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LC Super Hybrid to represent the UK in European Business Awards for the Environment

Controlled Power Technologies (CPT) and the European Advanced Lead-Acid Battery Consortium (EALABC) have received further recognition for their commercial development of affordable low voltage hybrid vehicle technology - as demonstrated in the low carbon LC Super Hybrid programme. Competing with other outstanding British organisations, they have been chosen by the RSA Environment Awards Forum to be one of 12 UK finalists to be submitted for the prestigious European Business Awards for the Environment (EBAE).

"The UK assessors were impressed by the combination of two extremely innovative technologies providing a much cheaper alternative to current offerings with clear replication potential," said Dr Malcolm Aickin, chair of the RSA Environment Awards Forum, referring to the potential universal application of the technology to the 100 million vehicles per annum that will be produced from 2020 onwards, which would reduce annual CO_2 emissions by 100 million tonnes globally. "The UK finalists are 'the best of the best'; the most far-sighted, responsible and innovative companies from across the country."

"Our highly controllable switched reluctance motor-generator technology is applicable to a wide range of vehicles produced by car, bus and truck manufacturers," said Nick Pascoe chief executive of CPT who received the award on behalf of the shareholder-employees and other shareholders backing this SME technology developer. "We are particularly excited by the potential of 48V hybrids, which significantly reduces CO_2 emissions for each vehicle, enabling them to meet the legislated fleet average 95g/km requirement by 2021."

"For the motorist the technology delivers a significant improvement in fuel economy for a premium of less than €1,000. This is significantly less than the additional cost of high voltage hybrids, which typically add €6,000 to €8,000 to the retail price. And it's less than one-tenth

the premium for plug-in hybrid and battery electric vehicles, which can add €12,000 to €15,000."

"The LC SuperHybrid programme has enabled us to validate the benefits, including both fuel economy and driver enjoyment, and push the assumed boundaries of intelligent electrification applied to the state of the art in internal combustion engines".

EALABC project coordinator Allan Cooper said: "The EALABC is similarly delighted to receive this recognition for its high power density lead-carbon battery breakthrough, which is ideally suited to this new breed of affordable low voltage hybrids. Ironically, the leap forward we've achieved in energy storage uses carbon to significantly enhance the performance of lead-acid batteries, which have the additional advantage of already being the most recycled product on the planet."

The LC Super Hybrid programme demonstrates to the global automotive industry a low cost approach to affordable hybrid vehicles, deploying two major technology breakthroughs. The combination of switched reluctance motor-generators and advanced lead-carbon batteries enables low voltage electrification of the powertrain below the safety critical 60 volt threshold.

By 2020, this low voltage approach could be applied to 50 million new vehicles per annum – essentially enhancing those vehicles already expected to have a basic stop-start capability and encouraging further aggressive engine down-sizing. The increased functionality combined with sophisticated energy management available at 48 volts, compared with 12 volts, would allow global vehicle manufacturers to reduce the carbon footprint of a typical family saloon by 50g of CO_2 per kilometre – that's around 12 tonnes of CO_2 saved during the lifetime of the vehicle.

Universal application of the technology to the 100 million vehicles per annum that will be produced from 2020 onwards would reduce annual CO_2 emissions by 100 million tonnes globally per annum (50g/km x 20,000km average annual mileage per vehicle x 100 million vehicles).

The 12V and 48V LC Super Hybrid demonstrators represent the culmination of more than a decade of research and development into lead-carbon battery technology by the international ALABC and almost 15 years of research in switched-reluctance motor-generators by CPT – a venture capital spin-out from Visteon, itself originally part of Ford, who started the research in the UK.

Now at a high level of commercial readiness the LC Super Hybrid technology is helping to validate this innovative low voltage approach to electrical boosting and efficient energy recovery by showing vehicle manufacturers the significant fuel economy benefits and CO_2 reduction that can be achieved on today's baseline.

The first vehicles to feature this smart hybridisation of the powertrain, which transforms a downsized internal combustion engine into a highly efficient high performance power unit, are expected to make their showroom debut from 2016 onwards.

