Addressing the Issues of a Growing Industry

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2007 – A Short But Wild Ride

- Ethanol goes from being the hero of the 2005 EPACT to the villain.
- Organized, calculated campaign to discredit biofuels globally.
- Blistering media coverage and public scrutiny.
- Yet, new RFS increases ethanol demand by 500%!

How Did This Happen?
Factors That Drove Legislation

- Relentless increase in energy costs
- Ongoing tensions in the Mideast
- Ethanol program – one of the few success stories
  - Biofuels the centerpiece of any new legislation
- End of year politics – threat of election year wall
Energy Policy Act of 2005 established first RFS
- Replaced oxygen standard
- Required 4 BGPY increasing to 7.5 by 2012
- Took effect as MTBE was going out, creating immediate demand of 6 BGPY
Background (Continued)

- Modern day Gold Rush
  - Cheap corn + high ethanol
  - Capital Available
  - State and local incentives

- Huge catalyst for economic development
- Incredible political support
Ethanol Capacity

- 131 Current Plants – 7 Billion GPY
- 72 Construction/Expansion – 6 Billion GPY
Ethanol production estimates based on year-to-date production from U.S. EIA.
Existing/Planned Capacity Quickly Surpassed Requirement

Billions of Gallons

- Supply
- Requirement

Years: 2006 to 2012
Single focus bills like an RFS are almost impossible to pass. Energy legislation has become a balloon flattening exercise that must consider:

- Impacts on CO$_2$ emissions, climate change
- Impacts on the budget/subsidy
- Impacts on other energy
- Impacts on food and consumer goods
- Impacts on trade and foreign policy

Must also address CAFE
- Alt fuel vehicles and Infrastructure
- Stationary source power/RPS
- Energy balance/lifecycle emissions
The Enemy of the Good is the Perfect

- The panacea problem
  - How much matters:
    10% = 15 BGPY = $38 billion
- The Brazil syndrome
- Accuracy in reporting and assessing
  - Bush “20 in 10” plan
  - Wild, inaccurate reports of biofuel requirement
Intense Criticism

- Oil Industry Unleashed
  - Threatened to stop refinery expansions
  - Ethanol prices grossly under value while collecting tax benefits

- Meat Industry, Other Feeders
  - Well orchestrated campaign to discredit ethanol
    -- Energy Balance
    -- Water
    -- Subsidies
    -- Food
    -- Emissions – plant and vehicle
New Bill Reflects Carbon and Food Concerns

- Creates 36 BGOPY RFS
- Limits corn use
- Requires new sources of ethanol
- Requires reductions in GHG emissions
- Creates E85 initiatives
Almost Didn’t Get There:
Failure to Communicate

<table>
<thead>
<tr>
<th></th>
<th>Senate</th>
<th>House</th>
</tr>
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<tbody>
<tr>
<td>RFS</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>RPS</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>CAFE</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Tax Incentives</td>
<td>No</td>
<td>Yes</td>
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</table>
### New RFS Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Volume of Renewable Fuels</th>
<th>Advanced Biofuel Requirement</th>
<th>Cellulosic Requirement</th>
<th>(Resulting Cap on Corn ethanol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>9.000</td>
<td></td>
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<tr>
<td>2009</td>
<td>11.100</td>
<td>.600</td>
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<td>10.5</td>
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<td>2010</td>
<td>12.950</td>
<td>.950</td>
<td>.100</td>
<td>12.0</td>
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<td>2011</td>
<td>13.950</td>
<td>1.350</td>
<td>.250</td>
<td>12.6</td>
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<td>2012</td>
<td>15.200</td>
<td>2.000</td>
<td>.500</td>
<td>13.2</td>
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<tr>
<td>2013</td>
<td>16.550</td>
<td>2.750</td>
<td>1.000</td>
<td>13.8</td>
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<tr>
<td>2014</td>
<td>18.150</td>
<td>3.750</td>
<td>1.750</td>
<td>14.4</td>
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<tr>
<td>2015</td>
<td>20.500</td>
<td>5.500</td>
<td>3.000</td>
<td>15.0</td>
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<tr>
<td>2016</td>
<td>22.250</td>
<td>7.250</td>
<td>4.250</td>
<td>15.0</td>
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<tr>
<td>2017</td>
<td>24.000</td>
<td>9.000</td>
<td>5.500</td>
<td>15.0</td>
</tr>
<tr>
<td>2018</td>
<td>26.000</td>
<td>11.000</td>
<td>7.000</td>
<td>15.0</td>
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<tr>
<td>2019</td>
<td>28.000</td>
<td>13.000</td>
<td>8.500</td>
<td>15.0</td>
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<td>2020</td>
<td>30.000</td>
<td>15.000</td>
<td>10.500</td>
<td>15.0</td>
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<tr>
<td>2021</td>
<td>33.000</td>
<td>18.000</td>
<td>13.500</td>
<td>15.0</td>
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<tr>
<td>2022</td>
<td>36.000</td>
<td>21.000</td>
<td>16.000</td>
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</table>
Advanced Renewable Fuels

