

BioEnergy

Fueling America Through Renewable Resources

The Effect of Ethanol on Grain Transportation and Storage

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Introduction

The rapid growth of ethanol production in Indiana is leading to drastic changes in grain marketing and transportation. The grain marketing system that facilitated the large-scale export of grain from Indiana by unit trains and barge will become more dependent upon trucks for inbound shipments of corn and outbound movements of ethanol and byproducts. With no end in sight for the expansion of ethanol plants in the state, it is conceivable that Indiana might become a net importer of corn. This shift from the past will have profound implications for

the grain transport system and associated agricultural and transportation businesses.

Since 2000, Indiana has produced around 850 million bushels of corn per year. The volume of corn fed to Indiana livestock is relatively stable, while corn used for processing in Indiana has been steadily growing over time, even without ethanol production. Roughly 160 million bushels (19%) is fed to animals raised in the state, 245 million bushels (29%) is processed in Indiana (of which 38 million bushels is processed into ethanol), and the remaining 445 million bushels (52%) is shipped out of the state (Table 1). The most common

Table 1. Rough Estimates of the Distribution of Indiana Corn Usage, by End Use

Production of Corn and Ethanol in Indiana	Scenario					
	2005 Baseline		Near Term Adjustments (2007) – More Ethanol		Longer Term Adjustments (2010)– More Corn and Ethanol at 1 Billion Gallons	
<i>Corn Raised</i>	<i>850 M bu</i>		<i>850 M bu</i>		<i>1,000 M bu</i>	
<i>Ethanol Produced</i>	<i>100 MGY</i>		<i>395 MGY</i>		<i>1,000 MGY</i>	
End Use of Indiana Corn	(M bu)	% of Total	(M bu)	% of Total	(M bu)	% of Total
Fed to livestock in Indiana	160	19%	160	19%	160	16%
Used by Indiana processors	207	24%	207	24%	207	21%
Used for ethanol in Indiana	38	5%	152	18%	385	38%
Shipped out-of- state to Southeast US livestock or export markets	445	52%	331	39%	248	25%
Total	850	100%	850	100%	1,000	100%

(Adopted from: Doering & Hurt, 2006.)

out-of-state markets are poultry and hog operations in the Southeastern United States, while lesser volumes are exported through ports on the Ohio River or Lake Michigan.

The growth of an ethanol industry in Indiana will reallocate the traditional usage of Indiana corn. This publication identifies some of the implications of this adjustment for the grain marketing and transportation systems.

Scenario 1—Near Term Adjustments

Changes in ethanol production are certain in the near term. Indiana's ethanol production capacity will grow from 100 million gallons per year (MGY) at one plant in 2005 to 395 MGY at five plants by 2007 (Doering & Hurt, 2006). At an extraction rate of 2.6 gallons of ethanol per bushel of corn, the utilization of corn for ethanol will rise from 38 to 152 million bushels. Thus, without any expansion in corn production, the amount of corn used for ethanol will rise from 5% to 18% by 2007 (Table 1).

Scenario 2—Longer Term Adjustments

Over the longer term, enthusiasm for more ethanol production in Indiana is high, with projections that Indiana should produce 1,000 MGY of biofuels (Informa Economics, 2006). As of July 2006, another 11 ethanol plants are proposed to be built in Indiana, with as much as an additional 940 MGY of ethanol production (*Indiana Biofuels Fact Sheet*, 2006). It is likely that crop production will shift from soybeans to corn in Indiana in response to growing ethanol demand and higher corn prices. Conceivably, around 1 billion bushels of corn could be produced per year in Indiana (Table 1). Thus, in the longer term, increased corn production along with annual ethanol production meeting the vision of 1 billion gallons of capacity will require 385 million bushels of corn, or 38% of the corn crop.

