ABF Economics
Agriculture and BioFuels Consulting, LLP

CONTRIBUTION OF THE ETHANOL INDUSTRY TO THE ECONOMY OF THE UNITED STATES IN 2017

Prepared for the Renewable Fuels Association by
John M. Urbanchuk
Managing Partner
February 12, 2018

The U.S. ethanol industry had a remarkable year in 2017. Ethanol production increased to record levels, domestic and export demand expanded, and construction of new production facilities posted its first major gain in more than five years.

- Industry output through October 2017 was 2.8 percent above 2016 levels and was poised to set a new record of more than 15.85 billion gallons for the full year.

- World oil prices reversed the declines seen in recent years and posted a 16.5 percent gain during 2017, leading to higher consumer gasoline prices. Despite higher average motor gasoline prices during 2017, gasoline – and ethanol – demand expanded by about one percent.

- Responding to record production and larger stocks, ethanol prices generally fell during 2017. Omaha Rack ethanol prices were 6.8 percent lower for the full year, while Iowa ethanol prices (FOB plant) fell 1.1 percent.

- The export markets were a significant bright spot for the industry. Based on USITC data, exports through November 2017 were up 12.5 percent from year-earlier levels and were poised to reach a record level of more than 1.3 million gallons for the year.

- At year's end, the U.S. ethanol industry had 465 million gallons of capacity under expansion or construction. This is the most significant increase in new capacity since 2011.

- The input markets were generally positive for the ethanol industry during 2017. American corn growers posted the second largest crop on record in 2017, which pushed feedstock prices lower throughout the year to the benefit of ethanol producers. Average cash market corn prices during

2017 were 2.3 percent lower than a year earlier.[1] Lower corn prices offset slight increases in natural gas and electricity prices and supported ethanol profitability in 2017. According to Iowa State University, net returns over variable costs for a typical Iowa dry mill ethanol plant were modestly higher than year-ago levels during the first half of 2017 but slipped in the second half as ethanol and DDGS prices fell. Despite this pattern, ethanol profitability (returns over variable costs) remained positive for the full year, averaging an estimated 20 cents per gallon.[2]

The regulatory and trade environment continued to provide challenges for the industry. On November 30, the Environmental Protection Agency (EPA) released its final rule for 2018 renewable volume obligations (RVOs) under the Renewable Fuel Standard (RFS). The final rule includes a requirement for 15 billion gallons of conventional renewable fuel (e.g., corn starch ethanol) in 2018, equal to the level established by Congress in the 2007 Energy Independence and Security Act. However, the rule uses EPA's cellulosic waiver authority to reduce the advanced biofuel requirement from the statutory level of 11 billion gallons to 4.29 billion gallons. Within this category the RVO for cellulosic biofuels is 288 million gallons, far short of the statutory level of 7 billion gallons and 7 percent lower than the final 2017 cellulosic biofuel requirement.

As pointed out above, ethanol exports expanded significantly in 2017, posting an estimated 12.5 percent increase to a new record level. However, tariffs on U.S. ethanol in China, Brazil, and the European Union constrained exports from growing more robustly. The situation for exports of ethanol co-products, notably DDGS, was also affected by trade barriers. As a consequence of anti-dumping and countervailing duties imposed against U.S. DDGS exports by China, exports to that country fell from 2.2 million metric tons for the first 11 months of 2016 to 347,000 metric tons in 2017. China, which has been the leading export market for U.S. DDGS, slipped to eighth place amongst top DDGS export markets.

According to the Renewable Fuels Association (RFA), at year's end the ethanol industry was comprised of approximately 211 plants in 28 states with nameplate capacity of 16.2 billion gallons and producing at a rate of 15.8 billion gallons. Conventional feedstocks (e.g., corn and sorghum) accounted for the

[1] No. 2 Yellow Corn, Central Illinois; ethanol FOB Iowa Plant and Ethanol Omaha Rack. Source USDA and Nebraska Ethanol Board.

[2] Iowa State University Ag Decision Maker D1-D10Ethanol Profitability available at http://www.extension.iastate.edu/agdm/energy/xls/d1-10ethanolprofitability.xlsx accessed Jan 11, 2018

majority of ethanol production, but the use of cellulosic biomass as a feedstock increased in 2017. At year's end, 465 million gallons of capacity was under expansion or construction.

