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Economic Impact Analysis of the Ohio Ethanol Industry

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ECONOMIC IMPACT ANALYSIS OF THE OHIO ETHANOL INDUSTRY

Nancy Bowen, Associate Professor in the Department of Extension, OSU College of Food, Agricultural, and Environmental Sciences.
Eric Romich, Assistant Professor in the Department of Extension, OSU College of Food, Agricultural, and Environmental Sciences.

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Roger Rennekamp, Associate Dean and Director, Ohio State University Extension

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Executive Summary

In 2010, the Department of Energy released a report on the status of the ethanol industry in the U.S. claiming that the ethanol industry is "one of the most significant success stories in American manufacturing over the past quarter-century." The industry had grown from 170 million gallons produced in 1980 to a peak capacity of nearly 13 billion gallons in 2010. Today, over 200 plants are producing more than 15 billion gallons nationwide. Since 2007, seven ethanol plants have been constructed in Ohio.

This study analyzes the aggregated, ongoing annual operations of the seven ethanol facilities in addition to three construction events (original construction, upgrades and planned expansion) that account for total economic impact of the ethanol industry in Ohio since its inception in 2007. The study estimates the impact of the ethanol industry in Ohio using IMPLAN, an economic input-output (I-O) model to measure overall economic impact. The model captures indirect and induced impacts that occur from an initial direct investment using 2015 IMPLAN data (the most recent available). The analysis is based on the premise that sectors are linked; a change in one sector will create change in others.

The study is based on the following assumptions:

1. Ongoing (annual) operation of seven ethanol facilities using an employment indicator of 339 annual average full time equivalent (FTE) jobs.

2. Original plant construction of six ethanol facilities between 2007-2008 using a capital investment indicator of $849.6 million.

3. Additional upgrades during the past ten years between 2007-2017 for expansion of six ethanol facilities using a capital investment indicator of $110.6 million.

4. Planned construction upgrades currently underway or planned for the near future for four plants, including one plant that is doubling in size, using a capital investment indicator of $145.5 million.

The total estimated economic contribution of the ethanol industry to the Ohio economy is summarized by type of activity in Table 1 below. Figures presented represent the sum of the direct, indirect and induced impact (see breakdown of impact types) for construction and operation activities. Operations impacts are annual, representing ongoing operations and support of permanent employment in Ohio. Construction impacts represent the support of temporary jobs during periods of construction, including original construction, major upgrades during a ten-year time span, and current or planned construction for the expansion of several existing plants.

Table 1. Total Estimated Economic Contribution of the Ethanol Industry in Ohio by Activity

Activity	Employment	Labor Income	Value Added	Output
Annual Operations	2,174	140.3 M	250.1 M	1.01 B
Original Construction (2007-2008)	12,163	627 M	927.7 M	1.78 B
Plant Upgrades	1,520	76.8 M	116 M	233.7 M
Current Expansion Plans (2017-2019)	1,840	94.9 M	140.4 M	270.2 M
Total	**17,697**	**939 M**	**1.43 B**	**3.30 B**

The analysis indicates that the annual operation of seven ethanol plants in Ohio supports 2,174 permanent jobs, $140.3 million in labor income and contributes value added activity of just over $250 million to the Ohio economy. The original construction and subsequent upgrade of seven ethanol production facilities in the ten years between 2007-2017 accounted for 13,683 temporary jobs, $704 million in labor income and $1.04 billion in added economic value.

Four plants have included current expansion plans in the very near future which also account for the support of another 1,840 in temporary employment, almost $95 million in labor income and value added of over $140 million.

Note: Output is included in this report, but measures the value of all sales, including intermediate inputs and final purchases, therefore resulting in double counting of intermediate purchases. Value-added is the additional value of goods and services (economic output minus intermediate inputs), so is a more accurate measure of impact.

Background

The continuous demand for energy is driven by several key factors such as population growth trends, consumer behavior, transportation activity, and economic development. Total primary global energy consumption rose by 93% from 283 quadrillion British thermal units (Btu) in 1980 to more than 549 quadrillion Btu in 2012. Petroleum and liquid fuels are the predominate energy source, providing 24 percent of the total energy consumed in 2012. Since 1990, total global petroleum consumption has increased more than 32% from 66.2 million barrels per day (b/d) to more than 98 million b/d in 2017. Projecting forward, the International Energy Outlook 2016 Report estimates global petroleum consumption will increase by an additional 23% to 121 million b/d in 2040 (USDOE/EIA, 2016).

