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

Prepared for the Renewable Fuels Association by

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The ethanol industry is one of the most significant success stories in American manufacturing over the past quarter-century. From a cottage industry that produced 175 million gallons in 1980, the American ethanol industry has grown to include 95 manufacturing facilities with an annual capacity of almost 4.3 billion gallons. 2005 was a watershed year for the ethanol industry. In August President Bush signed into law the Energy Policy Act of 2005 (EPACT05). Among the many incentives for renewable fuels, EPACT05 provided the ethanol industry with a Renewable Fuels Standard that requires a minimum of 7.5 billion gallons of renewable fuels to be used in the nation's highway fuel supply by 2012. As a consequence of strong demand from rapidly growing China and India world oil prices reached new record levels in 2005 while an unusually severe and destructive hurricane season pushed retail gasoline prices to new highs in the U.S. High gasoline prices combined with low corn prices resulting from the second largest crop on record to improve the economics of blending ethanol. We expect this economic advantage to remain for some time and the RFS to serve as a floor for ethanol demand, not a ceiling.

These developments have spurred a surge in ethanol plant investment and development. According to the Renewable Fuels Association 34 new plants and eight major plant expansions representing an additional 2,100 million gallons of capacity currently are under construction and more are planned. Total ethanol production for 2005 is estimated at four billion gallons on a year-end capacity base of 4.3 billion gallons.

This study estimates the contribution of the ethanol industry to the American economy in 2005; outlines a path of investment and development that takes ethanol production to 9.8 billion gallons by 2015 and describes the contribution of the industry to the economy by 2015; and examines the impact of ethanol production on local communities.

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Contribution of the Ethanol Industry in 2005

The ethanol industry provides a significant contribution to the American economy. The industry spent almost $5.1 billion on raw materials, other inputs, goods and services to produce an estimated four billion gallons of ethanol during 2005. 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 1.4 billion bushels of corn in 2005, valued at $2.9 billion. Ethanol production represents the third largest component of corn demand after feed use and exports and will account for 16 percent of total corn utilization this 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 industrial 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. In addition, the construction of new ethanol plants results in spending for a wide range of goods and services. At an estimated construction cost of $1.40/gallon for a new dry mill ethanol plant and $1.00/gallon for a plant expansion, the capacity currently under construction or expansion represents the expenditure of an additional $2.4 billion by the ethanol industry.

The spending associated with current ethanol production and investment spending on new plant capacity will circulate throughout the entire economy several fold. Consequently this spending will stimulate aggregate demand, support the creation of new jobs, generate additional household income, and provide 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.[1] The final demand multipliers for output, earnings, and employment for the selected industries are shown in Appendix Table 1.

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[1] 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.

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

- The combination of spending for annual operations and capital spending for new plants under construction added $32.2 billion of gross output to the American economy in 2005. Gross output represents the market value of an industry's production, including commodity taxes, and it differs from GDP.[2] Generally speaking, Gross Output is larger than GDP since it includes the value of intermediate goods and services, which are "netted out" of GDP. Reflecting this difference, the ethanol industry added $17.7 billion to the nation's Gross Domestic Product in 2005.

- New jobs are created as a consequence of increased economic activity caused by ethanol production. The increase in gross output (final demand) resulting from ongoing production and construction of new capacity supports the creation of 153,725 jobs in all sectors of the economy this year. These include more than 19,000 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 will put an additional $5.7 billion into the pockets of American consumers this year.

- The combination of increased output and GDP and higher income generates tax revenue for government at all levels. The full impact of the annual operations of the ethanol industry and spending for new construction will add more than $1.9 billion of tax revenue for the Federal government and nearly $1.6 billion for State and Local governments.

- Ethanol reduces our dependence on imported oil and reduces the U.S. trade deficit. The ethanol industry. The production and use of ethanol displaces crude oil needed to manufacture gasoline. According to the Energy Information Administration imports account for 65 percent of our crude oil supplies and oil imports are the largest component of the

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[2] BEA description of Gross Output taken from www.bea.doc.gov/bea/dn2/readgo.htm. According to BEA accounts GDP was 55% of the value total gross output in 2004.

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expanding U.S. trade deficit. The production of 4 billion gallons of ethanol means that the U.S. needed to import 170 million fewer barrels of oil in 2005, valued at $8.7 billion, to meet the same demand levels.

The Ethanol Industry in 2015

As indicated earlier the RFS provided by EPACT05 is expected to provide a floor for ethanol demand and production, not a ceiling. Ethanol demand is expected to increase due a combination of factors that include the decision by the oil industry to abandon MTBE; the aggressive production and promotion of alternative fuel (i.e. flexible fuel) vehicles by the major auto manufacturers; and anticipated increases in investment in flexible fuel infrastructure. Concerns over gasoline prices and energy security issues are expected to maintain public interest in alternative fuels.

According to the Renewable Fuels Association 34 new plants and eight major plant expansions representing an additional 2,100 million gallons of capacity currently are under construction and more are planned. A review of conversations with and public statements of ethanol industry analysts, plant developers, builders, and financiers lead us to anticipate that an additional 4.1 billion gallons of new capacity will be added between 2006 and 2015, with most of the capacity coming on line within the next three years.