This study estimates the contribution of the ethanol industry to the American economy in 2017 in terms of the employment, income, and Gross Domestic Product (GDP) directly and indirectly supported by the industry.

Expenditures by the Ethanol Industry in 2017

Ethanol producers are part of a manufacturing sector that adds substantial value to agricultural commodities produced in the United States and makes a significant contribution to the American economy.

Expenditures by the ethanol industry for raw materials, other goods, and services represent the purchase of output of other industries. The spending for these purchases circulates through the local and national economy, generating additional value-added output, household income, and employment in all sectors of the economy.[3] Ethanol industry expenditures can be broken into three major categories: construction of new production facilities, ongoing production operations, and research and development.

1. Construction
   Industry capacity increased nearly 300 million gallons during 2017 with much of this accounted for by expansion and "debottlenecking" of conventional ethanol and second generation (cellulose and advanced biofuels) production facilities. At year's end, RFA reported 465 million gallons of new capacity was under construction.
2. Ongoing production operations
   The industry spent an estimated $26.4 billion on raw materials, other inputs, and goods and services to produce ethanol during 2017, 5.1 percent more than in 2016. The 2.8 percent increase in industry output more than offset lower prices for feedstocks, so that aggregate expenditures for ongoing operations increased. Production costs were based on a model of dry mill ethanol production maintained by the author of this report. These estimates are consistent

[3] Expenditures for feedstock and energy were estimated using 2017 calendar year average prices. Revenues were estimated using 2017 calendar year average prices for ethanol (Omaha Rack); distiller's grains, and corn distillers oil. Prices were sourced from USDA/ERS and AMS, and EIA.

with generic dry mill ethanol costs, such as those published by Iowa State University.[4] Table 1 details the expenditures by the ethanol industry in 2016 and 2017.

Table 1
Estimated Ethanol Production Expenditures 2017

	2016 Mil $	2017 Mil $	Percent Change
Feedstock (corn)	$18,729	$19,137	2.2%
Enzymes, yeast and chemicals	$1,016	$1,105	8.8%
Denaturant	$707	$818	15.8%
Natural Gas, electricity, water	$2,522	$3,051	21.0%
Direct labor	$1,037	$1,103	6.4%
Maintenance & Repairs	$453	$482	6.4%
Transportation	$131	$139	6.1%
GS&A	$540	$575	6.5%
Total Operating Costs	$25,134	$26,411	5.1%
$/Gallon	$1.65	$1.67	1.2%

The largest share of spending was for corn and other feedstocks used as raw material to make ethanol. The ethanol industry used 5.66 billion bushels of corn (and corn equivalent) on a gross basis in 2017, valued at $19.1 billion. Reflecting this, the ethanol industry is a major source of support for agricultural output and farm income. The one other notable aspect of production expenditures was the impact of higher natural gas prices. Together, feedstock and energy accounted for more nearly 85 percent of ethanol production costs.

This analysis estimates both the total production effect and the crop price (farm income) effects of ethanol production on agriculture based on a structural model of U.S. agriculture maintained by the author. The impact of demand for corn to produce ethanol on farm income was adjusted so as to not overstate the impact of ethanol demand on revenue for the corn sector. This was accomplished by applying estimates of the effect of ethanol on corn prices taken from the literature to the share of corn demand accounted for by ethanol and actual change in corn prices.

[4] See the Ethanol profitability spreadsheet maintained by Don Hofstrand "Ag Decision Maker D1-10 Ethanol Profitability" available at http://www.extension.iastate.edu/agdm/energy/xls/d1-10ethanolprofitability.xlsx

The remainder of spending by the ethanol industry for ongoing operations is for a range of inputs such as enzymes, yeast and chemicals; electricity, natural gas, and water; labor; transportation; and services such as maintenance, insurance, and general overhead.

