Ethanol Industry Perspective on the “Blend Wall”

Renewable Fuels Association
About the RFA

• The Renewable Fuels Association (RFA) promotes policies, regulations and research and development initiatives that will lead to the increased production and use of fuel ethanol.

• RFA membership includes a broad cross-section of businesses, individuals and organizations dedicated to the expansion of the U.S. fuel ethanol industry.
Ethanol as a Fuel & Fuel Additive

1. **E10 (10% ethanol by volume)**
   - Approved for use in all vehicles and engines
   - ~98% of ethanol consumed as E10
   - 80% of U.S. gasoline blended with ethanol

2. **E85 (70-85% ethanol by volume)**
   - For use in flex-fuel vehicles (FFVs) only
   - 7+ million FFVs; ~2,000 retail outlets
   - <2% of ethanol consumed as E85

3. **Mid-level blends (20, 30, 40% ethanol by volume)**
   - For use in FFVs only
   - Dispensed by “blender pumps” (<250 stations)
   - Specifications, BMPs, etc. under development
Renewable Fuels Standard (RFS)

Note: 20% reduction for conventional biofuels applies only to new construction
The Bottom Line

• EISA requires consumption of 36 billion gallons of renewable fuels annually by 2022
• Most of the renewable fuel will be ethanol (~33-34 billion gallons)
• ~34 billion gallons = 27% of 2022 projected gasoline use
• Current law and infrastructure preclude the use of >10% ethanol blends in conventional autos
• How will required renewable fuels enter the marketplace once the E10 market is saturated?
Meeting RFS Ethanol Targets

• E10 reaches saturation at ~12.5-14 billion gals.
  – 2010 RFS = 10.6 bg (conventional + undifferentiated advanced)
  – 2011 RFS = 12.3 bg (conv. + und. advanced + cellulosic)
  – 2012 RFS = 13.15 bg (conv. + und. advanced + cellulosic)
  – 2013 RFS = 14.2 bg (conv. + und. advanced + cellulosic)

• Meeting mid- and long-term RFS targets will require:
  – Rapid proliferation of E85 (FFVs & infrastructure); and
  – Approval of blends >E10 for conventional autos
E10 saturation is approaching more rapidly because of falling gasoline demand.

EIA reduced its 2009 gasoline demand estimate each month from 1/08 to 1/09.
RFS Ethanol Requirements
(% of projected gasoline use)

Ethanol Use Required Under EISA, as Implied % of Total (Blended) Gasoline Consumption

NOTE: Does not include effect of small refiners exemption through 2010
The E10 Blend Wall

Notes: (1) Assumes undifferentiated biofuel will be ethanol in mid-term; (2) Does not account for small refiner exemption through 2010
E85 as an Option

- FFVs can use any combination of gasoline and ethanol up to 85% ethanol by volume
- FFVs account for 3% of U.S. light duty fleet
- E85 is offered at 1.5% of U.S. retail stations
- Other challenges:
  - Mileage loss
  - Infrastructure cost
  - Specifications & standards
  - Mismatch between FFV density & E85 availability
E85 as an Option

• For E85 to absorb RFS-required ethanol in excess of the E10 market:
  – 60,000 retail outlets will be needed (DOE)
  – 90-110 million FFVs will be needed (DOE)
  – Mileage loss must be offset by discount pricing

• Domestic automakers are committed to FFVs

• Federal and state programs help defray costs of E85 infrastructure installation
Mid-Level Blends as an Option

- 10% ethanol by volume is max level for current conventional auto fleet and fuel supply chain
  - Automobile and small engine warranties
  - Specifications and standards
  - Storage, dispensing infrastructure (?)

- Moving beyond 10% would require:
  - Fuel waiver [CAA Sect. 211 (f)(4)]
  - Change to auto and small engine warranties
  - *Clear* certification of storage, dispensing equipment
Mid-Level Blends as an Option

Fuel Waiver

• To qualify for a waiver, applicant must show fuel or fuel additive will not “cause or contribute to a failure of any emission control device or system...”