About the EBAE awards

The LC Super Hybrid programme was nominated for the biennial EBAE competition by the UK's Low Carbon Vehicle Partnership, which had previously selected CPT and EALABC as winners of the LowCVP Low Carbon Champions Awards. The award was presented in the category for 'Low Carbon Innovation by an SME', which is open to small and medium sized enterprises such as CPT and institutions such as the ALABC research consortium. The LowCVP Low Carbon Champions Awards, which celebrate outstanding practice in accelerating the shift to lower carbon vehicles, are an RSA accredited scheme and its winners are eligible for entry into the EBAE awards.

The EBAE awards are an indication of businesses' strong interest in taking care of the environment and increased awareness of the benefits this offers. Companies of all sizes or sectors can nominate their projects by first taking part in national award schemes, which in the UK are accredited by The Royal Society for the encouragement of Arts, Manufactures and Commerce.

The European Business Awards for the Environment recognise outstanding, new or innovative contributions to sustainable development and the UK finalists will compete for a prize against winners from 28 other countries on the European stage.

The 12 UK entrants for Europe were selected from the winners and runners up of six of the 13 RSA Accredited award schemes. RSA Accreditation is only achieved by a select number of environmental and sustainable award schemes, who demonstrate the high standards expected by the RSA's Environment Awards Forum.

The biennial EBAE is comprised of four award categories in which companies are rewarded for; outstanding new or innovative management practices, products, processes and international co-operation activities which contribute to economic and social development without detriment to the environment. The LC Super Hybrid programme was nominated as one of four finalists in the product category. Other automotive industry and transport related nominees include Transport for London (TfL's commitment to sustainable travel) in the management category and Cynar Plc (End of Life Plastics to Usable Liquid Fuels) in the process category.

All 12 UK entrants will now go forward to the European finals, to be held later this year.

Ends

CPT/EALABC media contact: For a test drive of the LC Super Hybrid demonstrators or to request a media interview with Allan Cooper or Nick Pascoe, please contact Rob Palmer on +44 7768 242761 or email: rpalmer@palmerpr.com

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Notes to editors about the LC Super Hybrid technology

The state of the art in affordable CO_2 reduction was unveiled at the 2012 Geneva Motor Show, where the 12V LC Super Hybrid made its world debut helping to define a new class of low carbon hybrid vehicles – hence the 'LC' nomenclature.

This initial demonstrator represented the first cooperation between technology developer CPT and the EALABC, an international research group headquartered in London.

This cooperative development has since produced the world's first 48V hybrid. This second demonstrator made its debut at the 2013 Vienna Motor Symposium – placing CPT and EALABC in the vanguard of a new 48 volt standard proposed by the VDA and supported by leading German carmakers.

The 48V LC Super Hybrid provides an ideal compromise for performance and cost in the development of a new generation of affordable low carbon super fuel efficient vehicles. With global CO_2 emission targets rapidly converging on the 95g/km EC requirement by 2021, the auto industry has less than a decade to achieve another 25 per cent reduction to meet an indicative 70g/km by 2025 - putting pressure on automakers to come up with innovative and affordable technical solutions.

"Electric torque assist and energy recuperation are the key to solutions the motorist can afford and this has caused the industry to re-visit the previously mooted higher than 12 volts, but less than 60 volts, electrical architecture," says Pascoe. "Low voltage electrification deploying a nominal 48 volt standard – with an operating voltage between 24V and 54V - will be a major factor for enabling the required motor-generator efficiency and power levels."

The additional cost to the motorist to achieve the required 25-30 per cent reduction in CO_2 emissions is significantly less than the tax breaks and other incentives provided by more than

half of EU member states for electric vehicles. These subsidies are deemed necessary because of the high cost of batteries and an EV price twice that of a car with an internal combustion engine. The universal introduction of LC Super Hybrid technology with CO_2 emissions comparable to an EV but at half the retail price would eliminate the need for subsidies.

Both demonstrators include production-ready technology already sold by CPT to Valeo; becoming the first automotive component supplier to offer carmakers a range of electric superchargers to boost downsized engines.

Based on a 1.4-litre VW Passat – currently the European market leader in this sector and considered a world class industry benchmark for fuel economy in a full size family saloon - the LC Super Hybrid demonstrators are providing carmakers with real world validation of the technology.