3. Research and Development

The renewable fuels industry is a significant engine for research and development (R&D) both in the public and private sectors. Much of the R&D activity in the biofuels industry is aimed at discovering and developing advanced biofuels feedstock and the technology needed to meet RFS2 targets for cellulosic and advanced biofuels. The primary public-sector agencies underwriting R&D in biofuels are the U.S. Departments of Energy (USDOE), Agriculture (USDA), and Defense (DOD). In addition to the federal government, many states are funding R&D in feedstock development as well as infrastructure. These public funds are being leveraged significantly by private sector firms undertaking research in a wide range of biofuels activities. We have assumed that R&D spending on biofuels continued to expand during 2017 as the need for new feedstocks grows. Reflecting this we assumed that industry R&D expenditures grew at the overall rate of inflation and totaled an estimated $882 million in 2017.[5]

4. Co-product value

Most ethanol is produced by dry mills that also produce valuable co-products in the form of distillers dried grains (DDGS) and (industrial) corn distillers oil.[6] The ethanol industry produced an estimated 48.1 million short tons of DDGS and nearly 3.4 billion pounds of industrial corn distillers oil in 2017 with an aggregate market value of $6 billion. Ethanol producers were adversely affected by sharply lower DDGS prices in 2017, driven primarily by trade barriers and general price softness in the global feed complex. It is notable that these co-products are produced with little additional expenditure.

[5] Estimates of the amount of R&D spending on biomass and biofuels vary substantially. For a discussion of R&D spending on biofuels see "Agricultural Preparedness and the Agriculture Research Enterprise". President's Council of Advisers on Science and Technology. Washington DC, December 2012. A 2013 study prepared by Mary Solecki, Anna Scodel and Bob Epstein at E2 Environmental Entrepreneurs. "Advanced Biofuel Market Report 2013" suggests that R&D spending on biofuels approaches $1.7 billion. A (relatively) new report on federal spending on R&D in energy published by EIA ("Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013", March 2015) estimates Federal R&D expenditures for biomass of $300 million in FY 2013. This study does not include estimates for corporate (private sector) R&D.

[6] DDGS and corn distillers oil production is reported monthly in the USDA Grain Crushings and Co-Products Production report. http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1899

Spending associated with current ethanol production, new and expansion construction, and R&D circulates and re-circulates throughout the entire economy several-fold, stimulating aggregate demand, and supporting jobs and household income. The economic activity associated with export activity adds to this impact. In addition, expanded economic activity generates tax revenue for government at all levels.

Methodology

We estimate the impact of the ethanol industry on the American economy by applying expenditures by the relevant supplying industry to the appropriate final demand multipliers for value added output, earnings, and employment.

To understand how the economy is affected by an industry such as ethanol production, it is necessary to understand how different sectors or industries in the economy are linked. For example, in the renewable fuels production sector, the ethanol industry buys corn from the agriculture sector, which in turn, buys inputs from other suppliers such as fertilizer and pesticide producers that also purchase products from a range of other industries. These are referred to as backward linkages. Use by other sectors of natural gas as an input, such as manufacturing operations, is a forward linkage. Natural gas production and transmission industries are linked through both forward and backward linkages to other economic sectors in each state's economy.

The household sector is linked to all sectors as it provides the labor and management resources. In turn, changes that affect incomes of the household sector typically have significant impacts compared to a change in the sales of other sectors. This is because households typically spend most of their income on both retail and service goods and this is a critical component of the national economy.

This study uses an economic model known as IMPLAN (Impact Analysis for Planning) to develop a model of the national economy, including sectors that support the ethanol industry, the links between them, and the level of national economic activity. IMPLAN is a commonly used economic input-output (I-O) model. I-O models are constructed based on the concept that all industries in an economy are linked together; and the output (i.e., sales) of one industry becomes the input of another industry until all final goods and services are produced. I-O models can be used both to analyze the structure of the economy and to estimate the total economic impact of projects or policies. For this analysis, a model for the U.S. economy was constructed using current IMPLAN software and the most recent data available.

As in the past we continue to treat the share of industry earnings accounted for by locally owned firms as an addition to the household sector since the income is paid to local owners. The result of this is that their impact is estimated using multipliers for the household sector rather than those for conventional corporate income.

IMPLAN models provide three economic measures that describe the economy: value added, income, and employment.

- Value added is the total value of the goods and services produced by businesses in the country and is generally referred to as gross domestic product (GDP). It is equivalent to the sum of labor income, taxes paid by the industry, and other property income or profit.

