

PRESS RELEASE

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Ricardo and Growth Energy to demonstrate benefits of extreme ethanol optimization

- **Partners collaborate on first vehicle based demonstration of Ricardo's Ethanol Boosted Direct Injection (EBDI) engine technology**
- **Uses an American produced renewable ethanol – supports US jobs and increased energy security**
- **Cost effective extreme optimized power from any blend of ethanol**
- **Up to 30% fuel economy and CO₂ improvement compared with existing gasoline engines, with inherently low emissions and uncompromised performance**

It was announced today at the Washington Auto Show that Ricardo and Growth Energy are to collaborate on a project which will bring together for the first time the shared skills and expertise of a global leader in automotive and clean energy technology with America's foremost body representing US ethanol. Together these two partners aim to demonstrate that a highly optimized engine fuelled on ethanol can provide a cost-effective, low-carbon, high-fuel economy alternative to fossil fuel.

Two demonstrator vehicles are to be produced incorporating Ricardo's EBDI engine technology, showing that even for larger vehicles, extreme optimization of ethanol combustion can enable engine downsizing of the order of 50 percent and still deliver substantial fuel economy and CO₂ emission improvements from a cost-effective, high performance, inherently low emission powertrain. Based on test work already carried out, Ricardo estimates that a fuel economy improvement of up to 30 percent is possible with no loss of power or performance, using a downsized EBDI engine in place of currently available gasoline powertrain technology.

PRESS RELEASE

The project will use Ricardo's EBDI flex fuel engine, developed from a production V6 gasoline engine, to repower two GMC Sierra 3500 HD pickup trucks, each with a curb weight of 6000lbs (2721kg). Ricardo and Growth Energy have the objective of demonstrating through this project:

- the market-readiness Ricardo's EBDI technology, which optimizes flex-fuel vehicles to burn ethanol with consumer value, horsepower and fuel economy that is comparable to gasoline, and;
- domestic ethanol's potential, as a high-octane, low-carbon and renewable fuel, to lessen American dependence on gasoline refined from carbon-heavy oil imported from overseas at growing risk to US economic and national security.

Following completion of the ten month project, the demonstrator vehicles will be available for a range of demonstration, test and evaluation exercises to be organised by Growth Energy and Ricardo.

Speaking at the launch of this landmark initiative Ricardo Inc President Kent Niederhofer said:

“Ricardo is actively engaged worldwide in developing a wide range of high fuel economy, low carbon technologies aimed at creating practical solutions for a more sustainable transport system for the future. While we firmly believe that many of these technologies will be particularly appropriate to individual market sectors, EBDI engine technology offers a uniquely American solution for a wide range of vehicle applications, combining extreme optimized flex-fuel engine technology offering high fuel economy, low emissions and uncompromised performance using a source of renewable fuel produced here in the United States.”

Jeff Broin, Chairman of the Growth Energy Board of Directors, said:

“Ethanol is a high-octane, clean-burning fuel, produced right here in the United States. It has the potential to create U.S. jobs while reducing our dependence on foreign oil and it is cleaner than oil. We have known for years that engine technology would catch up with fuel technology – and this project today is proof of that. Demand for ethanol as a transportation fuel is only going to grow in the days to come, because of its low-carbon, renewable qualities. Ethanol is literally the fuel of the future, and now we will have engines in our cars, trucks and tractors that can be designed to make the best use of that fuel.”

PRESS RELEASE

EBDI: optimized power from renewable fuel

Ricardo's EBDI engine technology solves many of the shortcomings of current generation flex-fuel engines, which are typically only optimized for gasoline operation and do not make full use of the properties of ethanol. Unlike existing flex-fuel technologies EBDI takes full advantage of ethanol's properties of high octane and latent heat of vaporization to deliver near-diesel levels of engine efficiency at substantially reduced cost. For example, a flex-fuel product derived from a standard gasoline engine might suffer a fuel economy penalty of about 30 percent when operating on higher ethanol blends such as E85. The Ricardo EBDI engine addresses this problem by being able to adapt its operation to offer fully optimized flex-fuel performance on any blend of fuel from standard pump gasoline to E85 fuel. It achieves this through the sophisticated application of the latest in boosting technologies, fuelling strategy and combustion control, matching the effective compression ratio and in-cylinder conditions to precisely those required for optimal performance and fuel efficiency. In doing so it offers exceptional fuel economy and high specific performance without the need for complex aftertreatment technology to meet current or planned emissions regulations.