Following a tour of European carmakers, both demonstrators were recently shipped to the US for the SAE Congress in Detroit where they were driven by more carmakers.

Innovative elements of the switched reluctance technology uniquely distinguish it from the permanent magnet electric motors currently produced for the auto industry, which use extensive amounts of rare earth metals. In a high voltage hybrid the traction motor alone needs at least a kilogram of neodymium, raising issues of availability, price volatility and end-of-life recyclability.

Super durable switched reluctance machines replace these magnets with superfast electronic switches and clever software. The applications include electric supercharging, motor-generators for torque assist and kinetic energy recovery, as well as turbine integrated gas energy recovery systems.

Lead-carbon batteries are also highly durable and will similarly outlast the vehicle. They are 100 per cent recyclable using existing facilities, and have simple electronic and thermal management systems compared with more expensive NiMH and Li-ion batteries.

Electric supercharging enables the 1.4-litre engine in the demonstrator vehicles to be recalibrated, increasing power and torque such that their performance is comparable with VW's bigger 1.8-litre engine.

This results in the 12V car approaching diesel levels of fuel economy and CO_2 emissions with a 7-8 per cent improvement over a baseline that is already best in class. The 48V car already demonstrates a 13 per cent improvement with the promise of more to follow with further recalibration.

Drivability is also improved, which is highly desirable. Compared with the equivalent performance 1.8-litre VW model, the 12V car shows an economy improvement of 19 per cent, and when compared with a 2-litre naturally aspirated vehicle the emissions were 26 per cent lower.

Environmental benefits

Switched reluctance machines not only eliminate the need for rare earth materials, but also are uniquely suited to torque assist and energy recovery - enabling the industry to downsize its petrol and diesel engines reducing the bill of materials and production costs.

SR machines have been validated for 1.2 million stop-starts, compared with 30,000 for a conventional starter motor and up to 300,000 for first generation stop-start systems. So they can save a lot more energy during the critical in-use phase, which accounts for 80 per cent of the energy used by conventional vehicles, compared with 20 per cent for their production and end-of-life recycling.

CPT is the first to set this new standard certifying its belt-integrated starter-generator for continuous use throughout the lifetime of the vehicle. Requested by leading carmakers, this new standard is highly appropriate for a new breed of low voltage hybrids.

ALABC test programmes similarly demonstrate that lead carbon batteries can also last the lifetime of the vehicle in micro-mild hybrid applications. They have excellent charge and discharge characteristics, with the carbon-enhanced negative plate formulations dramatically improving life under this duty cycle.

Switched reluctance and lead-carbon technologies also avoid wasting energy as much as they avoid material waste. The 2010 Argonne Life Cycle Analysis of different battery technologies revealed that the energy required to manufacture lead-acid batteries is less than one-sixth (15-17 per cent) that of NiMH and Li-ion batteries, and that the CO_2 emissions are less than a quarter (22-25 per cent) of these far more expensive alternative battery chemistries.

The 2014 PE International Life Cycle Analysis concluded that the overall environmental footprint of a lead-acid battery is negligible compared with the manufacture of the whole vehicle and more than offset by the lower fuel consumption and CO_2 reduction of low voltage hybrids.

Lead is by far the most recycled of all metals. In many parts of the world lead-acid batteries are 100 per cent economically recovered in virtually emission free facilities and recycled directly into new batteries – unlike Li-ion batteries. And while NiMH batteries can be recycled, they cannot be recovered into batteries.

“Electrification at 48V is a rapid growth area for the industry,” says Pascoe. “It delivers the desired reduction in fuel consumption and avoids the need for high cost safety features and large battery packs.”

Demonstrating CPT and EALABC’s ongoing commitment to low voltage hybrid technology is the Advanced Diesel Electric Powertrain project known as ADEPT, which aims to meet legislated CO_2 emissions anticipated to be 60-70g/km by 2025. This will be a major achievement as it’s comparable to the well-to-wheel CO_2 emissions of a pure EV when the grid electricity comes from renewable sources, and half the emissions when supplied by coal fired power stations.

