

SwRI's HEDGE™ Consortium

Southwest Research Institute (SwRI) opened its HEDGE (High-Efficiency, Dilute Gasoline Engine) consortium in 2005 to improve gasoline engine technology for light- and heavy-duty applications. The multi-year consortium anticipated that the Environmental Protection Agency's post-2010 emission goals might limit the advantages in efficiency and cost that were then enjoyed by diesel engines. With improved combustion technology, the consortium organizers figured the gasoline engine may be able to better compete in key markets.

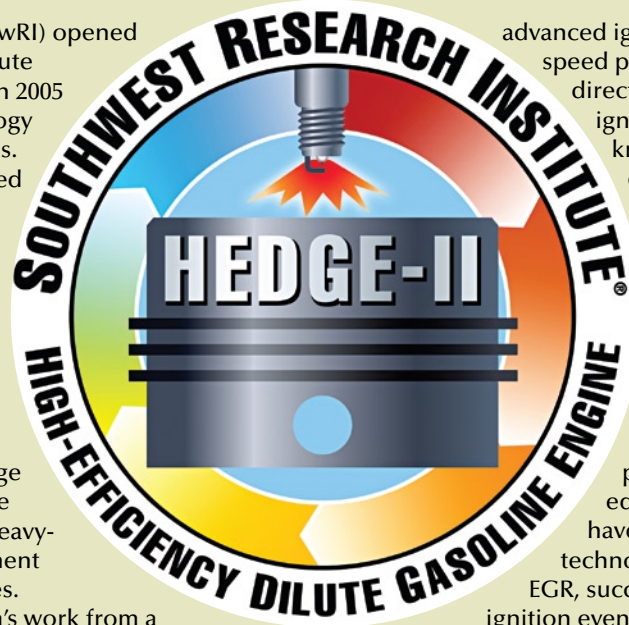
HEDGE was introduced to a range of companies in Europe, Asia and the United States, including light- and heavy-duty engine manufacturers, component suppliers, and oil and fuel companies. Participants selected the consortium's work from a number of projects recommended by Institute engineers and scientists based on SwRI's extensive automotive-related experience.

The original HEDGE consortium demonstrated that cooled EGR, when combined with an advanced ignition system for improved dilution tolerance, has the potential to significantly improve engine fuel efficiency by reducing knock and allowing for higher compression ratio operation. The gasoline engines in the HEDGE consortium demonstrated fuel consumption results that were equal to or better than similar displacement diesel engines.

After completing its original four-year schedule, a new HEDGE II consortium began in 2009, again focusing on high levels of exhaust gas recirculation (EGR) combined with supporting technologies to develop strategies for high efficiency. This program is focusing on extending the specific power levels of the engines for further improvement in vehicle efficiency.

There are 23 members of the consortium, including most major automotive manufacturers. Consortium participants gain the advantage of leveraging their annual contribution to produce substantially more pre-competitive research than would be possible with funding from a single member.

In June, SwRI engineers demonstrated that HEDGE technology, using cooled exhaust gas recirculation (EGR) and



advanced ignition systems, suppressed low-speed pre-ignition in turbocharged gasoline direct-injection engines. Low-speed pre-ignition (LSPI) causes heavy engine knock and can seriously damage engine parts or cause complete engine failure.

The presence of low-speed pre-ignition is considered a major impediment to automobile manufacturers' efforts to aggressively downsize engines to reduce carbon dioxide emissions.

"This is a substantial development because it has the potential to affect every original equipment manufacturer (OEM). We have demonstrated that our HEDGE technology, primarily the use of cooled EGR, successfully suppresses low-speed pre-ignition events and in a way that improves fuel economy," said Dr. Terry Alger, manager of the Advanced Combustion and Emissions Section in SwRI's Engine, Emissions and Vehicle Research Division.

"It is another significant step forward in developing an aggressive knock mitigation strategy," Alger said. "Our internally funded work has also looked into the fuel's effect on pre-ignition as well as potential non-EGR hardware and control solutions, but our first goal was to show how our cooled EGR technology suppresses the phenomenon."

SwRI also is working on examining lubricant effects on LSPI and expects to begin a separate consortium on the topic to develop new lubricants and lubricant testing methods.

"We will continue to develop these concepts that were initiated in the first HEDGE program and further develop the supporting technologies to implement this strategy in modern engines," Alger said. "We are already seeing concepts developed in HEDGE I enter production."

As an independent R&D laboratory, SwRI has extensive experience in managing consortia. The Clean Diesel consortium, begun in 1991, has conducted research in low-emission diesel engines with as many as 46 member companies worldwide. It is now in its fifth generation of research.

For more information about HEDGE II, contact Alger at (210) 522-5505 or terry.alger@swri.org.