As the global demands for energy continues to grow, concerns over energy security remains a top priority. According to a 2017 report to Congress titled, Valuation of Energy Security for the United States, the Unites States has a long history of developing policies, and regulations to address energy security, going as far back as the 1920s and the Federal Power Water Act, while modern concerns of energy security centered on oil, natural gas, and electricity have become extremely complex (USDOE/EIA, 2016). Perhaps the most memorable example of the impact from disruptions to energy supplies is the Oil Embargo of 1973, when OPEC countries initiated an embargo on oil shipments to the United States and other European Countries. Since the 1970s, U.S. energy policy has focused on strategies such as increased domestic production of oil and gas resources, increased energy efficiency, advancements in distribution infrastructure, storage capacity, research and development of new and emerging technologies, and the diversification of energy sources to address potential disruptions in the energy supply chain.

The ethanol industry plays a major role in the diversification of energy sources. Significant investments in technology and infrastructure for the ethanol industry provides additional capacity for domestic biofuel production. While this is not a sole solution to energy security, the biofuels industry, which includes ethanol provides a domestic alternative to petroleum to supply energy for the transportation sector.

This report will provide an overview of the ethanol industry and estimate impact of the ethanol industry in Ohio. Specifically, the central focus of this study is to use an economic input-output (I-O) model (IMPLAN) to measure overall economic impact of the ethanol industry in Ohio. The IMPLAN model captures indirect and induced impacts that occur from an initial direct investment using the most recent data available. The analysis is based on the premise that sectors are linked; meaning a change in one sector will create change in others. This study analyzes capital investments in new construction and facility upgrades as well as ongoing operations employment and annual payroll as inputs that account for total economic impact of the ethanol industry in Ohio.

Policy Review

Ethanol has been produced for fuel in the United States for about 40 years. The corn ethanol industry is the largest biofuel producer in the United States. The emergence of the ethanol industry has benefited crop farmers by boosting agricultural commodity prices, stimulated rural economies, reduced emissions from consumption of transportation fuels, and is now a significant source of U.S. motor fuel. While there are various factors driving the ethanol industry's significant growth today, much of its early success is a result of strategic government policies and regulations (USDA, 2015).

The industry launch was initiated by a subsidy of 40 cents per gallon provided in the Energy Policy Act of 1978 (Tyner, W., 2015). Over the years, various policy measures have been developed to foster the development of renewable fuels including blending and production tax credits, import tariffs on foreign-produced ethanol, research grants to stimulate the development of new biofuels technologies, and financing programs to encourage the development of renewable fuels production and distribution infrastructure. Perhaps the most important policy measure to advance the renewable fuels industry is the minimum usage requirements to guarantee a market for renewable fuels. The Renewable Fuel Standard (RFS) was established through the Energy Policy Act of 2005 and later expanded in the Energy Independence and Security Act of 2007. The expansion of the Renewable Fuels Standard, often referred to as the RFS2, establishes specific volumes of renewable fuels to be used in the production transportation fuels through the year 2022. The RFS2 establishes specific annual targets for total renewable fuels and includes specific targets for various technologies including biomass based diesel, cellulosic biofuel, and advanced biofuel (Chart 1).

Chart 1: Renewable Fuel Standard Volumes by Year

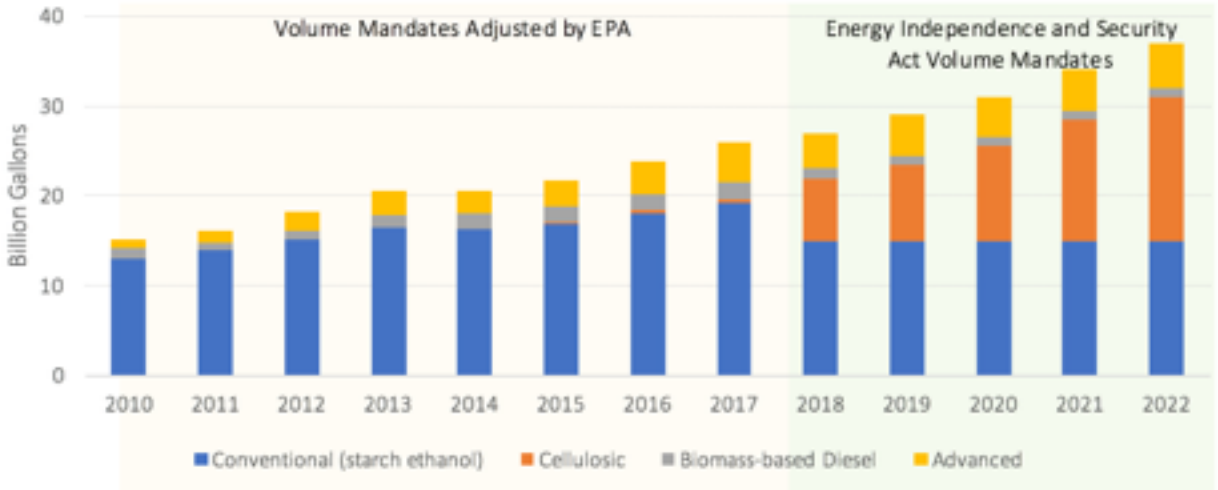

Chart 1 Source: United States Environmental Protection Agency (USEPA). (2017). *Renewable Fuel Standard Program*. Retrieved from United States Environmental Protection Agency: https://www.epa.gov/renewable-fuel-standard-program

The Clean Air Act provides EPA authority to adjust volumes as part of the annual rule process. In addition, if the EPA determines compliance with the RFS2 mandates would cause economic distress, environmental harm, or if there is inadequate supply, they may altogether waive the RFS volume mandates (USEPA, 2017).

