



## **CONTRIBUTION OF THE ETHANOL INDUSTRY TO THE ECONOMY OF THE UNITED STATES**

Prepared for the Renewable Fuels Association by

John M. Urbanchuk

Director, LECG LLC

February 20, 2008

2007 was a year of remarkable challenges and opportunities for the ethanol industry. Despite an all-time record corn harvest, producers were faced with significant increases in grain prices during the year. Spot market ethanol prices fluctuated more than 60 percent during the year, bottoming out at \$1.53 per gallon in September as concerns about potential oversupply roiled the markets. However, the year was capped by President Bush signing the Energy Independence and Security Act of 2007 (“EISA”) which requires the use of 36 billion gallons of renewable fuels by 2022. Ethanol prices recovered by year-end as crude oil flirted with \$100 per barrel.

Despite the challenges to profitability the ethanol industry continues to expand. Total ethanol production for 2007 is estimated at nearly 6.5 billion gallons, 33 percent more than 2006. Twenty-three new ethanol plants initiated production adding more than two billion gallons of capacity during 2007. At year’s end 63 ethanol plants were under construction and eight existing plants were expanding capacity. When completed, the total ethanol capacity will exceed 13.3 billion gallons.

This study estimates the contribution of the ethanol industry to the American economy in 2007.

### **Contribution of the Ethanol Industry in 2007**

The ethanol industry provides a significant contribution to the American economy. The industry spent \$12.5 billion on raw materials, other inputs, goods and services to produce an estimated 6.5 billion gallons of ethanol during 2007. An additional \$1.6 billion was spent to transport grain and other inputs to production facilities; ethanol from the plant to terminals where it is blended with gasoline; and co-products to end-users. The largest share of this spending was for corn and other grains used as the raw material to make ethanol. The ethanol industry used more than 2.4 billion bushels of corn in 2007, valued at \$8.1 billion. Ethanol has surpassed exports and the second largest



component of corn demand after feed use accounting for 19 percent of total corn utilization during the 2006/07 marketing season. In addition to providing a growing and reliable domestic market for American farmers, the ethanol industry also provides the opportunity for farmers to enjoy some of the value added to their commodity by further processing. Farmer-owned ethanol plants account for half of U.S. fuel ethanol plants and almost 40 percent of industry capacity.

The remainder of the spending by the ethanol industry is for a wide range of inputs such as enzymes, yeast and chemicals; electricity, natural gas, and water; labor; and services such as maintenance, insurance, and general overhead. Spending for these goods and services represents the purchase of output of other industries.<sup>1</sup> In addition, the construction of new ethanol plants results in spending for a wide range of goods and services. At an estimated capital cost of \$2.00 per gallon for a new dry mill ethanol plant, the 2,032 million gallons of new capacity brought on line during 2007 represented the expenditure of an additional \$4.1 billion by the ethanol industry. Nearly 60 percent of this (\$2.4 billion) spending was for steel pipe, tanks, machinery, and other equipment.

The spending associated with current ethanol production and spending on new plant capacity circulates throughout the entire economy several fold stimulating aggregate demand, supporting the creation of new jobs and additional household income. Finally, and importantly, expanded economic activity generates tax revenue for government at all levels. The impact of the ethanol industry on the American economy was estimated by applying the appropriate final demand multipliers for output, earnings, and employment for the relevant supplying industry calculated by the U.S. Bureau of Economic Analysis (BEA) to the estimates of spending described above.<sup>2</sup> The final demand multipliers for output, earnings, and employment for the selected industries are shown in Appendix Table 1.

The following summarizes the economic contribution of the American ethanol industry. These impacts are detailed by industry segment in Appendix Table 2.

---

<sup>1</sup> Expenditures for feedstock and energy were estimated using 2007 calendar year average prices. Revenues were estimated using 2007 calendar year average prices for Chicago ethanol, Distiller's grains, corn gluten feed and meal, and corn oil. Prices were sourced from USDA/ERS, EIA, and OPIS.

<sup>2</sup> The multipliers used in this analysis are the detailed industry RIMS II multipliers for the United States estimated by the Bureau of Economic Analysis, U.S. Department of Commerce.