- Labor income is the sum of employee compensation (including all payroll and benefits) and proprietor income (income for self-employed work). In the case of this analysis, demand for corn and other feedstock to produce ethanol supports farm income through higher crop receipts than would be the case without ethanol production.

- Employment represents the annual average number of employees, whether full or part-time, of businesses producing output. Value added including labor income and employment represents the net economic benefits that accrue to the nation as a result of increased economic output.

There are three types of effects measured with a multiplier: direct, indirect, and induced effects. Direct effects are the known or predicted changes in the economy. Indirect effects are the business-to-business transactions required to produce direct effects (i.e., increased output from businesses providing intermediate inputs). Finally, induced effects are derived from spending on goods and services by people working to satisfy direct and indirect effects (i.e., increased household spending resulting from higher personal income).

We also continue to reflect the additional value of output of co-products (DDGS and industrial corn distillers oil) in the analysis. Since these are co-products, and the backward linkages for their production is accounted for in the expenditures for ethanol production, the value for DDGS and corn distillers oil was treated as income and value added only, and we applied income multipliers to the employee compensation portion to avoid double counting.

Changes to the Analysis

As was the case in our 2016 study, we incorporated the explicit impact of ethanol and DDGS exports in the economic impact analysis. The methodology for estimating the impact of trade differs from that used for industry output.[7] We estimated the impact of ethanol and DDGS exports by applying USDA Agricultural Trade Multipliers for output and employment to the estimated value of exports for 2017 reported in the USITC trade databases. Since ethanol and DDGS are outputs of the organic chemical industry we used the USDA trade multipliers for the other organic chemicals industry. The USDA multipliers have three major components (or margins): production, transportation and warehousing, and wholesale/retail trade. Since IMPLAN already incorporates the impact of ethanol and DDGS production, to avoid double counting impacts we only applied the margins for transportation and trade to the value of exports. This represents the post-production (or ex-plant) impacts from exports. These results were added to the IMPLAN results and are detailed below.

The major addition to the 2017 economic impact study is an estimate of the contribution of the ethanol industry to each of the states with ethanol output during 2017. This was accomplished by calculating the proportion of individual state ethanol production reported by RFA to the state's relative share of U.S. national GDP, employment and income reported by the U.S. Bureau of Economic Analysis.

Results

The impact of ethanol industry production and exports on the U.S. economy in 2017 is summarized in Table 2. The full impact of the spending for annual operations of ethanol production, co-product output, exports, and R&D is estimated to have contributed nearly $45 billion to the nation's GDP in 2017, 5.3 percent more than provided in 2016. A significant component of this is from agriculture, reflecting the importance of ethanol demand to total corn utilization, the aggregate value of crop production, and crop receipts and farm income. The manufacturing activity of ethanol production alone contributed more than $13 billion to the U.S. economy.

[7] https://www.ers.usda.gov/data-products/agricultural-trade-multipliers.aspx

Table 2
Economic Impact of the Ethanol Industry: 2017

	GDP	Employment	Income
	(Mil 2017$)	FTEs	(Mil 2017$)
Ethanol Production	**$13,043**	**79,664**	**$6,821**
Direct	$4,325	10,529	$1,842
Indirect	$5,019	29,692	$2,864
Induced	$3,700	39,442	$2,115
Construction	**$716**	**7,205**	**$477**
Direct	$240	2,616	$192
Indirect	$210	1,749	$130
Induced	$266	2,841	$155
Agriculture	**$23,578**	**245,673**	**$12,600**
Direct	$4,360	55,828	$1,953
Indirect	$12,148	115,458	$6,602
Induced	$7,070	74,387	$4,045
R&D Expenditures	**$1,338**	**11,672**	**$1,127**
Direct	$460	2,933	$576
Indirect	$390	3,614	$188
Induced	$488	5,125	$364
Exports (Total)	**$5,780**	**14,566**	**$3,063**
Total Ethanol	**$44,455**	**358,779**	**$24,088**
Direct	$9,385	71,906	$4,562
Indirect	$23,546	165,078	$12,847
Induced	$11,524	121,795	$6,678

Employment

Jobs are created from the economic activity supported by ethanol production. While ethanol production is not a labor-intensive industry (accounting for about 10,500 full time equivalent direct jobs nation-wide)[8], the economic activity of supporting industries generates a substantial number of jobs in the nation. When the direct, indirect and induced jobs supported by ethanol production, construction activity, agriculture, exports, and R&D are included, the ethanol industry supported nearly 360,000 jobs in 2017.

