Emerging Alternative Fuel Issues

May, 2007

Agricultural Air Quality Task Force Meeting

Paul Argyropoulos, Senior Policy Advisor
EPA’s Office of Transportation and Air Quality
Future for Fuels
Meeting in the Middle?
- Currently, More Questions than Answers -

Environment

Energy

Economics

The Sweet Spot?
Existing and Emerging Issues That Will Impact the Fuels Mix

Production Technologies

- Infrastructure
- Economics
- Federal / State Incentives
- Energy Security, Diversity and Sustainability
- Environmental Protection: Multi-Media Issues
- Sustainable Feedstocks
- Metrics: Lifecycle, Energy, Hybrid
- Vehicles/Engines
- Fleet Efficiency
- Fuel Types and Usage Scenarios

The Sweet Spot?
Meeting Energy Needs, Environmental Protection Economically Sustainable
Where Are We Now?

- Federal Fuels – Systems / Integrated Approach
  - Final National RFS – April 10, 2007
  - Reformulated Fuels
    - Impact of Removal of Oxy Requirement
  - Conventional Fuels
  - The Re-emergence of “Alternative Fuels”? 
  - New/Future Fuels

- State Fuels
  - State Air Quality Fuels (SIP Fuels)
  - State Renewable and Alternative Fuels

- Other
  - EPAct Section 1509 – Fuels Harmonization vs. Trend Toward Diversification
  - National Biofuels Action Plan
  - Biomass Research and Development Board
  - National Advisory Council for Energy Policy and Technology
Boutique Fuels from State SIPs

Source: EPA

Legend:
- RVP of 7.0psi w/Sulfur Content
- RVP of 7.0psi
- RVP of 7.2psi
- RVP of 7.8psi
- Cleaner Burning Gasoline
- Winter Gasoline
- Texas Low Emission Diesel Fuel & State RVP Controls of 7.8psi
- Texas Low Emission Diesel and Federal RFG or RVP Control
BioFuels: State Mandates, Incentives, Production and Use

Source: ACE
Biodiesel: Production and Sales

-Source: National Biodiesel Board-

Commercial Biodiesel Production Plants (January 31, 2007)

- Discussions Continue on:
  - Emissions – Collaborative Testing Program
  - Market Potential
  - Fuel Quality

Estimated US Biodiesel Sales

<table>
<thead>
<tr>
<th>Fiscal Year (Oct. 1 - Sept. 30)</th>
<th>Million Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>0.5</td>
</tr>
<tr>
<td>2000</td>
<td>2</td>
</tr>
<tr>
<td>2001</td>
<td>5</td>
</tr>
<tr>
<td>2002</td>
<td>16</td>
</tr>
<tr>
<td>2003</td>
<td>29</td>
</tr>
<tr>
<td>2004</td>
<td>35</td>
</tr>
<tr>
<td>2005</td>
<td>76</td>
</tr>
<tr>
<td>2010</td>
<td>250</td>
</tr>
</tbody>
</table>
What The Country May Look Like in 2009
- An RFS Scenario -

9.6 Bgal Ethanol

Source: EPA
Federal Roles

- Research and Development
- Regulatory
  - The Clean Air Act and EPA
  - The Energy Policy Act and EPA
- New Policies – Mandatory and Voluntary Approaches
  - Incentives, credits, flexibilities, grants, other
- International Activities and Coordination Efforts
- Communication
Office of Transportation and Air Quality
- Biofuels Responsibilities -

- **Regulatory**
  - Clean Air Act gives EPA authority in a number of areas:
    - Fuel quality standards, fuel and additive registration
    - Vehicle certification – Conventional, FFVs and AFV’s
  - Energy Policy Act EPA has authority to:
    - Implement the Renewable Fuel Standard (RFS)
    - Perform studies on the emissions impact of renewable fuels

- **Voluntary Programs**
  - SMART WAY Transportation Partnerships, National Clean Diesel Campaign and Grow and Go Programs

- **Research, Development & Analysis**
  - Analysis – Including life cycle assessment of renewable fuel and environmental and economic impacts of increased biofuel production
  - Authorization for Grants for R & D and demonstration programs for production of cellulosic ethanol
The Final RFS: Flexible, Adaptable Program Design

- Signed on April 9th: Program Requires Growing Renewable Use from 4 BG / Year beginning in 2006 to 7.5 BG Year by 2012

- Major Compliance Element - Trading and Banking Provisions
  - Design supports maximum flexibility
  - Allows for compliance when, where and how it makes the most sense
  - Utilizes existing fuel program compliance mechanisms to greatest extent possible

- Renewable values based on volumetric energy content in comparison to corn ethanol
  (adjusted for renewable content)
  - Corn-ethanol: 1.0
  - Cellulosic biomass ethanol: 2.5
    - As specified in EPAct
  - Biodiesel (alkyl esters): 1.5
  - Renewable diesel: 1.7
  - Biobutanol: 1.3

