Oil Market Study Group:
RFS, the Blend Wall & Refinery Issues

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Before the CSIS Oil Market Study Group
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Blendwall Reached in 2010, RINs to be Scarce

Generating excess 'carryover' RINs

Mandates increase to levels now can only underblend

Peak Physical Blending Level - Adjusted to Annual Rate - Million Gallons per Month

Conventional Biofuels 'Mandate' - Adjusted to Annual Rate - Million Gallons per Month

Mandated volumes 4.6 billion gallons above physical limit 2013
Blending has Not Reacted to Ethanol Prod. Drop

- Weekly U.S. Refiner and Blender Net Input of Fuel Ethanol (Thousand Barrels per Day)
- Weekly U.S. Oxygenate Plant Production of Fuel Ethanol (Thousand Barrels per Day)
Ethanol and MTBE
US Refinery Yields

- U.S. Refinery Yield of Finished Motor Gasoline (Percent)
- U.S. Refinery Yield of Kerosene-Type Jet Fuel (Percent)
- U.S. Refinery Yield of Distillate Fuel Oil (Percent)
- U.S. Refinery Yield of Residual Fuel Oil (Percent)
Yield Shift Needed to Offset 400,000 b/d of Ethanol

A 1.8% shift offsets the ethanol shortfall

- Increase Gasoline Yield by 3%
  - Raise Gasoline Production by:
  - 2000-2011 Range - Raise Gasoline Production by:

- Increase Gasoline Yield by 2%
  - Raise Gasoline Production by:

- Increase Gasoline Yield by 1%
  - Raise Gasoline Production by:

- Increase Gasoline Yield by 2.3%
  - 2000-2011 Range - Raise Gasoline Production by:
NREL Study on Blending Economics

Impact of the Substitution Effect on the Price of a Gallon of E10 (Mileage-Adjusted)

- Ethanol substitution reduces costs
- 6¢ savings
- Ethanol substitution increases cost
- -6¢ savings

Crude oil
$/barrel

Corn
$/bushel

Iso-savings
Mileage adj. savings vs. E0 (¢/gal E10)
## Crop Planting, Prices and Ethanol Use

<table>
<thead>
<tr>
<th>Crop Year</th>
<th>Alcohol for fuel ethanol</th>
<th>Planted acreage (Million acres)</th>
<th>Production (Million bushels)</th>
<th>Yield per harvested acre (Bushels per acre)</th>
<th>Weighted-average farm price (dollars per bushel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005/06</td>
<td>1,603.32</td>
<td>81.78</td>
<td>11,112.19</td>
<td>147.90</td>
<td>2.00</td>
</tr>
<tr>
<td>2006/07</td>
<td>2,119.49</td>
<td>78.33</td>
<td>10,531.12</td>
<td>149.10</td>
<td>3.04</td>
</tr>
<tr>
<td>2007/08</td>
<td>3,049.21</td>
<td>93.53</td>
<td>13,037.88</td>
<td>150.70</td>
<td>4.20</td>
</tr>
<tr>
<td>2008/09</td>
<td>3,708.89</td>
<td>85.98</td>
<td>12,091.65</td>
<td>153.90</td>
<td>4.06</td>
</tr>
<tr>
<td>2009/10</td>
<td>4,591.16</td>
<td>86.38</td>
<td>13,091.86</td>
<td>164.70</td>
<td>3.55</td>
</tr>
<tr>
<td>2010/11</td>
<td>5,021.21</td>
<td>88.19</td>
<td>12,446.87</td>
<td>152.80</td>
<td>5.18</td>
</tr>
<tr>
<td>2011/12</td>
<td>5,050.00</td>
<td>91.92</td>
<td>12,358.41</td>
<td>147.20</td>
<td>6.20</td>
</tr>
<tr>
<td>05/06 vs 11/12</td>
<td>214.97%</td>
<td>12.40%</td>
<td>11.21%</td>
<td>-0.47%</td>
<td>210.00%</td>
</tr>
</tbody>
</table>
Corn Consumption by Sector

Source: USDA, World Agricultural Outlook Board, WASDE.
## Biofuel Crop Use – 400,000 b/d of Ethanol

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Net Acreage for Fuel (after DDGS 'offset'), million acres</td>
<td>27.51</td>
</tr>
<tr>
<td>Net Acreage for Fuel in waived RFS scenario - 400,000 bbl/d ethanol (excludes exports), no soy-based biodiesel</td>
<td>9.04</td>
</tr>
<tr>
<td><strong>Biofuel Land Use Reduction</strong></td>
<td>18.47</td>
</tr>
<tr>
<td><strong>Biofuel Land Use Reduction, % change</strong></td>
<td>67.13%</td>
</tr>
<tr>
<td>% of 2011/2012 corn and soy harvested acreage not needed for biofuels</td>
<td>11.47%</td>
</tr>
<tr>
<td>DDGS Shortfall, Million Acres of Corn and Soy Equivalent</td>
<td>-7.60</td>
</tr>
<tr>
<td><strong>Net Biofuel Land Use Reduction after DDGS Shortfall</strong></td>
<td>10.86</td>
</tr>
<tr>
<td><strong>Net Biofuel Land Use Reduction after DDGS Shortfall, %</strong></td>
<td>39.49%</td>
</tr>
</tbody>
</table>
Takeaways

• For a waiver to be effective it must cover multiple years – but this is outside of EPA’s authority
  • As long as obligated parties have RVOs looming, they will be inclined to blend at ~10% in order to generate RINs for future compliance

• RFS mandates are creating distortions in fuel and food production – flexibility needed.
  • Must include biodiesel – soy needed for DDGS offset
  • Ethanol is an important part of the gasoline pool and is unlikely to drop below 5% of the gasoline pool in a mandate free environment
  • At current levels ethanol is largely supporting exports rather than reducing crude oil consumption
  • Blendwall hinders next-gen biofuels entrance into market

• A few refiners would drop ethanol completely, others would blend at 10%, most somewhere in between.
  • UC Davis study submitted for EPA waiver comments found 7% blend rate given long term waiver

• Low cost RFS compliance options have been exhausted – the next compliance option for obligated parties is to export product (distillate)

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RVO = \text{Standard} \times (\text{gasoline} + \text{diesel}) + \text{Deficit}
\]
RFS Mandates

Billion Gallons


Biomass based Diesel
Any Advanced
Cellulosic Advanced
Corn Ethanol / Other
EPACT 05