Effect on Inbound and Outbound Transportation and on Grain Elevators

Inbound Transportation of Corn

Most corn is shipped by truck from the farm to either a nearby elevator or a local corn processor. The

draw area for a grain elevator can be up to 25 miles, although most corn is probably collected from farms located within 10 miles of the elevator. The capacity of an ethanol plant is much larger than that of most grain elevators, meaning that the draw area of the plant will be much larger, perhaps as large as 75 miles.

Thus, a shift to ethanol production will appreciably increase local trucking, as corn bypasses local grain elevators and is hauled by truck to ethanol plants. In turn, this will cause an increase in truck traffic, especially on state and local roads that feed ethanol plants. More corn will also be trucked locally if corn production expands. As ethanol plants procure grain, transportation flows are likely to change for other users of corn as well.

Outbound Transportation

In the near term, it is likely that over 100 million bushels of corn currently exported from Indiana will be diverted to ethanol production, while in the longer term, as much as 200 million bushels of corn could be shifted from out-of-state shipments (Table 1). The effect on outbound transportation will depend upon whether the corn diverted to ethanol production was previously destined to feeders in the Southeastern U.S. or for export along the Ohio River. Given that most ethanol plants are located in Northern Indiana, it is more likely that most of the grain will be diverted from rail shipments (Figure 1). The construction of each 100 MGY ethanol plant reduces 10,000 rail car shipments of corn from Indiana. Thus, growth from 100 MGY to 1,000 MGY of ethanol production could reduce outbound rail shipments up to 90,000 rail cars per year.

Of course, the decrease in outbound corn shipments will be offset by an increase in ethanol and the primary byproduct of ethanol production, dried distillers' grains with solubles (DDGS). A 100-MGY plant, operating on a 24/7 basis, will produce around the equivalent of 9 rail cars of ethanol and an additional 9 rail cars of DDGS per day. Yet it is not clear that either the ethanol or DDGS will be shipped by rail.

As an alcohol, ethanol creates some compatibility problems with the existing transportation infrastructure. At the production plant, ethanol is denatured by

blending it with 5% gasoline. Most ethanol delivered to local markets will move by tanker truck. For more distant markets, challenges exist for shipment by rail or pipeline. The U.S. rail system has evolved into an industry focused on volume movements via unit trains, (75 or more cars in a train). Yet, as of June 2006, only four fuel terminals in the U.S. had the capacity to receive unit trainloads of ethanol (Miller, 2006). Pipelines are not used for shipping ethanol for technical and operational reasons (Fulton, 2005). In addition, most pipeline systems run from the Gulf Coast to the North or Northeast. Construction of new ethanol-dedicated pipelines is viewed as infeasible due to low shipment volumes of ethanol (Fulton, 2005).

After the denatured ethanol arrives at a fuel terminal, it is then distributed to gas stations. Final blending occurs when delivery trucks are loaded at the terminal, a practice known as “splash blending” (McIntyre, 2006). This is to limit ethanol’s sensitivity to water, which tends to remove ethanol from the gasoline blend.

The mode of outbound shipment for DDGS will depend on distance and volume. Most current production is used to feed beef cattle, which are primarily found outside of Indiana. There is concern that the rapid expansion of ethanol production will lead to an over-saturation of the DDGS market, depressing prices (Miller, 2006). Thus, some DDGS will probably be included in diets for dairy, hogs, and poultry, depending upon prices of other feeds and dietary requirements.

Grain Elevators

Indiana has a history of being a large net exporter of corn. It is likely that at least 100 to 200 million fewer bushels of corn will be exported from Indiana to destinations out-of-state (Table 1). Some suggest that Indiana could become a net importer rather than an exporter of corn. The Indiana grain elevator industry and transportation system is designed to move large volumes of grains by either unit trains to the Southeast U.S. or by barge to export markets. The development of an ethanol industry will redirect corn to destinations in-state and may bypass local grain elevators. Thus, some facilities will likely close or consolidate as the marketing functions change (Doering & Hurt, 2006).