- The combination of spending for annual operations, ethanol transportation, and capital spending for new plants under construction added \$47.6 billion to the nation's Gross Domestic Product (GDP) in 2007.
- New jobs are created as a consequence of increased economic activity caused by ethanol production. The increase in economic activity resulting from ongoing production and construction of new capacity supported the creation of 238,541 jobs in all sectors of the economy during 2007. These include more than 46,000 jobs in America's manufacturing sector -- American jobs making ethanol from grain produced by American farmers.
- Increased economic activity and new jobs result in higher levels of income for American households. The production of ethanol put an additional \$12.3 billion into the pockets of American consumers in 2007.
- The ethanol industry more than paid for itself in 2007. The combination of increased GDP and higher household income generated an estimated \$4.6 billion in tax revenue for the Federal government and nearly \$3.6 billion of additional tax revenue for State and Local governments. Assuming that all of the 6.5 billion gallons produced during 2007 were marketed, the estimated cost of the two major Federal incentives in 2007, the VEETC and ethanol Small Producer Credit, totaled \$3.4 billion. *Consequently, the ethanol industry generated a surplus of \$1.2 billion for the Federal treasury.*
- Ethanol reduces our dependence on imported oil and reduces the U.S. trade deficit. The production and use of ethanol displaces crude oil needed to manufacture gasoline. According to the Energy Information Administration imports account for more than 65 percent of our crude oil supplies and oil imports are the largest component of the expanding U.S. trade deficit. The production of nearly 6.5 billion gallons of ethanol means that the U.S. needed to import 228.2 million fewer barrels of oil in 2007 to manufacture gasoline, or roughly the equivalent of five percent of total U.S. crude oil imports. The value of the crude



oil displaced by ethanol amounted to \$16.5 billion in 2007.<sup>3</sup> This is money that stayed in the American economy.

### **Impact of ethanol to the local economy**

The structure of the ethanol industry has changed dramatically over the past two decades. In 1991 35 plants produced 865 million gallons of ethanol. Two-thirds of capacity was accounted for by wet mill plants that had an average capacity of 95.5 MGY. The 20 operating dry mill plants had an average capacity of 16.5 MGY. By February 2008, the ethanol industry had 142 plants in operation with annual capacity of nearly 8.1 billion gallons. Dry mill plants accounted for more than 80 percent of capacity with an average size of 55 MGY. Virtually all of the 65 ethanol plants under construction or expansion today are dry mills with an average plant size of 82 MGY.

Ethanol plants make an important contribution to the economy of the local communities in which they are located. The contribution of an ethanol plant to a local economy can be estimated in the same manner as for the national economy described above. Expenditures for plant construction have a short-term impact that is replaced by the contribution from ongoing production. The size of the impact is directly linked to plant size and depends on the relationship between the ethanol plant and the local economy. Specifically this relates to the amount of inputs that are sourced locally. For purposes of this analysis we assume that half of the grain feedstock used for ethanol production is procured from local farmers (i.e. corn produced within a 100 mile radius of the plant) but that other inputs such as enzymes, yeast, chemicals and denaturant are produced by suppliers outside of the local community. As opposed to grain, only a small share of the expenditure for these inputs will accrue to local suppliers.

As shown in Table 2, annual expenditures for goods and services for a 50 MGY ethanol plant are estimated at \$83.6 million (2007 dollars) of which \$56.1 million would be local. Expenditures for a 100 MGY plant are estimated at \$165 million with the local component totaling \$109 million. There

---

<sup>3</sup> Ethanol directly competes with and displaces gasoline as a motor fuel. According to EIA one 42 gallon barrel of crude oil produces 19.2 gallons of gasoline. Ethanol has a lower energy content (84,400 btu/gal) than gasoline (124,000 btu/gal) so it takes 1.46 gallons of ethanol to provide the same energy as a gallon of gasoline. Therefore, 6.45 billion gallons of ethanol are the equivalent of 4.39 billion gallons of gasoline. Since one barrel of crude produces 19.2 gallons of gasoline, it takes 228.2 million barrels of crude to produce 4.39 billion gallons of gasoline, the amount displaced by ethanol. This oil was valued at the 2007 average price for West Texas Intermediate crude of \$72.20/bbl.

are relatively few economies of scale in dry mill ethanol production. The most significant savings for a larger plant are for lower capital costs in construction and reduced labor costs since larger new plants are more automated. Reflecting this, the impact of a 100 MGY plant is slightly less than twice that of a 50 MGY plant.

Table 2  
Annual Economic Impact of  
50 and 100 MGY Dry Mill Ethanol Plant

<b>Impact from annual operations</b>	<b>50 MGY</b>	<b>100 MGY</b>
Total Spending (Mil \$)	\$83.9	\$164.7
Local Spending (Mil \$)	\$56.1	\$108.9
Local GDP Impact (Mil \$)	\$152.3	\$300.1
Household Income (Mil \$)	\$40.4	\$76.7
Total Employment (Jobs)	618	1,137
Direct jobs	40	50
Indirect jobs	578	1,087

While the precise impact on a specific community will depend on the structure of the local economy (reflected in unique multipliers), the generalized annual contribution of a 50 and 100 MGY ethanol plant is summarized in Table 2.

