Technical Highlights for March 2014

Fuels, Engines, and Emissions Research Center (FEERC)Research Adopted into Law in the Environmental Protection Agency's (EPA's) Tier 3 Emissions Rulemaking

A set of correlations that allow non-methane organic gas (NMOG) emissions to be calculated based on the less expensive and less time consuming measurement of non-methane hydrocarbon (NMHC) developed by FEERC researchers Scott Sluder and Brian West has been adopted into law in EPA's Tier 3 final rule. EPA had previously allowed manufacturers to calculate NMOG based on a multiplier of 1.04 applied to NMHC emissions, but the addition of ethanol into the certification fuel under the Tier 3 rule caused this factor to be outdated. The new correlations take into account the fuel ethanol content in determining the multiplier that applied to NMHC emissions to calculate NMOG emissions. Inclusion of ethanol in the fuel increases the multiplier to reflect the fact that fuels containing ethanol produce more oxygenated compounds than fuels that do not contain ethanol. EPA has indicated that the correlations are expected to be the primary means for manufacturers to characterize NMOG emissions, meaning that this work will impact most, if not all, new car emissions certifications under the Tier 3 standard. Scott and Brian developed the correlations during their work on the Department of Energy (DOE) Intermediate Ethanol Blends Catalyst Durability Testing Program.

Exhaust Gas Recirculation (EGR) Fouling Studies Selected for Presentation at Ford Technology Fair

Collaborative work by Ford, the Oak Ridge National Laboratory (ORNL), and the University of Michigan has been selected for inclusion at a Ford-internal technology fair in Europe. The work focused on experiments and modeling of heat exchanger fouling associated with exhaust gas recirculation, a key technology for emissions compliance in diesel engines. The technology fair is intended to promote better sharing of significant developments between Ford's business units and will be held both in Dunton, United Kingdom, and Merkenich, Germany. FEERC researchers Scott Sluder and John Storey provided the experimental underpinnings for Ford's predictive model development. Michael Lance of ORNL's High Temperature Materials Laboratory (HTML) also worked with the team to provide assessments of key microstructural details of the EGR cooler deposits.

FEERC Meets High Level DOE Milestone for Demonstrating Advanced Combustion Drive Cycle Coverage

A team of FEERC researchers led by Scott Curran successfully met a high level DOE milestone demonstrating 75% drive cycle coverage of reactivity-controlled compression ignition (RCCI) using vehicle systems simulations. The vehicle system simulations used steady state RCCI engine maps developed at ORNL with B20 (20% biodiesel) and certification grade gasoline. A RCCI/diesel multi-mode strategy was used for engine speed and load points outside the RCCI coverage from the current engine map. The vehicle systems simulation results showed greater than 75% drive cycle coverage with RCCI over the UDDS (city) and HWFET (highway) drive cycles with B20 and gasoline multi-mode operation

FEERC Research Highlighted in Update to the Society of Automotive Engineers (SAE) Automotive Fuels Reference Book

FEERC research in alternative fuels, advanced combustion and waste heat recovery were referenced in the new third edition of the SAE Automotive Fuels Reference Book authored by Paul Richards. The best-selling series had not been updated since 1995. FEERC waste heat recovery research and energy analysis is featured in a chapter related to future trends and alternative fuels. FEERC research into advanced combustion modes including homogeneous charge compression ignition (HCCI), premixed charge compression ignition (PCCI), and RCCI research is referenced.

Invited Talks and Presentations

FEERC Staff Member Participates in Saudi Aramco Workshop on "Future of Transport Fuels"

Robert Wagner traveled to King Abdullah University of Science & Technology (KAUST) in Saudi Arabia to participate in an invitation-only three day workshop with the objective to discuss the forces that shape global transport energy scenarios, engine development trends and their implications for future transport fuels. The workshop brought together technical leaders from around the globe as well as researchers and stake holders from Saudi Aramco and KAUST. Total attendance was approximately 40 people and included 10 invited presentations from high level technical leaders from several organizations including General Motors, PSA, Massachusetts Institute of Technology (MIT), MAHLE Powertrain, CONCAWE, BorgWarner, Ricardo, and ORNL. Robert gave an overview of combustion and fuels research at ORNL as well as his perspective on future fuel opportunities. While at KAUST, he also toured the Clean Combustion Research Center and presented to the students on pushing the stability limits of advanced internal combustion engines.

FEERC Staff Member Invited to Participate in the United States (U.S.)-Israel Energy Dialogue

Brian West of ORNL's FEERC traveled to Israel this month to participate in an Energy Dialogue with the Israel Ministry of Energy and U.S. DOE and Embassy officials. Israel has recently discovered large natural gas reserves and is working aggressively to replace 30% of their transportation petroleum use by 2020. One path they are exploring is addition of 15% methanol (derived from natural gas) to their gasoline for use in their legacy fleet. Brian's experience in the DOE mid-level ethanol blends program is of great interest to Israel as they are conducting a similar program with M15. Brian presented an overview on the DOE ethanol program during the formal Energy Dialogue and also attended a detailed follow-up meeting with working level staff the next day.

ORNL Staff attend the U.S. Driving Research and Innovation for Vehicle Efficiency and Energy Sustainability (USDRIVE) Low Carbon Fuels For High Efficiency Engine Workshop

ORNL staff members Scott Sluder and Yarom Polsky participated in the USDRIVE Low Carbon Fuels for High Efficiency Engine Workshop. The workshop produced recommended topics for collaborative research and development (R&D) that will be recommended to the USDRIVE Executive Steering Group for inclusion in the partnership's activities. Fuel research has up until now not been a part of the USDRIVE partnership research program. The specific areas of interest were natural gas and biofuels and focused on mutually agreeable topics that included

natural gas storage, codes and standards, and refueling. Desirable and undesirable properties of biofuels were also of interest. The workshop was attended by representatives from DOE, the automotive industry, and the petroleum industry.