

Mass production micro-hybrid technology set to cut emissions and fuel use in cars

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The EUREKA (Belgium) i-StARS project is developing a compact, fully integrated and low-cost start-stop system for cars to replace conventional alternators in mass production. This second-generation starter alternator reversible system (StARS) is intended to enable the European automotive industry to meet new EU emissions legislation and significantly reduce fuel consumption without needing to redesign the engine. Additionally, it will fulfil global demands for more energy-efficient vehicles. Market forecasts indicate some one million vehicles a year will be using these systems by 2010 with a 4% penetration rate worldwide in the automotive market for such micro-hybrid applications in 2015.

European Union legislation is set to reduce average carbon-dioxide (CO₂) emissions for new cars from the current 160 g/km to 130 g/km in 2012. This will lead to a 19% reduction in CO₂ emissions and place the EU among the world leaders in fuel-efficient cars. The proposal is also intended to benefit consumers through important fuel savings.

Results of the EUREKA i-StARS project will help enable the automotive industry to meet these new regulations effectively. "Not only will it be possible to reduce consumption emissions without any major change to engine design, but this translates into a 6% saving in fuel use for the car driver," says Derek de Bono, marketing director of project leader Valeo Electrical Systems in France. Valeo is one of the world's leading automotive suppliers, providing a range of components and integrated systems for cars and lorries.

Hybridisation offers innovative solutions

Hybrid solutions have to be as minimally intrusive as possible in standard mass-produced power trains for cars. This calls for a high level of integration between the electrical machine assisting the internal combustion engine and its associated power and control electronics. Such a high level of integration imposes harsh thermo-mechanical constraints on the whole system, making it difficult, if not impossible, to use standard electronic assembly technologies. While robust electronics have been developed for railway and industrial applications, they do not correspond to automotive industrial requirements in terms of flexibility, yield and cost.

A first generation of alternator-based 'stop-start' systems developed by Valeo has already been in serial production with Citroen since 2004, on Smart cars since 2007 and on Mercedes-Benz A- and B-class vehicles as of the first quarter of 2009. This system performs a comfortable stop-start function that is completely transparent to the driver: the belt-driven starter-alternator system shuts down the engine during idle phases and restarts the engine quickly and silently on request. As a result, there is no fuel consumption, gas emission, vibration or noise at standstill. In the European standard driving cycle, fuel consumption is reduced by 6%; while in congested urban traffic, savings of up to 25% have been observed.

However, Valeo was keen to reduce the size of the micro-hybrid system to a single integrated package combining the alternator and all the power and control electronics required. In the current design, the electronics need a separate box.

Seeking external expertise

As Valeo had no in-house microelectronics capacity, it decided to set up a EUREKA project with two microelectronics partners: ON Semiconductors - formerly AMI Semiconductors - in Belgium for the two application-specific integrated circuits (ASICs) controlling and driving the system; and Freescale in France for the power-switching transistors. Valeo itself took the responsibility for the assembly of the mechatronics unit. The resulting unit has to provide high reliability in the harsh environment found under the car bonnet.

"EUREKA labelling provided credibility at a national and European level," says de Bono. "It is also enabling us to get the technology to market faster, speeding European access to cleaner technology and opening up global markets for our equipment."

Reducing emissions to 130 g/km adds costs for car manufacturers, forcing innovation in car design. This is a clear example of legislation putting the onus on industry to innovate; the goal is naturally to meet legislation without changing the functionality that car drivers have grown to expect from their car today. "Having a consortium in Europe enables us to develop the technology in Europe first before spreading it out globally - giving us a lead in innovative products," says de Bono.

The Peugeot-Citroen group has already announced that it will adopt the new second-generation technology on over a million cars a year as of 2010/11. "We are also talking to all the other carmakers in Europe - and there is interest in Asia, particularly from China, which is keen to reduce energy needs, and in the USA to meet the 35 miles/gallon limit they committed to in 2007," he adds.

More information : Valeo Electrical Systems, www.valeo.com

Source: EUREKA

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