- A 50 MGY ethanol plant will use 17.9 million bushels of corn annually and a 100 MGY plant will require 36 million bushels annually. Feedstocks account for about two-thirds of annual operational spending. If all grain is sourced locally, the economic impact is maximized.
- When viewed at the State level, a 50 MGY ethanol plant will add \$152 million annually to the size of the State economy measured by Gross Domestic Product. A 100 MGY plant will increase GDP by \$300 million. That is, the State economy will, be larger as a result of the operations of the ethanol plant.
- New jobs are created as a consequence of increased economic activity caused by ethanol production. Since there are few economies of scale in dry mill ethanol production, the



number of direct jobs in a 100 MGY ethanol plant is only marginally larger than for a 50 MGY operation. Based on observations of new operating plants, we estimate that a 50 MGY dry mill ethanol plant directly employs 40 people while a 100 MGY plant employs about 50 workers. Using this as a base, a 50 MGY plant would generate an additional 904 jobs in the entire State for a total employment impact of 944 jobs and a 100 MGY plant would have a total employment impact of 1,790 jobs.

- Increased economic activity and new jobs results in higher levels of income. The ongoing annual operations of a 50 MGY plant will increase household income by nearly \$40 million annually. A 100 MGY plant will increase household income by more than \$77 million.

**Appendix Table 1**

**BEA RIMS II Final Demand Multipliers, U.S.<sup>4</sup>**

	<b>Output</b>	<b>Earnings</b>	<b>Employment (Jobs)</b>
<b>Construction</b>	3.4464	1.0587	27.5088
<b>Annual Operations</b>			
Feed Grains (Corn)	2.7762	0.5310	16.1423
Other basic organic chemicals	3.3677	0.7145	15.2956
Petroleum refineries	2.7456	0.5419	10.6803
Power generation and supply	2.4766	0.5980	12.2665
Natural gas distribution	3.0580	0.6539	13.2728
Water, sewage	2.6056	0.7112	17.0152
Facilities support services	2.6713	0.9481	27.4222
Wholesale trade	2.7149	0.8127	19.0621
Office administrative services	2.8582	1.0071	24.2376
Earnings to households	2.3688	0.6611	18.8356
Rail Transportation	2.8547	0.7850	17.1281
Water Transportation	3.2566	0.8156	18.7806
Truck Transportation	3.0950	0.8617	22.7736

*Source: Regional Input-Output Modeling System (RIMS II)*

*Regional Economic Analysis Division, BEA.*

*Multipliers based on 1997 Benchmark I-O Table; 2004 regional data.*

<sup>4</sup> The multipliers represent the effect on output, income and employment of every \$1 million of expenditures.

**Appendix Table 2  
Economic Contribution of the Ethanol Industry: 2007**

Industry	Purchases (Mil 2007\$)	Impact		
		GDP (Mil 2007\$)	Earnings (Mil 2007\$)	Employment (Jobs)
Construction (labor and other)	\$1,706.9	\$3,200.1	\$1,807.1	42,959
Machinery and equipment	\$2,357.1	\$3,976.3	\$1,844.4	38,318
Plus initial changes		\$4,064.0		
<b>Total Construction</b>		<b>\$11,240.5</b>	<b>\$3,651.5</b>	<b>42,959</b>
<b>Annual Operations</b>				
Feed Grains (Corn)	\$5,700.6	\$8,609.3	\$3,027.0	84,191
Other basic organic chemicals	\$302.1	\$553.4	\$215.8	4,227
Petroleum refineries	\$444.6	\$664.1	\$240.9	4,344
Power generation and supply	\$308.6	\$415.8	\$184.6	3,464
Natural gas distribution	\$2,310.1	\$3,842.9	\$1,510.6	28,052
Water, sewage	\$32.6	\$46.2	\$23.2	507
Facilities support services	\$167.7	\$243.7	\$159.0	4,207
Wholesale Trade	\$1,463.8	\$2,161.9	\$1,189.6	25,529
Office administrative services	\$387.0	\$601.7	\$389.7	8,582
Earnings to households	\$252.6	\$325.6	\$167.0	4,354
Rail Transportation	\$916.6	\$1,423.5	\$719.5	14,364
Water Transportation	\$54.7	\$96.9	\$44.6	940
Truck Transportation	\$620.1	\$1,044.1	\$534.4	12,921
<b>Subtotal</b>	<b>\$12,961.1</b>	<b>\$20,029.0</b>	<b>\$8,406.0</b>	<b>195,682</b>
Plus initial changes:				
Value of ethanol production		\$13,530.0	\$252.6	
Value of co-products		\$2,819.5		
<b>Total Annual Operations</b>		<b>\$36,378.6</b>	<b>\$8,658.6</b>	<b>195,682</b>
<b>Grand Total</b>		<b>\$47,619.1</b>	<b>\$12,310.1</b>	<b>238,641</b>