Partnering with Industry to Shape the Future

NTEA Green Truck Summit

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March 6, 2013

NREL/PR-7A20-58090
The Future Comes in Many Shapes and Sizes

Prioritization is a Must
Setting Priorities and Overcoming Challenges

Most Important Challenge for 2013

- Reducing fleet fuel costs
- Improving maintenance expenses
- Ensuring drivers are driving safely
- Hiring and retaining qualified drivers
- Improving vehicle replacement costs
- Keeping in compliance with regulations
- Reducing crash rates
- Cutting emissions

Source: GreenRoad’s Fleet Leader 2013 Outlook
Courtesy of Automotive Fleet; December 11, 2012 (www.automotive-fleet.com)
One Size Does NOT Fit All
NREL’s Role in Making Calculated Decisions

People

Advanced Fuels

Advanced Vehicles

Fleet Operations

Compliance & Regulations
Intersection of Gasoline and Diesel Demand

Demand for Gasoline and Diesel (2004 - 2011)

Source: NACS Retail Fuels Report 2012
Diesel Retail Prices Outpace Gasoline

Retail diesel price minus retail gasoline price

$ per gallon

Source: U.S. Energy Information Administration, Weekly Retail Gasoline and Diesel Prices
The Rise of Natural Gas Use in Transportation

Looking Forward: Natural gas will grow from 1% of today’s global vehicle fuel mix to 4% by 2040.

- Compressed Natural Gas
- Liquid Natural Gas
- Gas-to-Liquid
- More R&D Underway

Source: U.S. Energy Information Administration
U.S. Natural Gas End Consumption

Mcf: November 2012

- Commercial & Residential: 1,974,999 Mcf
- Lease & Plant Fuel: 116,249 Mcf
- Pipeline & Distribution Use: 60,406 Mcf
- Transportation Fuel: 2,700 Mcf
World Transportation Fuel Demand by Type

![Graph showing fuel demand by type over time.](source: Exxon Outlook for Energy 2012: A View to 2040)

Millions of oil equivalent barrels per day.
Spectrum of Advanced Biofuel Technologies

Near Term

**Ethanol**: Grain or cellulosic material

**Biodiesel**: Transesterified vegetable and seed oils

**Green Diesel**: Hydrogenated fats, waste oils, or virgin oils

**Other Fermentation Products**: Butanol, acetates, lactates, etc.

**Pyrolysis Liquids**: Alternative feedstock to refinery

**Synthesis Gas**: Fischer-Tropsch liquids, methanol, dimethyl ether, or mixed alcohols.

Long Term

**Algae-Derived Fuels**: Source of triglycerides and carbohydrates

**Hydrocarbon Fuels**: From hydrogenation or produced in-situ.
Vehicle technologies are advancing beyond liquid fuels, like these electric hybrids.

Electric vehicles, however, come with their own challenges.
Let’s Talk Operations

NREL Approach to Support Fleet Operations

1. **Analyze Your Fleet:** Obtain data to deeply understand your fleet. How are you using your fleet now; What do you really need your fleet to do?

2. **Analyze Your Options:** Simulate potential fuel and vehicle technology applications against captured duty cycles.

3. **Select Your Solution Portfolio:** Understand what is right for entire fleet, depot, or route.
Spectrum of Analysis Tool

- **Calculators**
  - Vehicle Cost Calculator
    - Compare cost of ownership and emissions for most vehicle models.
  - Petroleum Reduction Planning Tool
    - Create a plan for your fleet to reduce petroleum consumption and emissions.
  - GREET Fleet Footprint Calculator
    - Calculate your fleet's petroleum use and greenhouse gas emissions footprint.
  - PEV Readiness Scorecard
    - Assess your community's readiness for the arrival of plug-in electric vehicles.

- **Interactive Maps**
  - Alternative Fueling Station Locator
    - Locate alternative fueling stations and get maps and driving directions.
  - TransAtlas
    - Analyze vehicle densities and locations of fueling stations and production facilities.
  - BioFuels Atlas
    - Compare feedstocks and analyze biofuel production by location.
  - Truck Stop Electrification Sites
    - Locate truck stops with electrification sites to reduce the need for idling.
  - Coalition Locations
    - Find Clean Cities coalitions and contact information for coordinators.

