Congress has a choice. Choose wisely.
E15 and Public Respiratory Health

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Renewable Fuels Association

- National Trade Association for the domestic ethanol industry promoting policy, regulations, research and development for the industry.

- History of the Association
  - Organized in 1981
  - Ethanol Producers constitute the Board of Directors
  - Representing domestic production
  - Leader in legislative and technical efforts of industry
U.S. Ethanol Industry

- Total production capacity of 14.8BGPY.
  - 2011 Production: 13.9BGPY
  - Current capacity utilization: 12.4BGPY (~83%)
  - ~14% reduction since June 2012

- 211 plants operating in 26 states.

Source: DOE/EIA
Lots of Attention in the Media....

• Food vs. Fuel
• Green House Gas Reduction
• Increases Price of a Gallon of Gas
• Lack of Supply
• Lack of Infrastructure
• Lack of ..... You fill in the blank here....

In Reality......
Ethanol in the Economy

- 90,400 direct jobs
- 311,200 indirect or induced jobs
- $43 billion contribution to GDP
- $30 billion in household incomes
Ethanol Exports

- Topped 1.9B gallons in 2011.
- One-third of that went to Brazil.
- Other curious importers: United Arab Emirates.
Why Biofuels?

The Bigger Picture

Biofuels Policy Objectives:

• Reduce dependence on imported oil
• Provide new markets for commodities
• Stimulate rural economies and create jobs
• Reduce GHG emissions and provide other environmental services

Ethanol accomplishes each of these objectives
First Generation Biofuels are the bridge to Second Generation Biofuels…..

ERA OF CLIMATE CHANGE

LEGISLATION

- Regulations effective July 1, 2010
- Rule establishes volume and GHG reduction requirements for specific categories of biofuels

<table>
<thead>
<tr>
<th>Category</th>
<th>GHG Reduction Req.</th>
<th>2022 Volume Req.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Biofuels</td>
<td>20%</td>
<td>15 bgy</td>
</tr>
<tr>
<td>Advanced Biofuels</td>
<td></td>
<td>21 bgy</td>
</tr>
<tr>
<td>Cellulosic</td>
<td>60%</td>
<td>16 bgy</td>
</tr>
<tr>
<td>Biomass-based diesel</td>
<td>50%</td>
<td>1 bgy</td>
</tr>
<tr>
<td>“Undifferentiated”</td>
<td>50%</td>
<td>4 bgy</td>
</tr>
</tbody>
</table>

- EPA includes indirect land use change emissions in determining GHG reductions
There is Broad Agreement That Corn Ethanol Reduces Direct GHG Emissions

Corn Ethanol GHGs vs. Average Gasoline

Four Recent Analyses

Most studies show ~30-50% GHG reduction

Cellulosic Ethanol Results in Even Greater GHG Reductions

**Sources:**
U.S. Crude Dependence

Source: EIA

U.S. OIL IMPORT DEPENDENCE WITH ETHANOL

U.S. OIL IMPORT DEPENDENCE WITHOUT ETHANOL
The Bottom Line

• EISA requires consumption of 36 billion gallons of renewable fuels annually by 2022.
• Ties a carbon intensity to motor fuels.
• Anticipate that most of the renewable fuel will be ethanol (~33-34 billion gallons).
• What will be the fuel mix?
  – ~34 billion gallons = 27% of 2022 projected gasoline use.
  – Will require the introduction of new fuel and fuel additives from non-fossil origin.
Transportation Fuels Today

• 136 billion gallons a year gasoline
  – 13.9 billion gallons a year ethanol
  – Fuel Use (FHA)
    • Declining fuel use in 2008
    • 2009 demand -0.1%
    • 2010 demand flat
    • 2011 demand decreasing
Ethanol in the Marketplace

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

- **E15 (15% ethanol by volume)**
  - Approved for 2001 model year vehicles and newer by EPA in 2010/2011
  - Complex regulatory framework for retailers: MMP, Survey, etc.
  - Only one station to date offering

- **Flex Fuels: E85 (70-85% ethanol by volume) and Mid-level blends (20, 30, 40% ethanol by volume)**
  - For use in flex-fuel vehicles (FFVs) only, 9 million FFVs
  - ~2,943 retail outlets offering E85 and/or MLEBs
  - ASTM standard published: D7794 and other infrastructure support underway, etc.
  - <2% of ethanol consumed as E85
EPA’s E15 Decision

- March 6, 2009 waiver submitted to US EPA to increase the allowable ethanol content in gasoline to 15% volume.
- US EPA received >78,000 comments from the public.
- EPA responded October 2010 and January 2011 with partial approval, partial denial:
  - Approved for Vehicle MY2001 and newer
  - Denied for Vehicles MY2000 and older, non road engines
  - Required conditions for E15 in marketplace, Misfueling Mitigation Rule
    - Plan to ensure legal usage of fuel in marketplace
    - RVP Cap of 9psi in summer volatility control season
    - Complex Model modifications
- See: [http://www.epa.gov/otaq/regs/fuels/additive/e15/](http://www.epa.gov/otaq/regs/fuels/additive/e15/)
Fuel Regulations

