



DOE's Intermediate Ethanol Blends Test Program

DOE, NREL, and ORNL Team

Presented by: Kevin Stork

Team Leader

Fuels Technologies & Technology Deployment

Biomass R&D Technical Advisory Committee Meeting

September 9, 2008



**Vehicle Technologies
Program**

Biomass Program





- **Background**
- **Meeting the EISA Renewable Fuels Challenge with Ethanol – RFS**
- **E85 & FFVs**
 - Expanded Use of FFVs
 - Improved Engine Efficiency
- **Intermediate Ethanol Blends Test Program**
 - Overview
 - Project descriptions & status



- **January 2007 – State of Union Address**
 - President announces 20 in 10 initiative: Focused on reducing gasoline demand by 20% in 10 years (2017)
 - $\frac{3}{4}$ from increased use of alternative fuels
 - $\frac{1}{4}$ from improved fuel economy
- **December 2007 – Congress Passes and President Signs the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140)**
 - Key elements
 - Expanded Renewable Fuel Standard (RFS)
 - Increased Corporate Average Fuel Economy (CAFE) Standard



- **Background**
- **Meeting the EISA Renewable Fuels Challenge with Ethanol – RFS**
- **E85 & FFVs**
 - Expanded Use of FFVs
 - Improved Engine Efficiency
- **Intermediate Ethanol Blends Test Program**
 - Overview
 - Project descriptions & status



- Expands the Renewable Fuel Standard to **36B gal/yr** renewables by **2022** (vs. 7.5B gal/yr by 2012 in EPA Act 2005)
- Fuels include:
 - Corn Ethanol
 - Advanced Biofuels
 - Ethanol: cellulosic and other non-corn biomass sources
 - Biomass-derived diesel
 - Biogas
 - Biobutanol and other alcohols
 - Other biomass-derived fuels
- **EPA** is developing regulations to implement
- RIN credit for **corn ethanol** limited to **15B** of 36B gal/yr in 2022 – **Advanced Biofuels** make up remaining **21B** gal/yr



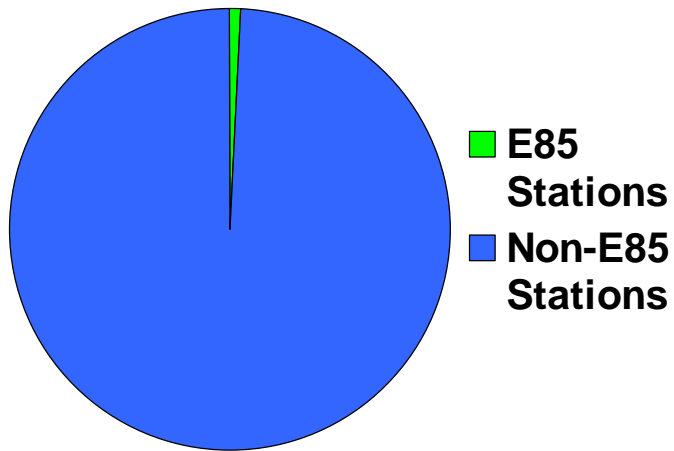
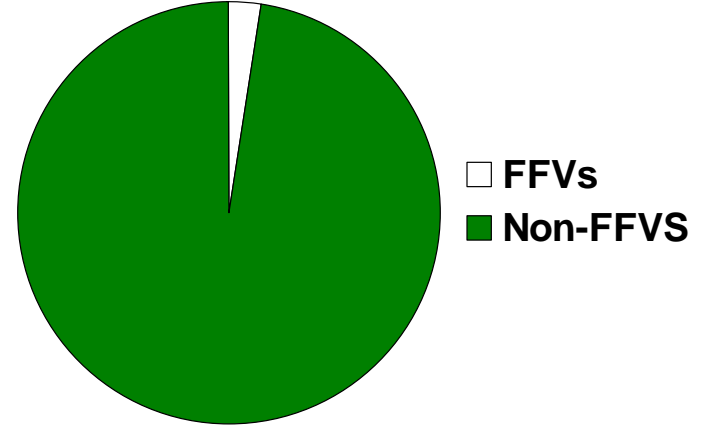
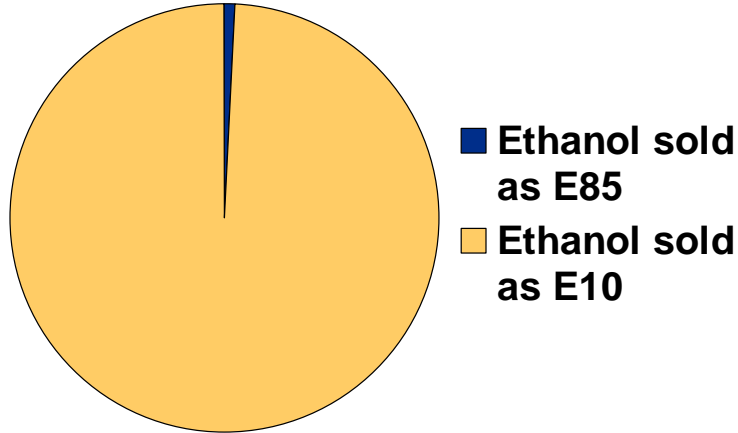
- **Current ethanol markets are not able to absorb volumes specified by the Energy Independence & Security Act (36B gallons)**
 - Today, blended gasoline used in standard vehicles (non-FFVs) is limited to 10 percent ethanol (E10).
 - More than 99 percent of the ethanol produced today is used in E10 blends; a tiny fraction is used to produce E85 for FFVs.
 - E10 markets are likely to saturate by 2013, possibly sooner, as production capacity approaches 15B gallons (~10% of all gasoline sold).
- **Two paths to increase ethanol markets beyond 15B gallons:**
 - Saturate E10 markets, and significantly expand E85 markets at a greatly-accelerated pace relative to today.
 - Certify “intermediate blends” of gasoline to use up to 15 or 20% ethanol (E15, E20) and let market forces drive ethanol supply distribution.
- **DOE already involved in expanded use of E85**
- **DOE recently began studying the impact of iBlends on the existing legacy fleet of vehicles and non-road equipment**