Notes to editors about Controlled Power Technologies

CPT is an independent, clean-tech company, based at Laindon in Essex and Coventry in the West Midlands, specialising in the development of cost-effective CO_2 reduction measures for the global automotive industry that avoid major redesign of the powertrain or vehicle electrical system. Its core competencies include low voltage power electronics, advanced control software and the application of low voltage electrical machines to gasoline and diesel powertrains.

The business was established in 2007 to acquire Visteon’s advanced powertrain business. With asset and technology acquisitions from Visteon, and the signing of associated licensing and collaboration agreements with Switched Reluctance Drives Limited, now part of Nidec Corporation, CPT gained immediate access to a portfolio of near-term solutions to the problem of automotive CO_2 reduction – and has since developed the technology to a high level of application and manufacturing readiness.

CPT gained considerable credibility in the automotive industry when it sold its VTES electric supercharger business to Valeo in December 2011 in a transaction valued at £30 million. An elite team of advanced powertrain development engineers, originally established in the UK by Visteon, had worked on the technology for more than 10 years following careful research and selection of switched-reluctance machines as the best technology for low voltage hybrid vehicle applications. The variable torque enhancement system known as VTES has been sold to Valeo for supercharger applications in cars and vans up to 3.5 tonnes gross vehicle weight.

CPT is now focused on bringing its liquid-cooled COBRA, SpeedStart and TIGERS technology to mass market readiness. COBRA is an electric supercharger for commercial vehicle and off highway applications. SpeedStart is an advanced motor-generator system, recently validated for 1.2 million stop-starts, offering significant additional functionality for 48V mild hybrid applications including torque assist for launch and low speed transient acceleration, optimised motorway cruise conditions with electric assist ‘load point moving’ and a leaner fuel calibration, in-gear coast-down and the ability to harvest significantly more kinetic energy from

regenerative braking compared with 12V stop-start systems. The turbine integrated gas energy recovery system known as TIGERS is a complementary application of CPT's switched reluctance electrical machine technology providing cost-effective thermal energy recovery and a means of replacing an existing alternator.

Today, CPT retains a highly experienced team of automotive engineers (most of whom have shares or options in the company) and is backed by a number of prominent investors specialising in the energy and environmental sectors including Conduit Ventures, Entrepreneurs Fund, Low Carbon Innovation Fund, Mowinckel Management, National Technology Enterprises Company, Reformer Group, Target Ventures and Turquoise Capital. CPT's technology development partner remains Nidec Corporation of Japan, one of the world's leading suppliers of electric motors. The company continues to recruit more high calibre engineers. Further information on CPT is available at www.cpowert.com.

Notes to editors about the EALABC

The European Advanced Lead-Acid Battery Consortium (EALABC) is the London-based arm of the Advanced Lead Acid Battery Consortium (ALABC), an international research consortium formed in 1992, to advance the capabilities of the valve-regulated lead-acid battery in order to help electric and hybrid electric vehicles become a reality. The research resources of the world-wide membership of ALABC are pooled to carry out a large program of research and development that would otherwise not be possible.

The ALABC is managed by the International Lead Zinc Research Organization based in North Carolina. ALABC membership currently stands at over 70 organisations. In recent years the European Consortium has been actively involved in vehicle demonstration of the progress made with the new generation of carbon-containing valve-regulated lead-acid (VRLA) batteries. For further information please visit www.alabc.org.