• To date, no such failure has occurred in automotive testing for mid-level blends (mostly E15 and E20)

• Applicant data should include: materials compatibility; drive-ability; durability; emissions

• Considerable amount of data available

• Significant work under way (CRC, DOE, trades)
### Sample of completed and ongoing research on mid-level blends

<table>
<thead>
<tr>
<th>ENTITY</th>
<th>STUDY/REPORT</th>
<th>FUELS TESTED</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinating Research Council</td>
<td>Fuel Permeation from Automotives</td>
<td>Conv. vehicles tested on E0, E6, and E20; FFVs tested on E85</td>
<td>Project complete; final report on CRC website</td>
</tr>
<tr>
<td>Coordinating Research Council</td>
<td>Effect of CO and RVP on Exhaust Emissions of In-Use Fleet</td>
<td>E0, E10 and E20 fuels</td>
<td>Project complete; draft final report</td>
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<tr>
<td>Coordinating Research Council</td>
<td>In-Use Evaporative Emissions</td>
<td>E0, E10, and E20 fuels</td>
<td>Pilot program complete (E0); main program ongoing</td>
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<tr>
<td>Coordinating Research Council</td>
<td>Exhaust and Evaporative Emissions Testing of Flex-Fueled Vehicles</td>
<td>Pilot program: E6, E85, 50/50 mix Main program E9, E32, E66 and E85</td>
<td>Project testing in progress</td>
</tr>
<tr>
<td>Coordinating Research Council</td>
<td>Mid Level Ethanol Blend Catalyst Durability Study</td>
<td>E0, E10, E15 and E20 fuels</td>
<td>Project testing in progress</td>
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<tr>
<td>Coordinating Research Council</td>
<td>EPAc Light Duty Vehicle Fuel Effects</td>
<td>E0, E10, E15 and E20 fuels</td>
<td>Project testing by EPA in progress</td>
</tr>
<tr>
<td>Coordinating Research Council</td>
<td>Coordinating Research Council, Inc., 2006 Hot-Fuel-Handling Program</td>
<td>E0, E5, E10 and E20 fuels</td>
<td>Project complete; final report on CRC website</td>
</tr>
<tr>
<td>Coordinating Research Council</td>
<td>Coordinating Research Council, Inc., 2008 Cold Start and Warm-up Driveability Program</td>
<td>E0, E15, E20, and E85 (fuel-flexed vehicles only)</td>
<td>Project complete; final report on CRC website</td>
</tr>
<tr>
<td>Coordinating Research Council</td>
<td>Fuel Chemistry Impacts of Gasoline/Ethanol Blends in HCCI Single Cylinder Test Engine</td>
<td>Ethanol effects tested up to E30</td>
<td>Testing complete; data analysis in progress</td>
</tr>
<tr>
<td>Coordinating Research Council</td>
<td>E20 Fuel System and Fuel Component Durability Study</td>
<td>E0, E10, and aggressive E20 fuels</td>
<td>Project testing in progress</td>
</tr>
<tr>
<td>Dept. of Auto Engineering Tech., Minnesota St. U., Mankato</td>
<td>The Effects of E20 on Automotive Fuel Pumps and Sending Units</td>
<td>E10, E20</td>
<td>Completed February 2008</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>Demonstration and Driveability Project to Determine the Feasibility of Using E20 as a Motor Fuel</td>
<td>E0, E20</td>
<td>Completed October 2007</td>
</tr>
<tr>
<td>Dept. of Auto Engineering Tech., Minnesota St. U. Mankato</td>
<td>An Examination of Fuel Pumps and Sending Units During a 4000 Hour Endurance Test in E20</td>
<td>E0, E20</td>
<td>Publication Pending</td>
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<tr>
<td>University of Minnesota</td>
<td>E20 Effects in Small Non-Road SI Engines</td>
<td>E0, E20</td>
<td>Completed January 2008</td>
</tr>
<tr>
<td>Dept. of Energy</td>
<td>Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1</td>
<td>E0, E10, E15, E20</td>
<td>Completed October 2008</td>
</tr>
</tbody>
</table>
E15 Fuel Waiver

• Submitted to EPA March 6, 2009
• Applicant was Growth Energy on behalf of certain ethanol cos. (fuel/additive providers)
• Public notice published in April 21 Fed. Reg.
• 30-day comment period closes May 21
• EPA has 270 days from date of submission to take action (Dec. 1, 2009)
• EISA eliminated approval by default
Impact of E15 Approval on Ethanol Market and RFS Compliance

E15 Blend Maximum

Million Gallons Ethanol

RFS Ethanol Production (Conventional + Advanced)
Theoretical E10 Blend Wall (100% Penetration)
Theoretical E15 Blend Wall (100% Penetration)
Long-term goals likely to require mid-level blends higher than E15

A Possible RFS Compliance Path for Ethanol? (Illustrative Only)
Summary

• The E10 “Blend Wall” is rapidly approaching
• E85 is an important long-term strategy, but is unlikely to absorb large quantities of ethanol above E10 market saturation in short term
• Approval of mid-level blends necessary for RFS compliance in near- and mid-term
• Long-term RFS compliance will require combination of mid-level blend approval and rapid E85 proliferation
• Considerable automotive research has already been completed with no “show-stoppers”
• Additional research continues
• *We can successfully break through the “Blend Wall” and meet RFS goals*