- **Data Searches**
  - Light-Duty Vehicle Search
    - Compare light-duty alternative fuel vehicles, electric vehicles, and hybrids.
  - Heavy-Duty Vehicle and Engine Search
    - Find medium- and heavy-duty alternative fuel vehicles, engines, and hybrid systems.
  - Fuel Properties Comparison
    - Compare alternative fuel properties and characteristics.
  - Laws and Incentives Search
    - Search for laws and incentives related to alternative fuels and advanced vehicles.
  - Find a Car
    - Compare fuel efficiency, costs, carbon footprints, and emissions.
  - State Information
    - Find state information about alternative fuels and advanced vehicles.
10 Ways to Get Started

Ten Ways You Can Start to Cut Petroleum Use Right Now

There are hundreds of ways vehicle fleets and individual drivers can reduce petroleum use – and reap the benefits of lower emissions, cost savings, and energy security. Knowing where to start and selecting the options that work best for your needs and goals can be daunting, so the Alternative Fuels Data Center (AFDC) has compiled a list of actions you can take today, along with longer-term strategies for the future.

1. **Behave yourself**
   Small changes in driver behavior can have big impacts on fuel economy. By breaking bad habits like jackrabbit starts, speeding, aggressive driving, and carrying unnecessary cargo, drivers can reduce fuel use by 10% to 20%. Check out the Driving Behavior section on the AFDC to find tips for fleets and individual drivers.

2. **Follow the leaders**
   Thousands of fleet managers, business owners, state and local officials, and other transportation decision makers across the country have blazed the trail toward petroleum-free transportation, so there’s no need to reinvent the wheel. Before you undertake an initiative of your own, find out how others have successfully deployed alternative fuels, pushed the envelope on fuel economy, and achieved fleet efficiencies. The AFDC features dozens of case studies, which you can search by geographic location, fuel or technology type, or fleet type.

3. **Explore the alternatives**
   When it comes to fueling your fleet, gasoline and diesel aren’t the only options out there. It’s possible to achieve emissions reductions and/or cost savings by using alternative fuels like propane, natural gas, electricity, biodiesel.

4. **Connect with Clean Cities**
   If you’re looking to leave petroleum in the rearview mirror, don’t go it alone. The U.S. Department of Energy’s Clean Cities program has nearly 100 local coalitions of fleets, fuel providers, businesses, utilities, and government agencies all working to reduce petroleum use and improve air quality.

5. **Don’t sit idle**
   An idling vehicle gets 0 mpg. Yet drivers in the United States waste billions of gallons of fuel every year by running their engines while going nowhere. Reducing idling time has many benefits, including reductions in fuel use, fuel costs,
Transportation

Bringing Advanced NGVs to Market

• Partnering with California Energy Commission

• Driving innovation to make more efficient, robust NG engines

• Expanding market offerings for NGVs

• Identifying challenges across the sector
  • Policy
  • Technology
  • Behavior

• Engaging with stakeholders to solve problems
Biofuels

Driving Down the Cost of Biofuels

• Cellulosic ethanol prices tied to cost of enzymes used to convert biomass into fermentable sugars
• NREL partnered with Novozymes and Genencor to engineer new low-cost enzyme production
• Collaborated on biomass characterization, pretreatment, and process integration research
• Exceeded enzyme cost-reduction goal by 10x
• DOE and NREL shifting focus to hydrocarbon fuels to redirect focus to replacing diesel and jet fuel (vs. gasoline)
Transportation

Enabling Heavy Hybrids

• Developed new hybrid propulsion system
• Doubles efficiency of heavy-duty trucks and buses while improving emissions
• Partnering with UPS, Coca-Cola, FedEx
• Projected savings of more than 250 million barrels of oil in 2020
Transportation

Tripling Lithium Battery Performance

• NREL patented a unique thin-film lithium battery

• Potential to triple performance at half the cost of today’s lithium-ion batteries

• Licensed by Planar Energy to commercialize for electric and plug-in hybrid vehicle market

• NREL partnering with Planar in research and process development to bring to market
Transportation

Vehicle Efficiency Research - ADAM

• Built ADAM, the “sweaty, shivering” manikin to measure human thermal comfort in cars

• Air conditioning consumes 7 billion gallons of gasoline annually - 10% of imported crude oil

• NREL researchers goal is to reduce fuel used for air conditioning

• ADAM used by most major car manufacturers to test new efficient cooling systems
Questions and Follow Up