Since ethanol production is more capital intensive rather than labor intensive, the number of direct jobs supported by the ethanol industry is relatively small and is concentrated primarily in manufacturing and

[8] The Census Bureau does not report employment in ethanol production. This analysis conservatively assumes the average ethanol plant employs approximately 50 full-time equivalent employees.

agriculture. Most agriculture jobs supported by the ethanol industry are jobs in support activities related to crop production, ranging from farm managers and bookkeepers to farm equipment operators. In addition, jobs supported by income generated and spent by employees supports a significant number of jobs in seemingly unrelated sectors such as retail and service sectors. In general, as the impact of the direct spending by the ethanol industry expands throughout the economy, the employment impact expands significantly and is spread over a large number of sectors. The number of jobs supported by ethanol and DDGS exports is estimated at more than 14,500. Most of these jobs are concentrated in transportation and export trade related administrative and financial industries.

Income

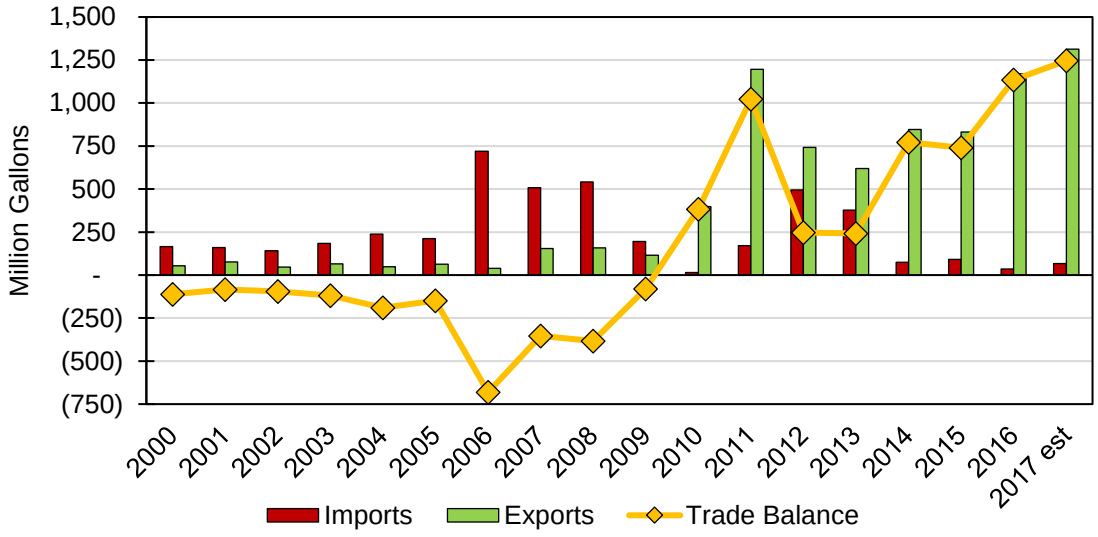
Economic activity and associated jobs produce income for American households. The economic activities of the ethanol industry put more than $24 billion into the pockets of Americans in 2017. As is the case with employment, the direct impact on income by the ethanol industry is largely concentrated in manufacturing and services. In many respects, this mirrors the employment structure of the American economy. The most significant impact of the ethanol industry continues to be increased income to farmers who benefit from the demand for feedstock, which leads to both increased production and increased prices as well as earnings from locally-owned ethanol plants.

Exports

As pointed out earlier, U.S. ethanol exports have expanded significantly over the last decade and are projected to total more than 1.3 billion gallons for all of 2017 with an export value of $2.4 billion. Exportable supplies of ethanol have grown over the past seven years as production exceeded domestic use. Moreover, the ethanol industry is generating a trade surplus and helping to reduce the nation's trade deficit. Figure 1 illustrates the growth in ethanol exports, imports and trade balance.