- Sought comment on life cycle energy, petroleum, GHG emissions

- Values can be adjusted in the future if metrics change
  - Provisions already in the regulations for adding new fuels and modifying existing values

- Program Starts September 1, 2007
Projected Renewable Use

- RFS program standard provides important foundation for ongoing investments
- Demand for renewable fuels are projected to outpace the RFS requirements
- Unclear what impacts new policies may have on altering national fuels landscape

If 100% of all Gasoline is E10

2 Cases on which impacts analyses were performed for the rule
More U.S. Corn is Used for Ethanol Production

Corn Use in 2012

- 14% Corn used for ethanol in 2012
- 20% Corn used for ethanol in 2012
- 26% Corn used for ethanol in 2012

Legend:
- Feed
- Ethanol
- Exports
- Domestic consumption
### An Air Quality Snapshot

<table>
<thead>
<tr>
<th></th>
<th>Nationwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>↓</td>
</tr>
<tr>
<td>Benzene</td>
<td>↓</td>
</tr>
<tr>
<td>NOx + VOC</td>
<td>↑</td>
</tr>
<tr>
<td>Ozone</td>
<td>Slight Increases on National Average Basis</td>
</tr>
</tbody>
</table>

**NOTE:** Impacts will vary by region since renewable fuel use varies

---

2004 Base Reference Year
Incremental Impacts From Base Reference Year to 2012 Cases
Lifecycle GHG Analysis

- Used the Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) model developed by Argonne National Laboratory

- Analysis represented marginal fuel production e.g., new fuel required to meet requirements

- Focused on corn ethanol and biodiesel (majority of the fuels used to meet the mandate)

- Used data from the rule cost / agricultural sector modeling as inputs to the lifecycle work
  - Ethanol and biodiesel production energy use
  - Land use change acres
  - Mix of fuels used for biofuel production process energy

<table>
<thead>
<tr>
<th></th>
<th>Corn ethanol</th>
<th>Corn ethanol (biomass fuel)</th>
<th>Cellulosic ethanol</th>
<th>Imported ethanol</th>
<th>Biodiesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHG</td>
<td>21.8%</td>
<td>54.1%</td>
<td>90.9%</td>
<td>56.0%</td>
<td>67.7%</td>
</tr>
</tbody>
</table>

The use of 1 Btu of corn-ethanol instead of 1 Btu of gasoline reduces lifecycle GHG emissions by 21.8%
### Environmental Indicators Examined in Agricultural Sector

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Nationwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>↑</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>↑</td>
</tr>
<tr>
<td>CRP Lands</td>
<td>↓</td>
</tr>
</tbody>
</table>

- Modest increase in fertilizer use; U.S. nitrogen use increases by less than 2% and U.S. phosphorous use increases by about 1%

- CRP withdrawals of 2.3 - 2.5 million acres; total CRP lands today are roughly 39 million acres

- In time frame of rulemaking, not enough time to look at other agricultural sector environmental impacts
U.S. Farm Income Increases While Food Costs Increase Modestly

Change in Net Farm Income in 2012

Increase in Annual Food Costs Per Person in 2012
The President called for a commitment to reduce petroleum-based gasoline consumption by 15% by 2017 through renewable plus alternative fuels.

15% reduction in 2017 translates into a target of ~35B gallons of renewable plus alternative fuel use in transportation system.

To reach goal, must consider several issues:
- Available fuel feedstock sources
- Production and Fueling infrastructure
- Appropriate fuels and fuel blends
- Impacts / Other

NEW POLICY
- Alternative Fuels Standard – President Sent New Legislation to Congress
- Senator Inhofe Introduced Administrations Legislation Last Week
- Biofuels for Energy Security Act of 2007 – Senators Domenici and Bingaman
- Advance Clean Fuels Act of 2007 – Senator Boxer
- Other…………………..
Emissions Overview
Source: EPA

This chart represents best available information about current or projected production practices and the impact of those practices on lifecycle greenhouse gas emissions. The numbers presented for renewable fuels were used in the analysis of the Agency’s Renewable Fuel Standard rulemaking. EPA along with other Federal agencies and stakeholders are committed to continuing to improve lifecycle analysis techniques.
Next Steps

- NEW POLICIES → New Regulations?
  - Alternative Fuels Standard and Beyond

- Evolve AFS program from foundation set by current RFS

- EPA to continue technical and regulatory expertise to assist policy makers to implement goals while protecting the environment

- International Efforts
  - Standardization?
  - Cooperative Arrangements

Web page and Links: http://www.epa.gov/otaq/
Paul Argyropoulos
Email: argyropoulos.paul@epa.gov
Phone: 202-564-1123