- All non-corn starch based grains
  - Wheat, sorghum, barley, rye, oats
- Sugarcane crops and bagasse
- Cellulose
  - Switch grass
  - Corn Stover
  - Grain fiber/hulls
  - Straw
- Lignin
  - More complex structure
- Waste Feedstocks
  - Ag, MSW, Forest
# New Renewable Diesel Requirements

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Applicable Volume of Biomass-Based Diesel (in millions of gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>500</td>
</tr>
<tr>
<td>2010</td>
<td>650</td>
</tr>
<tr>
<td>2011</td>
<td>800</td>
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<tr>
<td>2012</td>
<td>1.0</td>
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</table>
Farm Bill Playing a Key role on Biofuels

Title VII Research, Title IX – Energy

- Reauthorizes the Biomass R, D & D Programs

- Cooperative programs with DOE for Biofuels, Biorefinery Development
  - Loans, Loan guarantees, grants –
  - Bio Refinery and Repowering Assistance
  - $422MM

- Biomass Crop Transition Assistance
  - $227 MM

- Biomass Feedstock Purchase Assistance for Advanced Biofuel
  - $345 MM

- Other Assorted Programs
Tax Title Critical to Cellulosic Ethanol

- New total for cellulosic ethanol of $1.25
  - Base VEETC plus difference (.51 + .64)
- No Small Producer cap = additional 10 cents
  - (No 15 MGPY limit, no 60 MGPY plant cap)
- Includes all “Biofuels” for credit
- Accelerated depreciation of property
## Selected Companies Developing Ethanol From Lignocellulosic Feedstocks