- **Background**
- **Meeting the EISA Renewable Fuels Challenge with Ethanol – RFS**
- **E85 & FFVs**
 - Expanded Use of FFVs
 - Improved Engine Efficiency
- **Intermediate Ethanol Blends Test Program**
 - Overview
 - Project descriptions & status



US E85 Infrastructure Very Limited



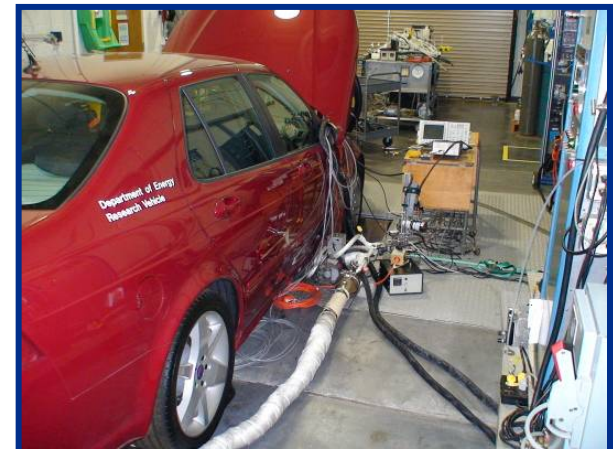
E85 Route to Solution:

In order for E85 market to absorb 21 billion gallons of ethanol per year by 2022 we estimate that the US would need :

- 26 billion gallons per year of E85: 3 to 4 **Orders of Magnitude** more than today
- 100 million FFVs vs 6 million FFVs today
- 60,000 E85 stations vs ~1,500 today



- **Support expanded use for FFVs for markets in which they make sense**
 - **Infrastructure awards**
- **Five awards to industry teams to increase efficiency and fuel economy of next-generation FFVs**
 - **Teams led by: Delphi, Ford, GM, Mahle, Bosch**
- **National Lab projects**
 - **Delphi – ORNL**
 - **State of CO E85 emissions speciation – NREL**
 - **Lean-burn study, Saab BioPower benchmarking – ORNL**





- **Background**
- **Meeting the EISA Renewable Fuels Challenge with Ethanol – RFS**
- **E85 & FFVs**
 - Expanded Use of FFVs
 - Improved Engine Efficiency
- **Intermediate Ethanol Blends Test Program**
 - Overview
 - Project descriptions & status



- DOE initiated study ~ 1½ yr ago
- Organizational meetings – DOE, National Labs, EPA, USDA, State of MN – March & June 2007
- Literature review April – July 2007
- Small, non-road engines (SNRE) given priority in summer 2007 at EPA request
- Established leveraging with CRC and EPA
- Vehicle evaluations underway late CY 2007
- Specialty engine test planning underway: ATVs, marine, motorcycles, snowmobiles





- **Very little data on E20 and almost none on E15**
- **NO_x emissions increase and long-term catalyst degradation seen with E20**
- **Materials compatibility issues with E20, and evidence of fuel filter plugging (even with E10)**
- **Average driver might not detect driveability problems (stumble, hesitation, etc.) in late-model vehicles using E20**
 - **No obvious initial problems**
 - **No long-term information available**
- **Drivers of older vehicles could notice driveability problems (potential tampering concern)**



- **E15/E20 impact on legacy fleet – pilot study (16 popular, late-model light-duty vehicles)**
 - Interim report to be published shortly
- **Leveraging several CRC and EPA projects:**
 - CRC E-77 evaporative emissions program
 - CRC CM-138 driveability program
 - EPA EPAAct program, emissions affected by fuels
 - CRC E-87 catalyst durability
 - CRC Probable – Engine Durability Program



All Testing Conducted at Neutral Sites



- **Materials compatibility reviews and studies**
 - **CRC AVFL-15, E20 fuel**
 - **Monitoring Minnesota E20 program; RIT fleet study**
 - **UL dispenser materials study underway**
- **Small, non-road engines: Done (accelerated at EPA request)**
 - **Report forthcoming**
- **Future specialty engine studies**
 - **Marine engines**
 - **ATVs, snowmobiles, motorcycles**
 - **Heavy-duty gasoline engines**





- **Only immediate effects – no long term results yet**
- **Consistent with prior studies so far**
- **Fuel economy decreased on volumetric basis for E10, E15, E20, and E30 – closely tracks fuel energy content**
- **Cars that ran less rich at full-throttle (open-loop conditions) exhibited higher exhaust temperature**
 - **Approximately half of vehicles tested**
- **In the post-2002 test cars, casual (untrained) observations do not suggest an impact on driveability at 75 deg F – other temperatures unknown**
 - **Additional testing at 50 deg F ongoing**
- **Older car driveability data being processed**



- **Engine durability study (CRC) – currently in planning**
 - **Long-block engine components (*i.e.*, major parts, no fuel system)**
- **Certain fuel system components compatibility**
- **Durability of the evaporative emission control parts**
- **Driveability vehicle sample very limited in size and operating conditions – may be expanded**
- **Medium-duty gasoline vehicles not covered in current test program**
- **Unforeseen issues**



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

Questions