Ends

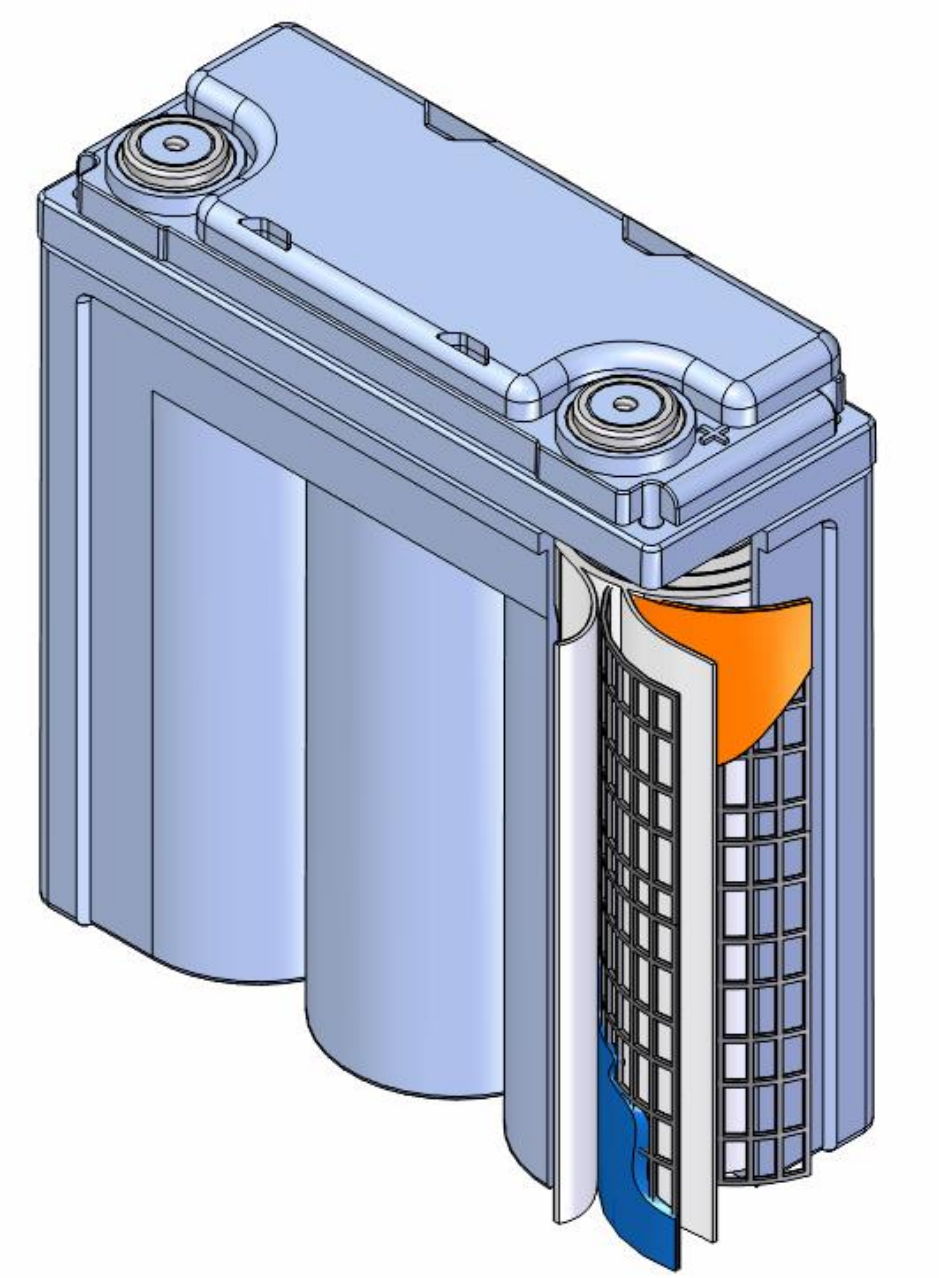
High resolution images of the thumbnails attached and previous CPT/EALABC announcements are available from Rob Palmer or can be downloaded at www.newspress.co.uk …

Pic 1 Pictured (from left to right) is Allan Cooper projects coordinator EALABC, Dr Malcolm Aickin, chair of the RSA Environment Awards Forum, and Nick Pascoe founder and chief executive CPT. Certificates for the 12 UK finalists were presented on Wednesday 14 May 2014 at a formal ceremony held at The Scotsman Hotel in Edinburgh

Pic 2 LC Super Hybrid technology demonstrators are based on a VW Passat 1.4-litre TSI model

Pic 3 LC Super Hybrids features an electric supercharger developed by CPT. This application of its switched reluctance motor has since been acquired by automotive components manufacturer Valeo for high volume implementation of the technology.

Pic 4 LC Super Hybrids feature a CPT SpeedStart switched reluctance motor-generator providing advanced stop-start, e-boosting and kinetic energy recovery system



Pic 5 LC Super Hybrids feature high power density lead-carbon batteries, which can meet the constant charging and discharging requirements of a low voltage hybrid electric vehicle. In this example from Exide, each of its Orbital spiral wound cells is enhanced with added carbon in the negative active material