Fuels & Lubricants R&D

Kevin Stork
Fuel & Lubricants R&D Team Lead
Vehicle Technologies Program
US Department of Energy
Washington, DC

2011 DOE Hydrogen Program and Vehicle Technologies Program Annual Merit Review
The Federal Role

- Undertake High-Risk Mid- to Long-Term Research
- Utilize Unique National Lab Expertise and Facilities
- Help Create a National Consensus
- Work Cooperatively with Industry
- Reduce/Displace Petroleum Use
Why do we have a fuels and lubricants activity in VTP?

- Enable advanced combustion through elucidation of fuel effects in such regimes
- Evaluate suitability of new fuels and fuel components for use in developing and legacy engines, with particular emphasis on biofuels

Who are our customers?

- Internal: Advanced Combustion Engine Team, Biomass Office
- External: Engine companies, autos, suppliers, energy companies (traditional and alternative), additive companies, academic research community
High energy density of liquid fuels is ideal for transportation use.

- **F&L Subprogram**
  - Battery maintained between 20-80% SOC
  - 174 (104*) MJ per m³

- **High energy density of liquid fuels** is ideal for transportation use.
Overall R&D Approach: Pre-FY 11

Primary Technical Targets

**2015 Fuel Target:** Expand operational range of low-temperature combustion to 75% of Federal Test Procedure

**2015 Lubricant Target:** Demonstrate cost effective lubricant with 2% fuel economy improvement
Subprogram Activities

Fuel Effects:
- Correlate chemical/physical properties to bulk fuel properties, combustion characteristics
- Supply open-source/public, reliable data on fuels and fuel effects on combustion
- Develop information to enable design of advanced combustion engines

Renewables and Synthetics:
- Evaluate advanced biofuels and other alternatives to petroleum
- Supply feedback on end-use suitability of new fuel/lubricant candidates to producers
- Allows fuel producers to make fit-for-service fuels

Analysis:
- Objective analyses of transportation energy pathways
- Help set R&D priorities
Subprogram Activities
Increased Emphasis

**Natural Gas:**

- U.S. reserves increased dramatically
- Currently far cheaper than petroleum
- Reserves suggest it will remain cheap for a long time

*What to do with all this natural gas?*

- Transportation – one of several potential uses; displace petroleum

**Lubricants:**

- 2-3% potential fuel economy improvement
- Retrofittable to legacy fleet in near-term
- Advanced engines may require different lubes

*How to influence huge industry with small investment?*

- Precompetitive research – advanced additives and base oils; reduce petroleum
**Budget & Accomplishments 2002-2011**

Years: 1998-2003
Diesel fuel sulfur effects on exhaust emission control testing program – resulted in diesel sulfur reduction to 15PPM – **enables diesel engines to meet current emissions regulation**

Years: 2008-2010
Critical research led to improved biodiesel ASTM standards – **enables B20 approved engines**

**Fuels Budget at a Glance**

- **2002**: $24,650
- **2004**: $15,887
- **2006**: $13,356
- **2008**: $17,376
- **2010**: $23,421
- **2012**: $18,503
  - Request

**Years: 2007-2011**
Developed and implemented DOE Intermediate Ethanol Blends Test Program – E15 approved for use in 2001 and newer vehicles – **enables additional 7 bgy of ethanol potential (displace 3% of light-duty petroleum use)**
## Fuel Technologies R&D Budget by Activity

<table>
<thead>
<tr>
<th>Major Activities</th>
<th>FY 2010 Appropriation</th>
<th>FY 2011 Appropriation</th>
<th>FY 2012 Request</th>
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<tr>
<td>Fuels Technologies</td>
<td>24,095</td>
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<td>Advanced Petroleum Based Fuels</td>
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<td>Non-Petroleum Based Fuels</td>
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<td>SBIR/STTR</td>
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<td>518</td>
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(Thousands of Dollars)
FY 11 is a year of reconfiguration of the Fuels & Lubricants area

Continuity . . .

- Fuels research as enabler of advanced combustion engines
- Retain and sharpen focus on renewables for GHG reduction
- Evaluate suitability of potential alternative fuels (e.g., OBP collaborations)

Changes . . .

- Prepare for new budget line in FY 12 – explicitly includes lubricants in addition to fuels
  - One of very few efficiency retrofit opportunities
- Incorporates the most-critical fuel science from old APBF line
- Expand study of next-generation biofuels; reduce ethanol and biodiesel work

FY 11 Request: $11,000K in Renewable & Synthetic Fuels R&D
- Zeroed-out the Advanced Petroleum Based Fuels line
- Substantially reduced Non-petroleum Based Fuels/Renewables & Synthetics