Ethanol exports generate economic activity largely through the requirements to transport ethanol from plants to ports and final destinations. This largely involves rail, barge, and ocean shipping. Additional impacts are generated by labor, administrative and financial requirements necessary to support export activity. These impacts are categorized as indirect since they are subordinate to production. Using the USDA Trade Multipliers suggests that the $2.4 billion of export value added $5.8 billion to GDP and supported more than14,500 jobs in all sectors of the economy.

Figure 1
U.S. Ethanol Trade

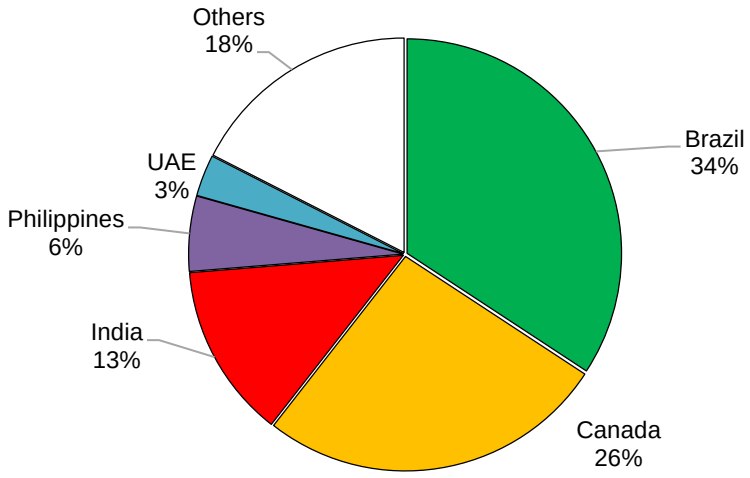


Source: Foreign Agricultural Service. Global Agricultural Trade System (GATS)

The growth in U.S. ethanol exports reflects not only larger exportable supplies but global expansion of renewable fuel use. A recent FAPRI forecast indicates that world ethanol production grew 1.5 percent in 2017. Considering that production in the U.S., the world's largest producer, increased 4.3 percent in 2017, the smaller increase in global output reflects an estimated 5 percent decline in Brazilian production.[9] As the world's two largest producers and exporters, this created a market opportunity for the U.S. One of the most significant developments for the U.S. industry has been the emergence of Brazil and India as export markets. Through November 2017, Brazil imported 379 million gallons of U.S. ethanol and has taken over Canada as the leading export market for ethanol. Exports to India totaled 153 million gallons in 2017. Exports to China which was the third largest U.S. ethanol market in 2016 have fallen to fewer than 3 million gallons in 2017. As shown in Figure 2, five markets account for 80 percent of total U.S. ethanol exports.

[9] FAPRI, University of Missouri-Columbia. International Biofuels Baseline Update. September 2017. FAPRI-MU Report #04-17

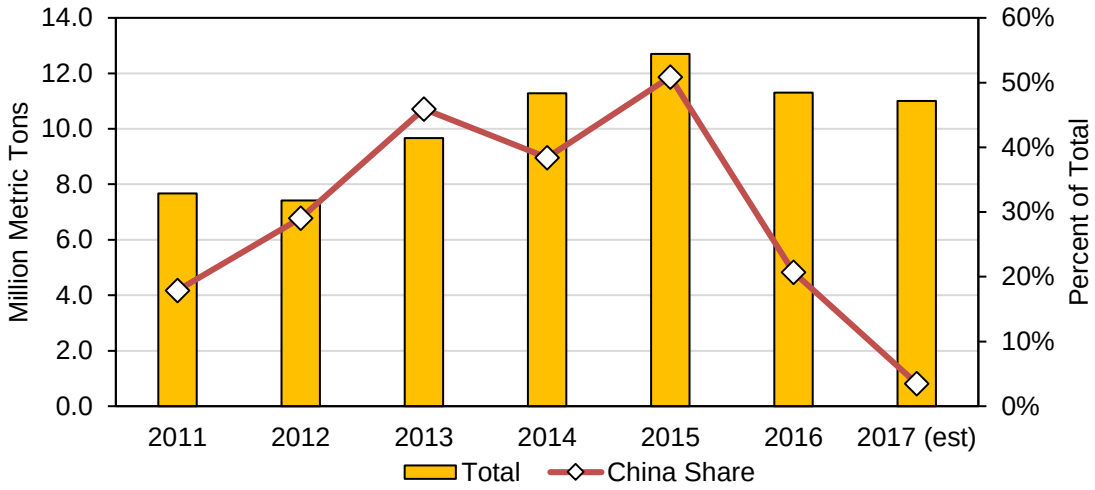
Figure 2
U.S. Ethanol Exports, Jan-Nov 2017



