strategies that all but eliminate NOx emissions. Parallel activity by the innovation group at Calor UK will develop and supply on-site fuelling solutions exactly tailored for ease of use by the customer, based on a 'Mother and Daughter' system whereby a bulk tank is delivered to the site with systems to enable safe refuelling to smaller, machine-specific storage tanks. This benefits the customer by enabling purchase at a wholesale LPG cost that is currently lower than red diesel. By adopting Calor's new bioLPG product CO2 emissions can be further reduced by up to 80%. EP Barrus, Europe’s leading supplier of industrial engines, are supporting OakTec in taking their new gas engine products to market, and in the CAGE project will work with selected OEM's to support the integration of the new gas engine into their machines. KCL will assess the emission reduction potential of the CAGE product on NRMM fleet emissions using a range of scenarios based on technology penetration into different engine sizes and machinery types. This will be based on a unique emissions inventory already developed on NRMM fleet location, activity and measured real world emission factors and offers the opportunity to optimise technology design from a clean air perspective.

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EDrive Engineering Services Ltd	SHIELD: Series Hybrid Intelligent Electric Loader Drive	£50,000	£50,000

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Project description - provided by applicants
The Series Hybrid Intelligent Electric Drive (SHIELD) project will develop the world's first single-speed series hybrid powertrain for front loaders used in the construction and mining industries, drastically reducing harmful emissions from this class of Non-Road Mobile Machinery (NRMM).

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Hubl Logistics Ltd	Cool Run: Hubl's solution to multi-temperature last mile delivery	£50,000	£50,000

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Project description - provided by applicants
The Cool Run system optimises the handling of food through a novel insulated pod system, which controls the temperature of individual unit loads. The system reduces vehicle cold air losses through door openings and retains the refrigerated air during multiple drops on the last mile delivery run. The pod system maintains the product at optimal temperatures so preventing thermal gain and product going above the legal temperature requirements. The reduction in thermal gain due to the breaks in the cold chain is avoided between storage locations, transport modes, delivery vehicle and final destination, so reducing the energy required to re-cool the products. Retention of product integrity and security, along with handling efficiencies will also contribute to the commercial viability of the concept. Cool Run is a concept for a temperature controlled product containment system for the transport of food and pharmaceuticals; it has the potential to reduce emissions from mobile refrigeration units, vehicle brakes, road surfaces and overall emissions relating to urban transport for last mile deliveries. The Cool Run project is applying a whole system approach to mitigate these issues by the combination of best in class technologies and the introduction of a new innovative unit load containment device which is the focus of the project. These combined technologies will enable urban delivery networks to operate in a significantly more efficient manner. The challenges related to multi-temperature food deliveries in urban areas are significant; mobile refrigeration system related, poor vehicle payloads and the impact on drivetrain selection. Demand for urban deliveries is growing expediently due to the demand for grocery home delivery, convenience store fulfilment and the booming restaurant and foodservice market. These trends are increasing in a less efficient model of food distribution as individual delivery units' sizes declines. These trends and associated issues represent a significant market opportunity which the Cool Run system addresses. The system provides a generic solution for both home and commercial deliveries. Most technology developments relating to mobile refrigeration and other vehicle emissions reductions have focused on specific vehicle-related components,e.g. improve chiller technologies. Emissions are not only created by the technology used but how they are used. Inefficiencies within the existing logistics system significantly contribute to the issues, e.g. Regular and prolonged opening of chiller box doors, sorting and picking activities on the vehicle extending dwell time, poor delivery sequencing, the distance between drops, stem milage to drop zone. Ineffective unit load containment, mixed systems-pallets, cages and loos-stacked products all resulting in poor load density and overall vehicle fill.