TECHNICAL HIGHLIGHTS FOR FEBRUARY 2014

The Oak Ridge National Laboratory's (ORNL's) Cold Weather Tips on fueleconomy.gov Catch Media Attention

ORNL maintains the www.fueleconomy.gov website for the Department of Energy (DOE) and the Environmental Protection Agency (EPA). In addition to providing EPA fuel economy (FE) estimates for every vehicle model sold since 1984, the site also provides tips to help consumers improve their personal FE. This month the ORNL team added a page on "Cold Weather Fuel Economy" which explained the many reasons that owners often notice decreased FE in the winter (http://fueleconomy.gov/feg/coldweather.shtml). The most prevalent reason is increased friction due to the cold lubricating oil and driveline fluids. The ORNL team mined the EPA database to compare city cycle tests at 75°F to tests at 20F°, highlighting that conventional vehicles suffer 12–22% FE loss at the colder temperature, while hybrids see a larger 31–34% loss. Tips to minimize the winter FE loss include combining trips to avoid unnecessary engine warm-ups, storing the vehicle in a garage when feasible, avoiding idling to warm the vehicle before a trip (idling cars get 0 mpg), and for plug-in electric vehicles, warming the cabin while plugged in can extend the range. Articles about the new page were published by *USA Today*, *The Detroit Free Press*, *ABC News*, and others.

Dr. Derek Splitter joins the Fuels, Engines, and Emissions Research Center (FEERC)

Dr. Derek Splitter joined the FEERC as a full time staff member. Derek is a graduate of the University of Wisconsin and most recently a post-doctoral researcher at ORNL under the direction of Dr. Jim Szybist. Derek is well known in the internal combustion engine technical community for his seminal work in reactivity controlled compression ignition (RCCI) combustion. RCCI combustion is thought to be a promising path forward achieving high efficiency clean combustion in the next generation of automobiles. Derek also has extensive expertise in other forms of advanced combustion as well as fuel technologies.

FEERC Team Successfully Measured Exhaust Emissions from a Miniature Reciprocating Engine

An ORNL team performed first-ever emission measurement on a miniature-sized glow-assist engine. The ORNL team consisting of Mike Kass, Mark Noakes, Maggie Connatser, and Sam Lewis measured the exhaust chemistry of a 4-cc single cylinder two-stroke engine running on a fuel mixture containing nitromethane, methanol, and oil. In order to enable measurements using a standard emissions bench, a three filter assembly was installed to remove oil and water from the exhaust. A portion of the exhaust was also collected for gas chromatograph-mass spectrometer (GC-MS) analysis. The exhaust analysis showed that very little CO and CO_2 was produced during combustion and this result when combined with oxygen measurements between 10–15% indicate that most of the fuel was not combusted in the cylinder. Preliminary GC-MS analysis confirmed that large quantities of nitromethane and methanol were present in the exhaust, which also indicates poor combustion. Previous studies had suggested that the poor efficiencies associated with these engines were due to incomplete combustion of the fuel. This ORNL study was the first to ever provide conclusive evidence indicating that this is, in fact, the case.

HIGH-LEVEL OR NOTEWORTHY VISITS

FEERC Researchers Discuss Continued Collaborations with a Major Boiler and Furnace Manufacturer

On February 24th and 25th, FEERC staff members Stuart Daw and Charles Finney hosted a team of researchers from The Babcock & Wilcox Company (B&W) to discuss future collaborations on developing advanced diagnostics for monitoring and control of coal- and biomass-fired utility boilers and industrial

furnaces. The planned work will extend previous ORNL and B&W research and development that resulted in commercial deployment of the FLAME DOCTOR system, which has been used at dozens of coal-fired power plants worldwide to increase plant energy efficiency and reduce emissions. Several other FEERC staff also met with the visiting team to present related FEERC research activities.

FEERC Researcher Invited to Participate on Coordinating Research Council (CRC) Diesel Performance Group Panel Meeting

Mike Kass attended the CRC Diesel Performance Group Corrosion Panel on February 20, 2014 in Houston, Texas. The focus of this meeting was to outline a study to investigate accelerated corrosion of fuelling infrastructure components to ultra-low sulfur diesel fuel. A plan was adopted and will be sent for review.

INVITED TALKS AND PRESENTATIONS

FEERC Perspective on Advanced Combustion in Hybrid Vehicles Presented at Society of Automotive Engineers (SAE) Hybrid Vehicle Symposium

Advanced combustion and vehicle systems integration research from FEERC researchers Scott Curran and Zhiming Gao was presented at the SAE Hybrid Vehicle Symposium held in La Jolla, California. The presentation, given by Paul Chambon from ORNL, focused on the future opportunities and challenges of integrating advanced combustion into hybrid electric powertrains. RCCI research and vehicle system simulations were used to illustrate particular points including initial RCCI series hybrid vehicle modeling over various drive cycles.

FEERC Researcher Invited to Participate on "Engine Expert" Panel at National Ethanol Conference

Brian West was invited to participate in the "Engine Experts Talk Ethanol" panel at the 19th Annual National Ethanol Conference. Brian discussed the benefits and challenges of using ethanol in modern vehicles and small non-road engines, drawing from his experience in leading portions of DOE's Intermediate Ethanol Blends Program. Attendees included automakers, oil industry, ethanol producers, and other interested parties.

FEERC Researchers Present, Participate in CRC Workshop on Advanced Fuel and Engine Efficiency

FEERC Researchers Scott Sluder and Scott Curran presented and FEERC director Robert Wagner and Scott Sluder co-chaired sessions at the CRC's Workshop on Advanced Fuel and Engine Efficiency held in Baltimore. The workshop was an invitation-only event for both the speakers and the audience. Speakers from automotive companies and suppliers, energy companies, research institutions, and national laboratories covered a wide range of topics related the future interactions between fuels and engine efficiency and emissions controls. Scott Sluder presented "Relentless Progress: Emissions Regulations and the Road Ahead," an overview of present and future emissions regulations during an opening session while Scott Curran presented on "Fuel Effects on RCCI Combustion: Performance and Drive Cycle Considerations." Robert Wagner co-chaired the advanced combustion session as well as a break-out session. Scott Sluder co-chaired a break-out session on compression ignition.

ORNL Delivers Two Presentations at the Advanced Engine Combustion (AEC) Program Review Meeting

Two ORNL researchers delivered presentations at the bi-annual AEC Program Review Meeting held at Sandia National Laboratories in Livermore, California: Dean Edwards and Jim Szybist. Dean presented an overview of ORNL's collaborative efforts with industry partners to accelerate development of advanced, high-efficiency engines through innovative strategies which maximize the benefits of detailed models and high performance computing resources such as ORNL's Titan. Jim presented experimental efforts

related to in-cylinder reforming as an enabler to dilute combustion for high efficiency. The presentations were made to an audience of approximately 80 representatives from DOE, industry, academia, and other national labs. All of the presentations were well-received and generated a significant amount of interest and discussion.