Source: USITC Trade Database

DDGS exports fell an estimated 2.5 percent during 2017 to an estimated 11 million metric tons, the lowest level in four years. When combined with sharply lower DDGS prices, export revenue fell an estimated 15 percent to $1.8 million. The biggest story for DDGS export markets has been the collapse of the China market. As shown in Figure 3, China's share of U.S. exports increased from 6.5 million metric tons as recently as 2015 (51 percent of total) to less than 350,000 metric tons in 2017, or 3.5 percent of total. The reason for the sharp drop is the imposition of anti-dumping and anti-subsidy taxes in early 2017.

Figure 3
U.S. DDGS Exports



Source: USDA Foreign Agricultural Service Global Agricultural Trade System (GATS).

Tax revenue

The combination of GDP and household income supported by the ethanol industry contributed an estimated $5 billion in tax revenue to the Federal Treasury in 2017. State and local governments also benefit from the economic activity supported by the ethanol industry, earning $5.7 billion in 2017.

Crude oil displacement

Ethanol also plays a positive role in reducing our dependence on imported oil, expands the supply of motor gasoline, reduces the U.S. trade deficit, and reduces greenhouse gas emissions relative to conventional gasoline.

The production and use of ethanol displaces crude oil needed to manufacture gasoline and expands the volume of motor gasoline available to consumers. According to the Energy Information Administration (EIA), U.S. dependence on imported oil and refined products has dramatically declined since peaking in 2005. The use of domestic biofuels (ethanol and biodiesel) continues to be a contributor to the steady decline in oil import dependence. EIA reports that in 2017, 25 percent of all petroleum products

consumed in the U.S. were imported from foreign sources, up slightly from 2016.[10] World crude oil prices have increased 16.5 percent during 2017 and higher prices have stimulated U.S. oil production. EIA reports that U.S. field oil production in October 2017 reached nearly 299 million barrels, the highest level since August 2015. Total field production of crude oil for the 10 months of 2017 was 3.2 percent above year earlier levels. This is reflected in drilling activity. The number of operating rotary oil rigs, which peaked at 1,596 in October 2014, bottomed out at 320 in May 2016, and had recovered to 738 by November 2017. The production of 15.8 billion gallons of ethanol displaced 532 million barrels of crude oil needed to produce gasoline in 2017. If applied to imports, the value of the crude oil displaced by ethanol increased to $26.9 billion in 2017.[11] This is money that stays in the American economy and, when combined with the GDP generated by ethanol production, is helping make America great again.

State Level Impacts of Ethanol Production

The ethanol industry has diversified geographically in recent years. At the end of 2016 RFA reports that 26 states had operating ethanol plants that produced an aggregate of 15.8 billion gallons. Each of these plants is essentially a biorefinery that is an integral part of the other organic chemicals industry in the U.S. manufacturing sector. As such the expenditures on feed grains and other feedstocks and inputs generates economic activity, income and supports job creation.

This year's analysis marks the first attempt to estimate the impact of the ethanol industry on the economy of each state with operating plants. This estimate was made by calculating the relative proportion of each state's ethanol production to U.S. GDP, employment and income for each state reported by the U.S. Bureau of Economic Analysis. The 26 states with producing ethanol plants account for more than 75 percent of national GDP, and about 73 percent of national employment and household income. The results of this analysis are detailed in Table 3.

[10] EIA. *Frequently Asked Questions. "How much oil consumed by the United States comes from foreign countries?"* http://www.eia.gov/tools/faqs/faq.cfm?id=32&t=6. Accessed Jan 15, 2018.