<table>
<thead>
<tr>
<th>Company/Location</th>
<th>Feedstocks</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abengoa (Madrid)</td>
<td>Corn stover, wheat straw, milo stubble, switchgrass</td>
<td>Enzymatic hydrolysis; fermentation; thermochemical</td>
</tr>
<tr>
<td>ALICO (La Belle, Florida)</td>
<td>Wood, citrus waste, urban green waste</td>
<td>Thermochemical: gasification; fermentation</td>
</tr>
<tr>
<td>Bioengineering Resources</td>
<td>Urban green waste, wood chips, car tires, plastics</td>
<td>Thermochemical: gasification; fermentation</td>
</tr>
<tr>
<td>Resources (Fayetteville, Arkansas)</td>
<td>Urban green waste, wood chips, car tires, plastics</td>
<td>Thermochemical: gasification; fermentation</td>
</tr>
<tr>
<td>BlueFire Ethanol (Irvine, California)</td>
<td>Urban trash, rice and wheat straws, wood waste</td>
<td>Concentrated acid hydrolysis</td>
</tr>
<tr>
<td>Clearfuels Technology</td>
<td>Sugarcane bagasse</td>
<td>Thermochemical: steam reformation (similar to gasification); modified Fischer-Tropsch</td>
</tr>
<tr>
<td>(Aiea, Hawaii)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colusa Biomass Energy (Colusa, California)</td>
<td>Waste rice straw, rice hulls</td>
<td>Enzymatic hydrolysis; fermentation</td>
</tr>
<tr>
<td>Coskata (Warrenville, Illinois)</td>
<td>Undisclosed</td>
<td>Microbial</td>
</tr>
<tr>
<td>Company/Location</td>
<td>Feedstocks</td>
<td>Technology</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Earthanol (Irvine, California)</td>
<td>Undisclosed</td>
<td>Undisclosed</td>
</tr>
<tr>
<td>Flambeau River Biorefinery (Park Falls, Wisconsin)</td>
<td>Spent pulping liquor</td>
<td>Alcohol sulfite cooking liquor to fractionate softwood chips; fermentation (ICM)</td>
</tr>
<tr>
<td>ICM, Inc. (Missouri)</td>
<td>Agricultural residues, such as corn fiber, corn stover, switchgrass and sorghum.</td>
<td>will integrate biochemical and thermochemical processing and demonstrate energy recycling within the same facility</td>
</tr>
<tr>
<td>Iogen (Ottawa, Canada)</td>
<td>Wheat straw, barley straw, corn stover switchgrass, rice straw</td>
<td>Enzymatic hydrolysis; fermentation (Trichodermareesei)</td>
</tr>
<tr>
<td>Lignol Innovations (Colorado)</td>
<td>Wood chips, corn stover, switchgrass</td>
<td>Enzymatic hydrolysis; fermentation</td>
</tr>
<tr>
<td>Company/Location</td>
<td>Feedstocks</td>
<td>Technology</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
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</tr>
<tr>
<td>Mascoma (Cambridge, Massachusetts)</td>
<td>Switchgrass, wood</td>
<td>Enzymatic hydrolysis; fermentation</td>
</tr>
<tr>
<td>Pacific Ethanol Inc. (Oregon)</td>
<td>Agricultural and forest product residues</td>
<td>BioGasol's proprietary conversion process</td>
</tr>
<tr>
<td>Poet (Sioux Falls, South Dakota)/DuPont (Wilmington, Delaware)</td>
<td>Corn fiber, corn cobs</td>
<td>Enzymatic hydrolysis; fermentation</td>
</tr>
<tr>
<td>Range Fuels (Georgia)</td>
<td>Wood residues</td>
<td>Thermochemical: gasification; undisclosed catalyst</td>
</tr>
<tr>
<td>Stora Enso’s (Wisconsin Rapids, Wisconsin)</td>
<td>wood wastes</td>
<td>Fischer-Tropsch diesel fuel.</td>
</tr>
<tr>
<td>Verenium (Cambridge, Massachusetts)</td>
<td>Sugarcane bagasse, wood</td>
<td>Enzymatic hydrolysis; fermentation</td>
</tr>
<tr>
<td>Western Biomass Energy (Upton, Wyoming)/ KL Process Design Group (Rapid City, South Dakota)</td>
<td>Wood chips, wood waste</td>
<td>Enzymatic hydrolysis; fermentation</td>
</tr>
</tbody>
</table>
Where Will the Ethanol Go?

- E10 – all U.S. gasoline = 15 billion gallons

- E85
  - 8 million FFVs by 2009 – 6 BGPY
  - If only half use E85 – 3 BGPY
  - If only half, half the time – 1.5 BGPY

- 16 million FFVs by 2012 – 12 BGPY
  - If only half use E85 – 6 BGPY
  - If only half, half the time – 3 BGPY
Where Will the Ethanol Go?

- **Mid-Level Blends -- E-20 - E-40**
  - **Plus**
    - Potentially increases blend market within existing infrastructure
    - Builds on current customer base
  - **Minus**
    - Not approved above 10%
    - **Unknowns:**
      - Emissions
      - Parts compatibility
      - Refueling compatibility
      - Small engines
Where Do We Go From Here?

- Climate change/global warming remains a key issue
- **Senate**: Liberman – Warner
  - Cap and trade
  - Low Carbon Fuel Standard
- **House**: Dingell and Energy Committee
  - California Preemption issue
  - At odds with Pelosi/Boxer
- Opportunities for Ethanol
  - E85 – major CO₂ reduction
  - E10 – Additional value over RFS, octane
  - Credits to be generated from repowering

Consensus to act, disconnect on how.
Wait until next (non) election year!
Thank you!

For more information log on to

www.cleanfuelsdc.org
www.ethanolacrossamerica.net