The results of test bed evaluation of the EBDI engine already carried out by Ricardo have demonstrated the potential of this technology to deliver significant fuel-efficiency improvements with uncompromised performance, in particular while operating on high ethanol blends. "People are likely to be amazed with the performance and fuel economy that can be delivered from a comparatively small displacement engine running on a renewable fuel such as ethanol," said Rod Beazley, director of the Ricardo Inc Spark Ignited Engines Product Group. "In the project we are announcing today with Growth Energy, we will be substituting a 3.2-litre V6 engine in a 1 ton pickup truck vehicle usually powered by a 6.0l V8 gasoline or a 6.6l diesel engine. The reason we are doing this is that while the engine test results speak for themselves, there is no substitute for experiencing in a vehicle the benefits of uncompromised performance and extremely high fuel economy that can be achieved using a renewable fuel like ethanol in an optimal manner. Moreover by using a truly flex-optimized engine such as EBDI, the best possible performance and fuel efficiency can be delivered from whichever gasoline-ethanol mix is selected by the driver when next stopping for fuel."

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Ethanol: Good for the Climate, Great for America

The U.S. Department of Energy estimates that for every one billion gallons (US) of ethanol produced, 10,000 to 20,000 jobs will be added to the economy. If Growth Energy's Green Jobs Waiver is approved by the U.S. Environmental Protection Agency, it could create as many as 136,000 new jobs when the ethanol blend rises to 15 percent. According to US Department of Energy estimates, ethanol use reduces the price of gas by as much as 20-35 cents/gallon (US), saving the average American household \$150-\$300/year.

This project is highly relevant to the emerging needs of the North American transportation sector. Under the Renewable Fuels Standard adopted by Congress as part of the 2007 Energy Independence and Security Act, the United States has established the goal of consuming 36 billion gallons (US) of renewable fuels, such as ethanol, by 2022. The intent of the legislation is to reduce the consumption of fossil fuels – reducing net emissions of greenhouse gases – and reinforce economic and national security through the development of domestic sources of renewable energy. The achievement of these targets will require the coordinated efforts of automotive manufacturers, engine-makers and renewable fuels producers in delivering a fleet of passenger, light- and heavy-duty vehicles that are optimized for renewable fuels such as ethanol. Through the project announced today, Ricardo and Growth Energy aim to demonstrate that EBDI offers a market-ready solution that could enable the delivery of such optimized vehicles.

“Ethanol is the only renewable fuel that is ready to displace more foreign oil,” said (Ret.) Gen. Wesley K. Clark, Co-Chairman of Growth Energy. “If we are ever to achieve the energy independence that is vital to the economic and national security of our nation, we must begin to put more ethanol into our fuel tanks – and less gasoline from foreign oil. As science moves from making ethanol from corn to producing it from corn cobs and other plant materials, ethanol will provide even greater sustainability. Through this project with Ricardo we aim to be able to put potential customers in the driving seat and demonstrate to them that with EBDI technology, ethanol can deliver performance and fuel economy and offers an attractive and sustainable transport solution using an American produced renewable fuel. Consumers should have a choice at the pump – and domestic ethanol should be one of those options for fuel.”

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PRESS RELEASE

NOTES TO EDITORS:

Ricardo plc: With technical centers and offices in the UK, USA, Germany, the Czech Republic, China, Japan, India and Korea, Ricardo is a leading independent technology provider and strategic consultant to the world's transportation sector industries. The company's engineering expertise ranges from vehicle systems integration, controls, electronics and software development, to the latest driveline and transmission systems and gasoline, diesel, hybrid and fuel cell powertrain technologies. Its customers include the world's major vehicle, engine and transmission manufacturers, tier 1 suppliers and leading motorsport teams. Ricardo is committed to excellence and industry leadership in people, technology and knowledge; approximately 70 per cent of its employees are highly qualified multi-disciplined professional engineers and technicians. A public company, Ricardo plc posted sales of £197.7 million in financial year 2008 and is a constituent of the FTSE techMark 100 index – a group of innovative technology companies listed on the London Stock Exchange. Ricardo Inc is the North American subsidiary of Ricardo plc, and is headquartered at Van Buren Township, Michigan, USA. For more information, visit www.ricardo.com.

Ricardo is grateful for the support provided by the following Tier 1 partners in its EBDI research: Behr, Bosch, Delphi, Federal-Mogul, Grainger and Worrall Castings and Honeywell.

Growth Energy: Growth Energy is a new, proactive group committed to the promise of agriculture and growing America's economy through cleaner, greener energy. Growth Energy members recognize America needs a new ethanol approach. Through smart policy reform and a proactive grassroots campaign, Growth Energy promotes reducing greenhouse gas emissions, expanding the use of ethanol in gasoline, decreasing our dependence on foreign oil, and creating American jobs at home.

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