Federal

- EPA Health effects testing/fuel registration
  - EPA waiver conditions
- EPA Fuel Detergent Certification
- EPA Non-attainment
- FTC Octane Certification

State

- Weights & Measures fuel regulations
- ASTM/ NCWM fuel quality/ specification
- FTC octane certification
- State fire code and UST regulations
- EPA or air quality management

Additional industry requirements: Automaker Warranties and Safety and Emergency Response.
E15 Federal Regulatory Pathway

• March 2009- Industry waiver application submitted.
• Feb. 2012- Industry submitted information allows registration with EPA.
• July 2012- EPA approves waiver conditions submitted by industry: Misfuelling Mitigation Plan.
• July 2012- First station offers E15.
E15 Fuel Characteristics

• “Indistinguishable” compared to E10 in most aspects.
  – Completely miscible with gasoline.
  – Identical impact to vapor pressure.
  – Additional ethanol reduces sulfur, toxics, and aromatics - all regulated characteristics of gasoline.
• Increase octane number a minimum of 1.2 AKI.
• Increase oxygen content ~2% wt.
Effects of E15 on Air Quality

- Emissions compared to E10:
  - Reduce VOC evaporative and exhaust emissions,
  - Reduce carbon monoxide (CO),
  - Either have no effect or a slight increase in nitrogen oxides (NOx).

Important to note: EPA did not allow 1# waiver for E15, vapor pressure of fuel impacts evaporative and exhaust VOC emissions.
Gasolines containing oxygenates, such as ethers and ethanol, and reformulated gasolines might be available in your area. We recommend that you use these gasolines, if they comply with the specifications described earlier. However, E85 (85% ethanol) and other fuels containing more than 15% ethanol must not be used in vehicles that were not designed for those fuels.
State Fuel Regulations

• Each state has authority to characterize and implement fuel requirements.
• State regulations fill in gaps for EPA regulations.
• Many state regulations are tailored for traditional, petroleum based fuels.
  – Updates needed to allow new fuels, fuel blends.
Example: State Adoption of ASTM
• Public and Private Industry coming together to provide much needed emergency response information.

• Toolbox for First Responders: Training Manuals, Hazard Preparedness for Incidents, Fixed Facility Manual, MSDS, and more.

• Ethanol Emergency Response information available: www.ethanolresponse.com
Future Vehicle Needs

• Auto manufacturers are challenged with more restrictive emissions requirements and increasing fuel economy standards.
• These requirements will require a step change to the base fuel available in the US.
• Recent research indicates that increasing octane enables greater engine efficiency.
  – Ethanol’s greatest fuel property is boosting octane values.
  – Ford, AVL, MIT, Ricardo, DOE, CRC, etc. all conducting research on increased octane benefits to engine efficiency.
## Internal Combustion Engine Options

Costs and benefits of fuel economy improvements show that a mix of options are available to OEMs. Higher octane fuels will facilitate vastly more efficient engines.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Benefit</th>
<th>Cost</th>
<th>Vehicle Manufacturers Using</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Fuels</td>
<td>+</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>Compression Ratio Increase</td>
<td>+</td>
<td>0</td>
<td>All</td>
</tr>
<tr>
<td>Cam Profile Switching</td>
<td>++</td>
<td>$$</td>
<td>Honda, Mitsubishi, Porsche, Audi</td>
</tr>
<tr>
<td>Active Valvetrain</td>
<td>+++</td>
<td>$$$</td>
<td>Fiat, BMW</td>
</tr>
<tr>
<td>Direct Injection Fuel Sys.</td>
<td>++</td>
<td>$$</td>
<td>Mitsubishi, Audi, GM, Ford, BMW, etc.</td>
</tr>
<tr>
<td>Turbocharging</td>
<td>++</td>
<td>$$</td>
<td>Ford, Volvo, GM, Audi, BMW, etc.</td>
</tr>
<tr>
<td>Advanced Boosting systems</td>
<td>+++</td>
<td>$$$</td>
<td>None</td>
</tr>
<tr>
<td>Exhaust Energy Recovery</td>
<td>+</td>
<td>$$$</td>
<td>Commercial vehicles</td>
</tr>
</tbody>
</table>
Parting Thoughts

• New fuels, like E15, are only the beginning of the implementation of the Energy Independence and Security Act.

• Lessening the negative impacts of fossil fuels/gasoline on humans and the environment are possible with first and future generation biofuels.

• Regulatory framework for fuels must be updated.
  – Federal and state fuel regulations tailored for fossil fuels and restrict development/deployment of new fuels.