Bioenergy Situation & Outlook
Ag Lenders Conference
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Fall 2018

What you might have missed...
Record US Corn Ethanol Production
Record US Corn Ethanol Exports
Expanding US Corn Ethanol Capacity (16.3 billion gallons)
E15
EPA Hardship Waivers
Chinese Ethanol Plans

US Corn Ethanol Use>>Feed & Residual

Accounting for ‘Feedback’

US Corn Supply & Demand Sankey
based on August 8, 2018 WASDE (USDA)

Data: WASDE, Grain Crushing and Co-Products Production Report
Ethanol Crush Margins (Bushel-Basis South Dakota)

2.8 gallons ethanol
17 pounds distillers grains
.75 pounds corn oil
From
1 bushel of corn

2.8 x 1.31 $3.67 etoh
17 x .065 $1.11 ddgs
.75 x .2375 $ .18 oil
-3.03 $3.03 corn
$1.92/bu

Corn Ethanol-US Production & Use

Production & Use (Billion Gallons Per Year)

Data: EIA

15 billion gallon mandate

Record Corn Ethanol Exports – 2 billion gallons est. 2018

What are the five largest US ethanol destinations (Jan-May 2018)?
Hardship Waivers

The Renewable Fuel Standard (RFS) allows the EPA to waive the Renewable Volume Obligation (RVO) of small refiners (<75,000 bbls/day) enduring severe hardship due to the policy.

The EPA under Scott Pruitt waived:
- 19 of 20, 2016 waivers – 790 million gallons
- 29 of 33, 2017 waivers – 1.46 billion gallons

Equivalent of 800 million bushels
Should waived gallons be reallocated?

D6 RIN Prices (cents)

Market Expansion

Domestic: The administration has announced that it has begun working on new regulations to allow the use of E15.

Foreign: Much of the ag industry sees corn ethanol as the best opportunity for trade growth.

China: Hasn’t done much to show they will be able to achieve their stated E10 by 2020 goal.
Pacific Carbon

California has created a carbon market for biofuels. Its Low Carbon Fuel Standard (LCFS) has set annual carbon intensity standards for fuels (CAP).

Regulated parties (blenders and refiners) are required to supply fuels with increasingly smaller carbon footprints over time. They can do by blending ever higher levels of biofuels or trading for permits from other parties that do (TRADE).
An Example

Company X has the ability to easily blend ND corn ethanol with a carbon intensity of 76 g CO₂ e/MJ with gasoline that has a carbon intensity of 96.

The resulting blend has a carbon intensity of 94, this is above the 2018 standard so the refinery needs to trade for carbon credits.

Importance/Impacts

There is a mechanism that rewards incremental improvements in carbon reductions.

$180/MT is real money.

- -> corn-ethanol refinery investments.
- -> corn production practices. For example, no till.
- -> new biofuel pathways.
### Carbon Intensity of Beets, Beet-ethanol, and Corn-ethanol

<table>
<thead>
<tr>
<th>Process</th>
<th>gCO2-eq/wet short ton</th>
<th>gCO2-eq/MJ beet ethanol</th>
<th>gCO2-eq/MJ corn-ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedstock Production</td>
<td>21,615</td>
<td>10.1</td>
<td>15</td>
</tr>
<tr>
<td>Domestic Land Use Change</td>
<td>-882</td>
<td>-0.4</td>
<td>-</td>
</tr>
<tr>
<td>Land Use Change</td>
<td>15,556</td>
<td>7.1</td>
<td>28</td>
</tr>
<tr>
<td>Feedstock Transport</td>
<td>8,183</td>
<td>3.8</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Upstream Emissions, Mean</strong></td>
<td><strong>44,954</strong></td>
<td><strong>21.0</strong></td>
<td><strong>47</strong></td>
</tr>
</tbody>
</table>

*24 gallons/short ton; 89 MJ/gallon ethanol

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### Energy Beet

**2018 Industrial Beet Crush Calculator**

<table>
<thead>
<tr>
<th></th>
<th>Revenue Per gallon</th>
<th>Revenue Per Tons</th>
<th>Break Even</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>$1.31</td>
<td>$28.35</td>
<td>$1.47</td>
</tr>
<tr>
<td>Pulp</td>
<td>$4.64</td>
<td>$113.41</td>
<td>$187.72</td>
</tr>
<tr>
<td>Beet</td>
<td>$40.00</td>
<td>$551.11</td>
<td>$56.80</td>
</tr>
<tr>
<td>ARB Carbon</td>
<td>$180.00</td>
<td></td>
<td>$36.31</td>
</tr>
<tr>
<td>CapEx</td>
<td>$4.00</td>
<td></td>
<td>$0.34</td>
</tr>
<tr>
<td>OpEx</td>
<td>$0.05</td>
<td></td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**Assumptions**

- Ethanol $1.31 gallon
- Pulp Price $4.64 tone
- Beet Price $40.00 tone
- ARB Carbon $180.00 MT
- CapEx $4.00
- OpEx $0.05

**Expenses**

- Beet $1.79
- CapEx $0.50
- OpEx $0.05

**Grand Forks Cellulosic**

- Co-located at Simplot
- 18.8 million gallons
- 500,000 tons of waste
- (especially beet tailings, potato scraps)
Oil!

Record ND production in July

Growing global demand

ND Rig Count
10/18 - 71
10/17 - 54
10/14 - 192

Saudi Arabia...