Renewable Fuel Vehicle Modeling and Analysis

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NREL is a national laboratory of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy operated by the Alliance for Sustainable Energy, LLC
Overview

Timeline
Project start date: FY08
Project end date: FY09
Percent complete: 50%

Budget
• Total project funding (FY08- FY09)
  – DOE $150K
  – Contractor $0K

Barriers
Renewable fuel production
Renewable fuel cost
Hybrid and plug-in hybrid electric vehicle cost

Partners
• Vehicle Systems (DOE)
• Fuels Technologies (DOE)
Objective

Evaluate renewable fuel pathways
  – Combinations of
    • Renewable fuels (ethanol)
    • Advanced vehicles

  – Impact on
    • Petroleum displacement
    • Cost/benefit
Milestones and Timeline

Milestone 6.4: Renewable Fuel Vehicle Modeling Analysis

Next Steps
- Mid-level blends
- Consumer preference approach

FY09

FY08

Link Models
Validate
Run Analysis

• Mid-level blends
• Consumer preference approach
Approach

Link Critical Models & Data

Battery wear model

Renewable fuels

Component cost models

Driving statistics

Fuel economy
Approach

Net Present Cost

What?

NOT the sum of all fuel costs
- The money needed today to pay for the vehicle and all future fuel purchases (e.g., only need $5 today to pay for $10 of fuel in 10 years)
- The lower the net present cost, the better the investment

Why?

Cost influences consumers

- JD Power 2002: "The number one reason for considering a hybrid is concern over high fuel prices"
- JD Power 2002: 2/3 of those willing to consider an HEV would NOT consider unless it achieves fuel payback
- JD 2004: 2/3 say willing if there is payback
- JD 2004: Top reason for staying with conventional: value/costs/operating costs
- JD 2006: Main issue considered for hybrid is if the price premium of the powertrain would pay for itself
- EPRI 2001: Participants thought fuel cost savings were one of the most attractive features of HEVs. Although environmental benefits, fewer trips to the gas station, and the flexibility of the dual-mode operation were influential in purchasing a vehicle, few respondents were willing to pay more for these attributes.
Approach

Key Assumptions

Long term perspective
E85 has 85% ethanol (in reality it contains less ethanol on average)
Average vehicle: mid-size car (similar to Prius)
35 MPG CAFE
$4.10/gallon gasoline (EIA 6/30/08)
$3.34/gallon E85 (e85prices.com 7/8/08)
E85 fuel consumption increase: 33%
$0.10/kWh electricity (EIA 2007 average)
8% discount rate
15-year life (BTS)
12,375 miles/year (FHWA)
235 million vehicles (BTS)
Ethanol boost efficiency & cost claims

1. Ethanol Turbo Boost For Gasoline Engines, Ethanol Boosting Systems LLC, 
2. Average stock market return 12% http://www.finfacts.com/stockperf.htm, adjusted for 4% inflation, last 7 years averaged < 3%
   http://www.inflationdata.com/Inflation/Inflation_Rate/CurrentInflation.asp
Accomplishment

HEVs Could Provide a Large Reduction in Oil Use with Little Additional Cost

Cost and Fuel Use

Renewable Fuel Standard (RFS): 36 billion gallons per year by 2022 (http://www.whitehouse.gov)

* Net includes vehicle and fuel cost
Accomplishment

E85’s Price Tracks with Gasoline’s, So Flex-Fuel Vehicles Have Been Just Shy Of Cost Effective
Cost and Fuel Use

The Ethanol Production Mandate (RFS) Does Not Entirely Supply the Fleet

Cost and Fuel Use

Renewable Fuel Standard (RFS): 36 billion gallons per year by 2022 (http://www.whitehouse.gov)

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Future Work

Add other renewable fuel options for comparison
- Mid-level ethanol blends (10, 15, 20)
- Dedicated E85 vehicles (optimized for E85)
- Biodiesel (B20)
- AER PHEV 40
- Compare
  - Cost/benefit
  - Fuel use compared to production

Technical Target Tool approach
- Trade-off performance, vehicle cost, and fuel cost to find consumer-preferred vehicles
- Estimate oil use reductions based on those preferences
Summary

Flex-fuel vehicles
- Could significantly reduce oil use
- Are capable of using far more ethanol than produced today
- Need lower cost ethanol

Flex-fuel HEVs
- Reduce the long term ethanol production needs
- Provide a low cost, high oil reduction option

Information presented to industry through the Vehicle Systems Analysis Technical Team