The rapid growth in ethanol production will likely lead to long-term structural changes in grain transportation and storage. This change is analogous to the situation in the early 1980s, when the grain industry quickly shifted from primarily shipping grain by single-car rail or truck to multi-car trains. The previous transition was relatively swift, but greatly altered the structure of the grain elevator and transportation industries. The changes associated with the development of the ethanol industry are likely to be quite speedy as well.

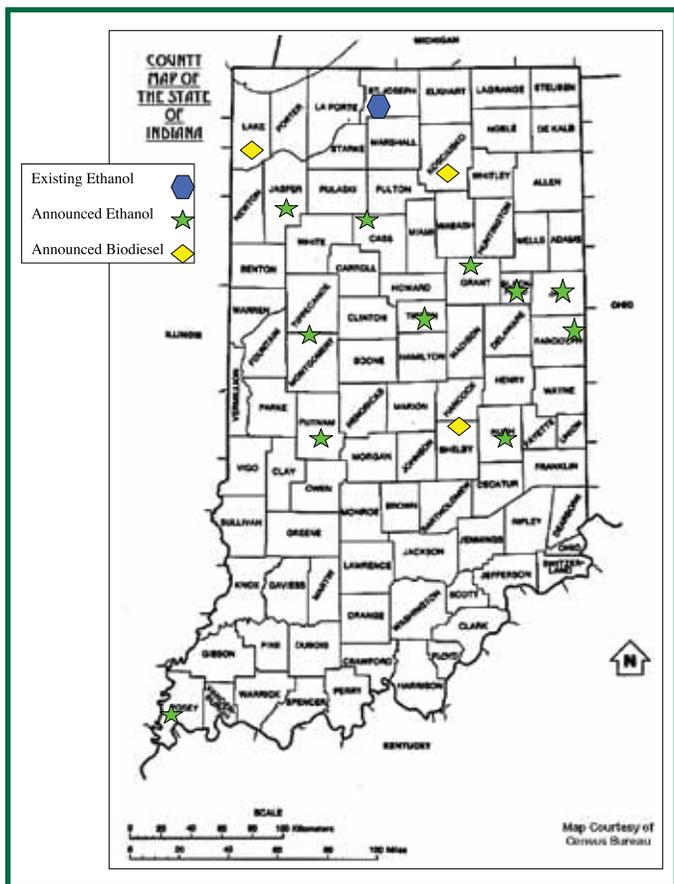


Figure 1. BioFuels Plants in Indiana, 2006.

SOURCE: Indiana Department of Agriculture.

<http://www.in.gov/isda/bioenergy/ethanolplants-map-03062.pdf>

Conclusion

Undoubtedly, the grain and transportation industries of Indiana face drastic changes over the next few years in response to the growth of an ethanol industry. Some of the possible changes to the grain and transportation sectors include the following.

- More corn will be trucked further on average from the farm to ethanol plants, primarily on state and local roads.
- Perhaps corn will be moved by short-haul unit trains of corn within the state of Indiana.
- Indiana might become a net importer rather than an exporter of corn. Grain flows follow market areas rather than political boundaries.
- Rail traffic from Indiana to Southeast U.S. poultry and hog markets will decline.
- The volume of corn and soybeans exported from Indiana ports will decline.
- Some elevators located within a 50 miles radius of ethanol plants will close or perhaps become vertically aligned with ethanol plants.
- Outbound shipment of ethanol will be by truck to local markets and by rail to more distant markets. Barge shipments might be possible as well.
- Pipelines are an unlikely solution to move ethanol.
- The market for DDGS from Indiana ethanol plants could include local markets to beef feedlots in the Western U.S. However, the market for DDGS could become over-saturated with the rapid growth in ethanol production.

New research would be useful to determine how many ethanol plants can be supported by corn production in Indiana, as well as the sensitivity of the solutions to different scenarios. This information would prove useful to farmers, as well as the grain elevator, ethanol, and transportation industries, and also to state transportation planners, as they all adjust to the emergence of an ethanol industry in Indiana.

References

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