



Reducing CO₂ emissions with a combined 2 and 4-stroke petrol engine

By creating a petrol engine capable of switching from 2-stroke to 4-stroke combustion, a consortium led by Ricardo UK Ltd plans to demonstrate how levels of CO₂ emission and fuel economy more typical of a modern diesel engine may be achieved. The engine would also feature class-leading performance and the low noise characteristics of a petrol engine, a combination critical for successful premium vehicles

Key benefits

- using smaller and therefore more fuel efficient engines to reduce CO₂ emissions but without compromising performance and driveability
- using low-cost, existing technology in an innovative combination to respond to the motor industry's single greatest research challenge
- providing the speed range and refinement of the gasoline engine with the fuel economy of a diesel

For several years, the main driver behind the research programmes of motor manufacturers has been the introduction of both voluntary and legislative targets to reduce the fuel consumption and therefore CO₂ emissions of vehicles.

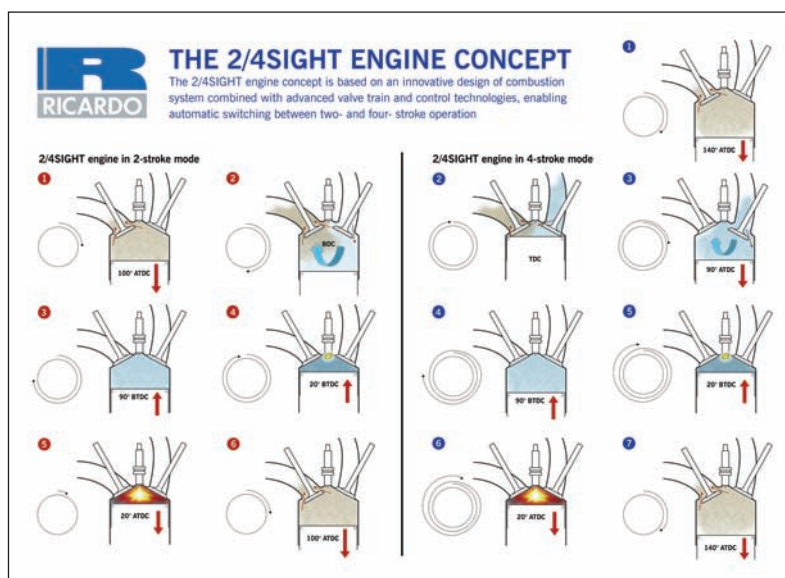
This takes into account their so-called 'fleet average' CO₂ emission figures, which are the average CO₂ emissions produced from each vehicle in a manufacturer's model range, weighted by sales volume. Gaining better fuel economy through reduced consumption is the primary means of lowering CO₂ levels, so achieving this with little or no performance penalty is now at the top of their research agendas.

During the early 1990s, there was considerable interest in the cost-effectiveness and light weight of the 2-stroke

engine as a possible route to achieving reduced fuel consumption. This was largely superseded by alternative research priorities until 2002, when Ricardo UK led a research project into the potential of a combined 2-stroke and 4-stroke engine.

Its findings were encouraging, and in 2005 the company pulled together a consortium to run the 30-month 2/4SIGHT project. This has the aim of creating a downsized 2.0 litre, 6-cylinder engine that can switch between 2-stroke and 4-stroke combustion. Costing £1.8 million, the project is half-funded under the government's Technology Programme.

Ricardo UK Ltd is leading the project, in partnership with Denso UK Ltd, Ma (Innovation) 2T4 Ltd and Brighton and Brunel universities.



Objectives

The key to reducing an engine's CO₂ emissions is to increase its efficiency. This enables a smaller engine – possibly boosted by a device such as a turbocharger – to generate levels of power equivalent to a larger engine, while consuming less fuel.

The 2/4SIGHT project is seeking to apply the results of the earlier desktop study, which successfully suggested how the immense torque of supercharged 2-stroke combustion engine could be delivered alongside the smooth running of a 4-stroke engine. This study enabled an understanding of the technical requirements involved, and provided a compelling case for further research and development work.

According to Ricardo UK's Tim Lake, "We were confident we could downsize an engine for better efficiency. The current project was launched at the beginning of 2005. It aims to deliver a test-bed engine, to be built by Ricardo and tested at the University of Brighton together with simulation of the engine in a large and a small vehicle."

Solutions

To date, the new project has focused on designing the engine itself and overcoming the control, calibration and application challenges of switching between its 2 and 4-stroke modes.

It is expected that the 2.0 litre engine under development will deliver class-leading low speed torque alongside driveability characteristics more typical of a 3.0 to 4.0-litre engine. In this way, it will enable a 30% reduction in CO₂ emissions compared to the output of a conventional 3.0 to 4.0-litre equivalent gasoline engine. According to Tim Lake, "As a gasoline engine, operating primarily as a 4 stroke engine with 3 way catalyst, it will comply with planned future European emissions legislation."

Results

The project team is now poised to build the test bed engine. According to Tim Lake, the 2/4SIGHT project as a whole has gone to plan so far. The team believes there are significant commercial applications to be derived from their work, and they initially plan to target the 2.0 litre engine at the premium vehicle and sports utility vehicle (SUV) markets.

According to Tim, "There is also potential for a three-cylinder 1-litre variant for family cars. We would expect this to be of interest to vehicle

manufacturers, if we can produce a more cost effective route to better fuel consumption than the current trend to an increased market share of expensive diesel engines."

The adoption of this technology by manufacturers would be largely based on existing technologies and infrastructure and would be a significant contribution by the UK motor industry to reduced CO₂ emissions from larger premium vehicles.

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URN 06/1118