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Ethanol-Livestock Integration

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two ethanol plants are exploring the possibilities of linkages between ethanol and livestock production. The E3 BioFuels plant in Mead, Nebraska, and the Panda Ethanol plant in Hereford, Texas, are trying to take advantage of the synergies between ethanol and livestock production. These two plants are also testing whether cost advantages in ethanol production still exist for the Midwest or whether there may be advantages in locating ethanol production closer to end users for both ethanol and ethanol by-products, specifically distillers grains.

**Corn and Cattle:**

**Two Plants’ Advantages**

The E3 BioFuels plant is on the verge of starting production as of this writing. The plant is co-located with a 30,000-head cattle feedlot. This co-location determined the size of the ethanol plant. The 24-million-gallon-per-year plant is designed to be powered by biogas derived from the 228,000 tons of manure annually produced at the feedlot. The feedlot has a slatted floor system that allows the manure from the cattle to be captured and processed in two 4-million-gallon digesters. Power is also saved because the distillers grains from the ethanol production process are not dried; wet distillers grains will be fed directly to the cattle in the feedlot. In addition, thin stillage, another ethanol co-product, will be fed into the digesters to help maintain digester temperatures without the use of natural gas. In this closed-loop system between ethanol and livestock, output from each component can be used as input for the other. In fact, the end product from the digester can be used as fertilizer, providing an additional linkage to the corn used in the production scheme.

Panda Ethanol is expected to come online in the latter half of 2007. Like the E3 BioFuels plant, the Panda plant will use manure as a power source. With the Panda plant’s location in the middle of Texas cattle country, manure is in steady supply. The 100-million-gallon-per-year plant will also create 900,000 tons of wet distillers grains to be fed to local cattle. Both plants take advantage of two key factors: the ability to use cattle manure as an energy source for the ethanol plant and the ability to feed wet distillers grains to the cattle. Both factors contribute to cost savings in plant operation and should allow the plants to be highly competitive in the ethanol industry. But these two plants do highlight a question about the ethanol industry and its relationship with livestock: does it make more economic sense to place the ethanol plant where livestock currently are or to move the livestock and the ethanol plant close to where the corn is grown? Historically, the ethanol industry has located plants in areas of inexpensive corn and has not taken advantage of livestock synergies. The E3 BioFuels and Panda plants show that the ethanol industry is evolving to capture other cost advantages.

**Modeling Three Scenarios**

To examine this question, we have constructed a simple economic model of a 50-million-gallon-per-year ethanol plant, accounting for capital, operating, and transportation costs for the plant. The plant yields 2.75 gallons of ethanol and 17 pounds of dried distillers grains per bushel of corn. We use recent prices of $135 per ton for dried distillers grains, $39 per ton for wet distillers grains, $2.00 per gallon for ethanol, and $3.63 per bushel for corn to calculate the revenues and feedstock costs for the plant. We allow operating costs to shift based on whether the plant dries its distillers grains or not. We assume that drying costs make up 50 percent of the plant’s energy costs or roughly 25 percent of total operating costs. We have also gathered railroad and trucking transportation cost information to compute transportation costs at various plant locations and distances to markets. We examine three scenarios involving two prototype plants located near corn in Iowa and one plant located near cattle in Texas. For the Texas plant, we assume that all distillers grains are fed wet to cattle within a 50-mile radius, all corn is railed in from Iowa 900 miles away, and the ethanol is shipped 100 miles to reach its market. For both Iowa plants, we assume the ethanol is shipped 1,000 miles to reach its market, half of the distillers grains are fed locally (average distance of 50 miles), and half of the distillers grains are dried and shipped 900 miles to Texas. For one of the Iowa plants, we assume the locally consumed distillers grains are dried (dry DG). For the other, we assume the local distillers grains are wet (wet DG). These scenarios allow us to examine the impact of wet versus dry distillers grains and transportation costs at the same time.
Ethanol plant costs and revenues

<table>
<thead>
<tr>
<th></th>
<th>Wet DG</th>
<th>Dry DG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iowa</td>
<td>Texas</td>
</tr>
<tr>
<td>Capital cost</td>
<td>0.72</td>
<td>0.72</td>
</tr>
<tr>
<td>Operating cost</td>
<td>1.37</td>
<td>1.17</td>
</tr>
<tr>
<td>Corn cost (including transportation)</td>
<td>3.71</td>
<td>4.26</td>
</tr>
<tr>
<td>Ethanol transportation cost</td>
<td>0.30</td>
<td>0.03</td>
</tr>
<tr>
<td>Distillers grains transportation cost</td>
<td>0.13</td>
<td>0.07</td>
</tr>
<tr>
<td>Ethanol revenue</td>
<td>5.50</td>
<td>5.50</td>
</tr>
<tr>
<td>Distillers grains revenue</td>
<td>1.07</td>
<td>0.99</td>
</tr>
<tr>
<td>Margin</td>
<td>0.35</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Linkages Key to Competitiveness
The top five lines of the table above outline the costs per bushel of corn each plant faces. The Texas plant would have a $0.20 operating cost advantage over the Iowa plant that ships wet DG and a $0.39 operating cost advantage over the Iowa plant that ships dry DG. These operating cost advantages reflect the drying costs at each plant. The Iowa plants make up some of the cost difference through transportation, as the cost per bushel of moving the corn is higher than that of moving the ethanol and the distillers grains. The Iowa plants have a $0.22 to $0.25 transportation cost advantage. The lower half of the table shows the revenues for the plants and their margins, the difference between revenues and costs. Given our ethanol price assumption, all three plants have ethanol revenues of $5.50 per bushel of corn. The distillers grains revenues differ across plants, depending on the percentage of distillers grains sold wet versus dry. Because the price of the dry DG is well above that of the wet, the Iowa plants derive more revenue from distillers grains than does the Texas plant. When the costs and revenues are combined, the Iowa plant selling wet DG has the highest margin, earning $0.35 per bushel of corn, followed by the Texas plant and then the Iowa plant selling dry DG. However, these results are dependent on the transportation cost assumptions and the percentage of distillers grains fed wet versus dry for the Iowa plants. For example, if the Iowa plant with wet DG can sell only 20 percent of distillers grains wet, then its margin drops below the Texas plant. If the Iowa plant with dry DG can sell all of its distillers grains within 250 miles of the plant, then that plant’s margin will exceed the margin for the Texas plant. Clearly, opportunities provided by linkages with the livestock industry will determine the relative competitiveness of the different locations. It is also worth noting that the relative cost advantages will change with variations in the relative transportation cost of the different products and co-products.

These results show that Iowa ethanol plants will need to develop stronger linkages to the livestock industry to maintain their competitive edge. The ability to feed wet DG to cattle provides the Texas plant in our example a sizable operating cost advantage. The building of the E3 Biofuels and Panda Ethanol plants indicates that this advantage has attracted some ethanol investors. If Iowa ethanol plants can establish sizable feed shipments for wet DG for dairy and beef cattle or dry DG for hogs and poultry in the state, then Iowa plants can also capture significant operating and transportation cost advantages.

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