

Clean High-Efficiency Diesel Engines VI (CHEDE-VI)

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CCHEDE-VI builds on 20 years of clean diesel consortia programs managed by Southwest Research Institute® (SwRI®). CHEDE-VI will be a four-year, research-based, multi-client consortium with a diesel-fuel emphasis and alternative fuel activities. The program will include pre-competitive research to meet U.S. antitrust laws and to allow multi-client cooperation for future technology assessment.

To meet industry needs 5–10 years in the future, the consortium will pursue research on the world's most efficient heavy-, medium- and light-duty engines, including combustion, turbocharging, heat transfer control and recovery, advanced friction reduction, waste heat recovery, energy management and hybridization, and advanced aftertreatment engineering (SCR, LNT, DPF).

Goals

- Development of pre-competitive technologies that member companies can incorporate into their products
- Research and demonstration of technologies to achieve 55% engine-system efficiency
 - Engine goal ~48% BTE
 - Plus waste energy recovery = 55 BTE total

Research Areas

The scope of research in the CHEDE-VI consortium considers the impact of new technology on worldwide markets. Project activities will concentrate on advanced heavy-, medium-, and light-duty engines and advanced combustion.

Heavy-Duty Engines

Industry drivers include cost of operation, CO₂ regulation, and future criteria for pollutant regulations. CHEDE-VI research will focus on system efficiency improvement through in-cylinder thermodynamics, friction reduction, improved aftertreatment, and exhaust waste heat recovery.

Medium-Duty Engines

Industry drivers include initial cost, packaging and heat rejection robustness to off-road operation, and future criteria for pollutant regulations. CHEDE-VI research will focus on cost-effective aftertreatment, energy management, and combustion optimization.

Light-Duty Engines

Industry drivers include initial cost, cold-start emissions, CO₂ regulation, and future higher load test cycles. CHEDE-VI research will focus

on vehicle efficiency improvement via in-cylinder thermodynamics, hybrid integration, and improved cold start.

Advanced Combustion

The diesel engine industry is very interested in the potential for new combustion systems that could be market changers. CHEDE-VI research will focus on advanced combustion concept evaluation, advanced injection systems, and friction reduction.

Clean Diesel Success

Clean Diesel I (1991–1995)

- Focused on development of EGR technology for control of engine-out NO_x emissions
- Achieved compliance with 2004 emissions regulations in 1994
- Technology now in production on all on-road diesel engines

Clean Diesel II (1995–1999)

- Examined effects of dilute combustion on engine-out emissions
- Focused on advanced EGR systems, including development of model-based control technology
- Demonstrated fuel injection system with advantages of rapid mixing using small holes and high pressures (up to 300 MPa) – now becoming part of the production solution

Clean Diesel III (1999–2003)

- Initially focused on development of diesel aftertreatment systems, including SCR+cDPF and LNT+cDF
- Demonstrated US 2010 compliant emissions levels using advanced low-temperature combustion technology, incorporating VVA technology

Clean Diesel IV (2003–2007)

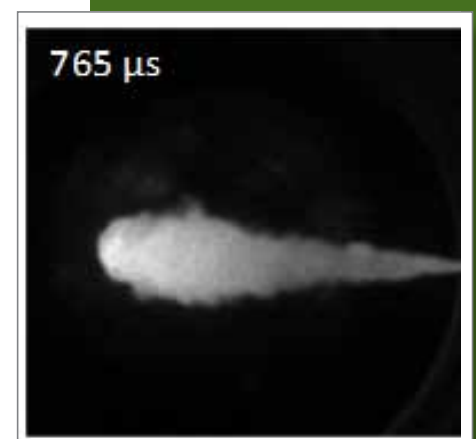
- Continued development of full operating range HCCI engine concept
- Demonstrated acceptable operation with peak loads of 11 bar in a multi-cylinder HCCI engine using low-octane gasoline specially formulated for HCCI operation
- Preliminary data indicated that Tier II, Bin 2 diesel technology is possible

Clean Diesel V (2007–2011)

- Full operating range HCCI engine demonstration
- Dilute diffusion combustion engine research
- Expansion of SwRI's advanced low-temperature combustion technology
- Integration of cost-effective aftertreatment systems
- Advanced model-based control system research



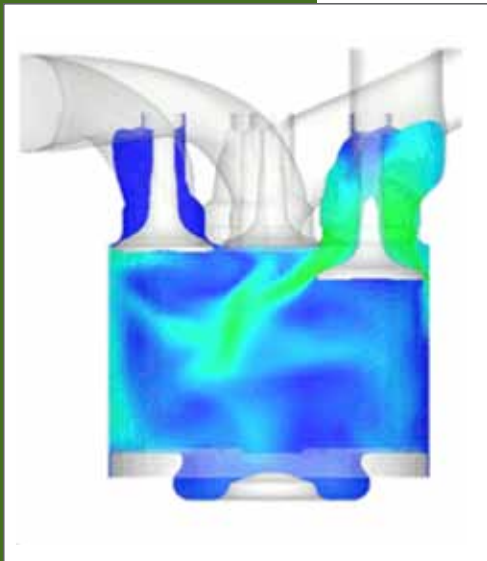
Light-duty diesel test cell installation



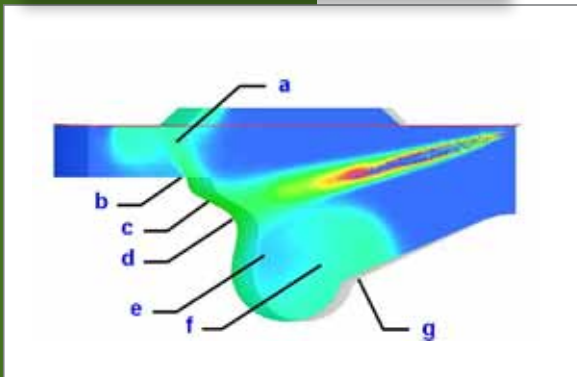
Injection research: Non-vaporizing, 1000 μs injection, 120° C, 25 kg/m³

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Combustion optimization

Facilities

SwRI maintains state-of-the-art facilities for clean diesel research, including:

- 15.0L test bed
- 6.8L test bed
- 1.6L test bed with HIL hybrid
- 0.4L single-cylinder VCR test bed
- Optical combustion bomb
- High-pressure spray laboratory

Patents

SwRI's diesel consortia have a strong history of innovation, with 17 patents awarded to date. Topics include:

- Diesel cold start strategies
- Microwave-enhanced combustion
- HCCI transient control strategy
- VVA-enabled aftertreatment regeneration
- Combustion bowl design for high EGR
- Stoichiometric diesel combustion with EGR
- Diesel / water co-injection
- Adaptive urea dosing strategy
- Aftertreatment temperature maintenance

Membership and Benefits

- Interested companies may join the consortium at any time during the four-year program
- A yearly renewable contract is offered to members
- The impact of the yearly contribution is multiplied by the number of participants
- Results from SwRI's internal research program will be shared with consortium members
- SwRI will aggressively pursue patent applications for technology developed during the CHEDE-VI program
- Consortium participants will receive a royalty-free license to use the technology



Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres in San Antonio, Texas, and provides more than 2 million square feet of laboratories, test facilities, workshops and offices for more than 3,000 employees who perform contract work for industry and government clients.

We welcome your inquiries.

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