[11] Ethanol directly competes with and displaces gasoline as a motor fuel. According to the EIA, one 42 gallon barrel of crude oil produced 19.7 gallons of gasoline in 2017. Ethanol has a lower energy content (76,700 btu per gallon LHV) than gasoline (114,000 btu per gallon LHV), and thus it takes 1.48 gallons of ethanol to provide the same energy as one gallon of gasoline. Therefore, 15.8 billion gallons of ethanol are the equivalent of 10 billion gallons of gasoline. Since one barrel of crude produces 19.7 gallons of gasoline, it takes 510 million barrels of crude to produce 10.5 billion gallons of gasoline, the amount displaced by ethanol. This oil was valued at the 2017 year-to-date average composite acquisition cost of crude oil by refiners of $49 /bbl.

Table 3
Contribution of the Ethanol Industry to Individual State Economies, 2017

	Production (Mil Gal)	Production Share	GDP (Mil $)	Employment (Jobs)	Income (Mil $)
Iowa *	4,177	26.3%	$3,868	39,018	$3,010
Nebraska	2,176	13.7%	$2,015	21,685	$1,664
Illinois	1,659	10.5%	$1,536	16,070	$1,316
Minnesota*	1,204	7.6%	$1,115	11,923	$1,010
Indiana	1,173	7.4%	$1,086	12,127	$990
South Dakota	1,060	6.7%	$982	11,051	$913
Wisconsin	583	3.7%	$540	6,505	$593
Ohio	548	3.5%	$508	6,172	$569
Kansas	491	3.1%	$455	5,629	$531
North Dakota	465	2.9%	$431	5,381	$513
Texas	385	2.4%	$357	4,619	$459
Michigan	354	2.2%	$328	4,323	$439
Missouri	261	1.6%	$242	3,437	$376
Tennessee	225	1.4%	$208	3,001	$352
California	218	1.4%	$202	2,937	$347
New York	150	0.9%	$139	2,317	$301
Colorado	127	0.8%	$118	2,107	$286
Georgia	120	0.8%	$111	2,044	$281
Pennsylvania	110	0.7%	$102	1,953	$274
Oregon	98	0.6%	$91	1,843	$266
Virginia	64	0.4%	$59	1,533	$243
Idaho	60	0.4%	$56	1,497	$241
Mississippi	54	0.3%	$50	1,442	$237
Arizona	50	0.3%	$46	1,406	$234
Kentucky	36	0.2%	$33	1,278	$225
Florida	8	0.1%	$7	1,023	$206
All Other	--	--	$29,771	186,459	$8,211
TOTAL U.S.	**15,856**	100.0%	$44,455	358,779	$24,088

* Iowa and Minnesota impacts explicitly include new construction activity, and an export and R&D allocation.

As might be expected the impact on a state's economy is generally proportional to ethanol production. With two exceptions (Iowa and Minnesota for which individual analyses were conducted) the results in Table 3 should be considered as generalized impacts. That is, the structure of each state economy is unique and economic impact multipliers reflect this difference. Additionally, there are regional differences in feedstock costs, ethanol and DDGS prices, and other input costs that, with the exception of Iowa and

Minnesota, have not been explicitly considered. Relatively few states procure all of their feedstock inputs locally. Consequently leakages (spending that takes place out-of-state such as for corn imported from a neighboring state) are not factored into the analysis. This means, for example, that the impacts for a corn-deficient state like Pennsylvania may be overstated to the extent that the dollars spent for corn imported from Ohio or Indiana represent income for non-Pennsylvania farmers and are not netted out of the analysis. Finally, again with the exception of Iowa and Minnesota, no state by state allocation of R&D expenditures or exports has been incorporated since these are not likely equally distributed over all states.

Having said that, the ethanol industry has the largest relative impact on the economies of Iowa (3.4 percent of state GDP), South Dakota (2.1 percent of GDP) and Nebraska (1.7 percent of GDP). This is a reflection both of the size of the ethanol industry as well as the importance of agriculture to the state economy.

Conclusion

The ethanol industry continues to make a significant contribution to the economy in terms of job creation, generation of tax revenue, and displacement of crude oil and petroleum products. The importance of the ethanol industry to agriculture and rural economies is particularly notable. Continued growth and expansion of the ethanol industry through new technologies and feedstocks will enhance the industry's position as the original creator of green jobs and will enable America to make further strides toward energy independence.