Table 1 details our expectation for ethanol industry expansion and production through 2015. As shown in Table 1, this investment is expected to bring total industry capacity to 10.3 billion gallons by 2015. Assuming an average capacity utilization rate of 95 percent, ethanol production is projected to top 9.8 billion gallons by 2015.

Feedstock availability is not expected to be a constraint for ethanol production over the next decade. Corn, which is currently used the make about 90 percent of all U.S. ethanol, is expected to remain the predominant feedstock, although its share likely will decline modestly by 2015. The ethanol industry also is making significant improvements in yields. Based on improved technology and new plant designs, and reports of yields from new plants, we expect average ethanol yields to increase from the current level of 2.75 gallons per bushel to nearly 3 gallons per bushel by 2015. When this is taken into consideration, we project total corn utilized for ethanol production to increase from 1,586 million bushels this season to nearly 3 billion bushels by 2015.

Table 1
Projected Ethanol Capacity and Production
2005-2015

	ETOH Capacity (MGY)	Net New Capacity (MGY)	Capacity Utilization (Pct)	ETOH Production (MGY)	Corn Share (%)	Other Feedstocks (MGY)	Ethanol Yield (Gal/bu)	Crop Year Corn Use for ETOH (Mil Bu)
2005	4,286	686	93%	4,003	90.0%	600	2.750	1,586
2006	5,911	1,625	95%	5,615	90.0%	562	2.765	2,196
2007	7,611	1,700	95%	7,230	90.0%	723	2.780	2,502
2008	8,361	750	95%	7,943	90.0%	794	2.795	2,643
2009	8,761	400	95%	8,323	90.0%	832	2.810	2,751
2010	9,161	400	95%	8,703	89.0%	957	2.825	2,805
2011	9,461	300	95%	8,988	88.5%	1,034	2.840	2,853
2012	9,711	250	95%	9,225	88.0%	1,107	2.855	2,895
2013	9,961	250	95%	9,463	87.5%	1,183	2.870	2,926
2014	10,161	200	95%	9,653	87.0%	1,255	2.885	2,951
2015	10,361	200	95%	9,843	86.5%	1,329	2.900	2,976

Source: LECG, LLC

A combination of improved corn yields and acreage shifts from other crops will enable the U.S. corn sector to supply the ethanol industry without significant increases in prices that would adversely affect ethanol profitability or the livestock and poultry industry. As corn stocks are drawn down from this season's 2.4 billion bushel projected carryout, farm-level corn prices will increase, reaching $2.58 per bushel by the 2015 marketing year. The impact of this level of demand for ethanol on stocks measured by the stocks to use ratio and farm-level corn prices is illustrated in Figure 1.

Figure 1
U.S. Corn Stocks and Farm Price
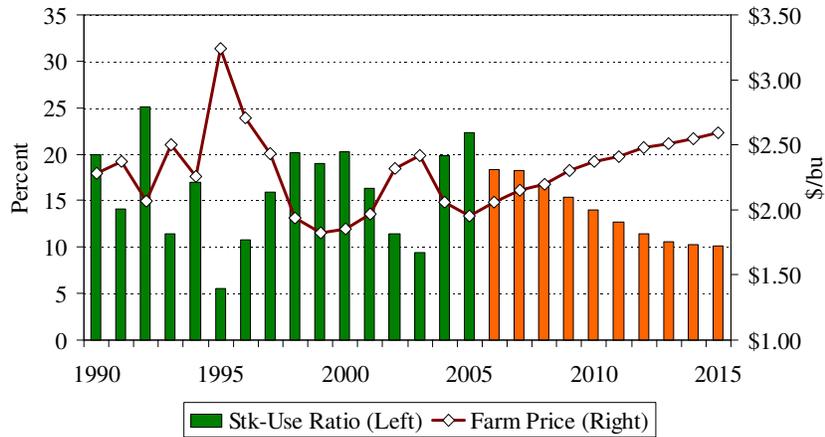
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The investment in an additional 6 billion gallons of new ethanol capacity and production of 9.3 billion gallons by 2015 will make a significant contribution to the U.S. economy.

- The combination of spending for annual operations and capital spending for new capacity will add $83.1 billion (2005 dollars) of gross output to the American economy by 2015. Adjusting for the difference between gross output and GDP, the U.S. economy measured by Gross Domestic Product economy will be nearly $46 billion (2005 dollars) larger by 2015 as a result of the ethanol industry. in 2005.

- New jobs are created as a consequence of increased economic activity caused by ethanol production. The increase in gross output (final demand) resulting from ongoing production and construction of new capacity supports the creation of as many as 203,879 jobs in all sectors of the economy by 2015.

- Increased economic activity and new jobs result in higher levels of income for American households. The production of ethanol will put an additional $14.6 billion into the pockets of American consumers in 2015.

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- Ethanol reduces our dependence on imported oil and reduces the U.S. trade deficit. The ethanol industry. The production and use of ethanol displaces crude oil needed to manufacture gasoline. According to the Energy Information Administration imports account for 65 percent of our crude oil supplies and oil imports are the largest component of the expanding U.S. trade deficit. The production of 9.8 billion gallons of ethanol by 2015 means that the U.S. will import 3.7 billion fewer barrels of oil between 2005 and 2015. This means that $197.4 billion dollars will stay in the U.S. instead of being shipped offshore to pay for foreign oil.

Impact of ethanol to the local economy

The structure of the ethanol industry has changed dramatically over the past 15 years. 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 January 2006, the ethanol industry comprised 92 plants with annual capacity of more than 4.3 billion gallons. Dry mill plants accounted for 71 percent of capacity with an average size of 42 MGY.

Virtually all new ethanol plants being built today are dry mills and average plant sizes are closer to 100 MGY than 50 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 all grain feedstock is procured from local farmers (i.e. corn produced within a 100 mile radius of the plant) but that other inputs such as natural gas and chemicals are provided by suppliers outside of the local community. As opposed to grain, only a small share of the expenditure for chemicals, enzymes, and natural gas will accrue to local suppliers.

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As shown in Table 2, annual expenditures for goods and services for a 50 MGY ethanol plant are estimated at $46.7 million (2005 dollars) while spending for a 100 MGY plant is estimated at $88.2 million. There 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
a 50 and 100 MGY Dry Mill Ethanol Plant

	50 MGY	100 MGY
Annual Expenditures (Mil 2005 $)	$46.7	$88.2
Gross Output (Mil 2005 $)	$209.2	$406.2
GSP (Mil 2005 $)	$115.0	$223.4
Household Income (Mil 2005 $)	$29.7	$51.2
Employment (Jobs)	836	1,573

While the precise impact on a specific community will depend on the structure of the local community (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 18.2 million bushels of corn annually and a 100 MGY plant will require 36.4 million bushels annually. Feedstocks account for about two-thirds of annual operational spending. If all grain is sourced locally, the economic impact is maximized. The spending for production for a 50 MGY plant will generate $209 million (2005 dollars) of new gross output while a 100 MGY plant will generate $406 million annually for the local economy.

- When viewed at the State level, a 50 MGY ethanol plant will add $115 million annually to the size of the State economy measured by Gross State Output. A 100 MGY plant will increase GSP by $223 million. That is, the State economy will, be larger as a result of the operations of the ethanol plant.

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- New jobs are created as a consequence of increased economic activity caused by ethanol production. The increase in gross output (final demand) resulting from ongoing production of a 50 MGY ethanol plant will support the creation of as many as 836 jobs in all sectors of the local economy while a 100 MGY plant will generate nearly 1,600 new 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 in the local economy by nearly $30 million annually. A 100 MGY plant will increase household income by more than $50 million.

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Appendix Table 1
BEA RIMS II Final Demand Multipliers, U.S.[3]

	Output	Earnings	Employment (Jobs)
Construction	3.4230	1.0521	28.4941
Annual Operations			
Feed Grains (Corn)	2.7644	0.5277	18.9075
Other basic organic chemicals	3.3519	0.7101	15.9730
Power generation and supply	2.4634	0.5944	12.8781
Natural gas distribution	3.3205	0.5774	16.5073
Water, sewage	2.5899	0.7068	17.8532
Facilities support services	2.6503	0.9423	28.3832
Office administrative services	2.8359	1.0009	25.1341
Households	2.3296	0.6476	19.4085

Source: Regional Input-Output Modeling System (RIMS II). Regional Economic Analysis Division, BEA.
Multipliers based on 1997 Benchmark I-O Table; 2003 regional accounts data.

Appendix Table 2
Economic Contribution of the Ethanol Industry: 2005

			Impact	
Industry	**Spending (Mil 2005$)**	**Output (Mil 2005$)**	**Earnings (Mil 2005$)**	**Employment (Jobs)**
Construction	$2,433.2	$8,328.8	$2,560.0	65,842
Plus initial changes		$2,433.2		
Total		**$10,762.0**	**$2,560.0**	**65,842**
Annual Operations				
Farm Products/Agriculture	$2,901.3	$8,020.3	$1,531.0	52,095
Industrial chemicals	$361.4	$1,211.2	$256.6	5,481
Electric, natural gas, water	$1,374.8	$4,390.1	$800.7	20,976
Maintenance and repair	$82.6	$219.0	$77.9	2,227
Business Services	$103.1	$292.3	$103.2	2,460
Earnings paid to households	$251.9	$586.9	$163.1	4,643
Subtotal	**$5,075.0**	**$14,719.8**	**$2,932.5**	**87,883**
Plus initial changes:				
Value of ethanol production		$5,467.5	$251.9	
Value of co-products		$1,244.0		
Total Annual Operations		**$21,431.2**	**$3,184.4**	**87,883**

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[3] The multipliers represent the effect on output, income and employment of every $1 million of expenditures.

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