U.S. Ethanol Trends

Production

Since the renewable fuel standards were expanded in the Energy Independence and Security Act of 2007 the production of ethanol has increased by 135 percent, which is an average of 13.5 percent annually (Chart 2). Ongoing infrastructure investments in the ethanol industry have increased the capacity and production. For example, the number of ethanol plants in the U.S. has expanded from 54 facilities in 2000 to 213 facilities in 28 states in January of 2017. In addition to the increase in the physical number of ethanol plants, continued expansions have increased the capacity of many existing facilities.

Most of the ethanol capacity is located in the Petroleum Administration for Defense District (PADD) 2 which cover the Midwest region including North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Kentucky, Tennessee, and Ohio. In 2016, the production capacity in PADD 2 represented 93 percent of the total U.S. production capacity. Ethanol production typically trends extremely close to plant capacity. According to EIA's most recent data, in 2016 the nameplate capacity of U.S. ethanol plants was 15.5 billion gallons, while the actual fuel ethanol production reached record high level of 15.3 billion gallons. While ranking as the largest producer of ethanol, the U.S. was, during the early 2000's, a net importer of ethanol. However, starting in 2010, the U.S. became a net exporter of ethanol with net exports reaching 1.01 billion gallons in 2016 (Chart 3).

Chart 2: U.S. Ethanol Plants, Capacity, and Production

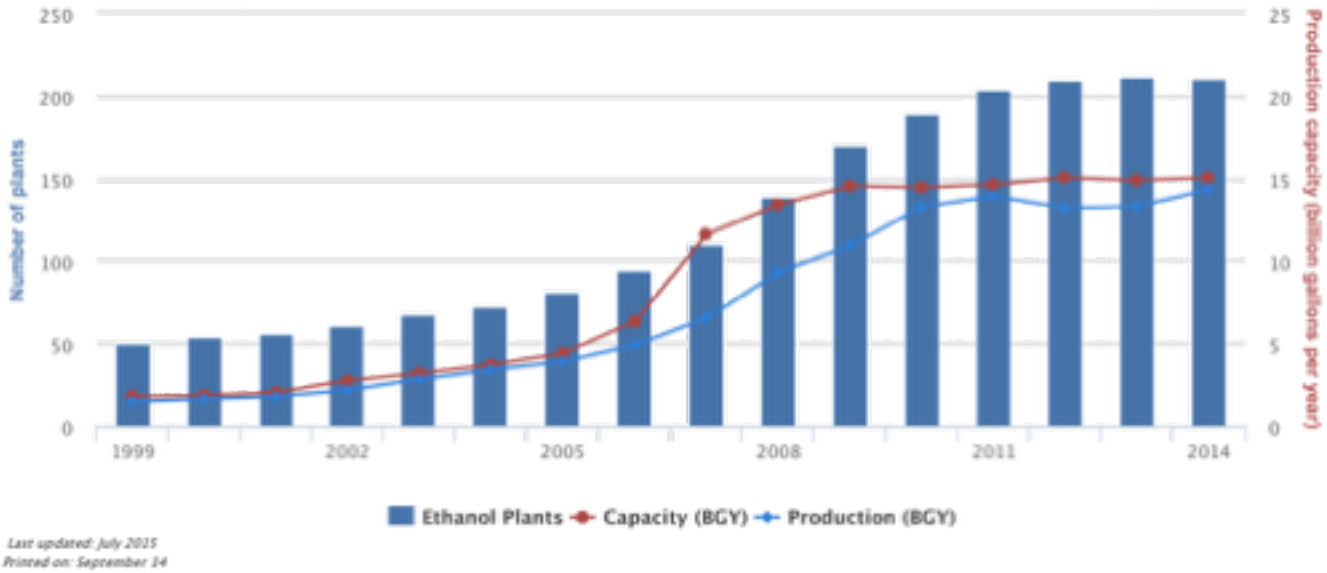

Chart 2 Source: U.S. Department of Energy, Energy Efficiency and Renewable Energy. (2017). *Maps and Data*. Retrieved from Alternative Fuels Data Center Biofuels Production: https://www.afdc.energy.gov/data/categories/biofuels-production

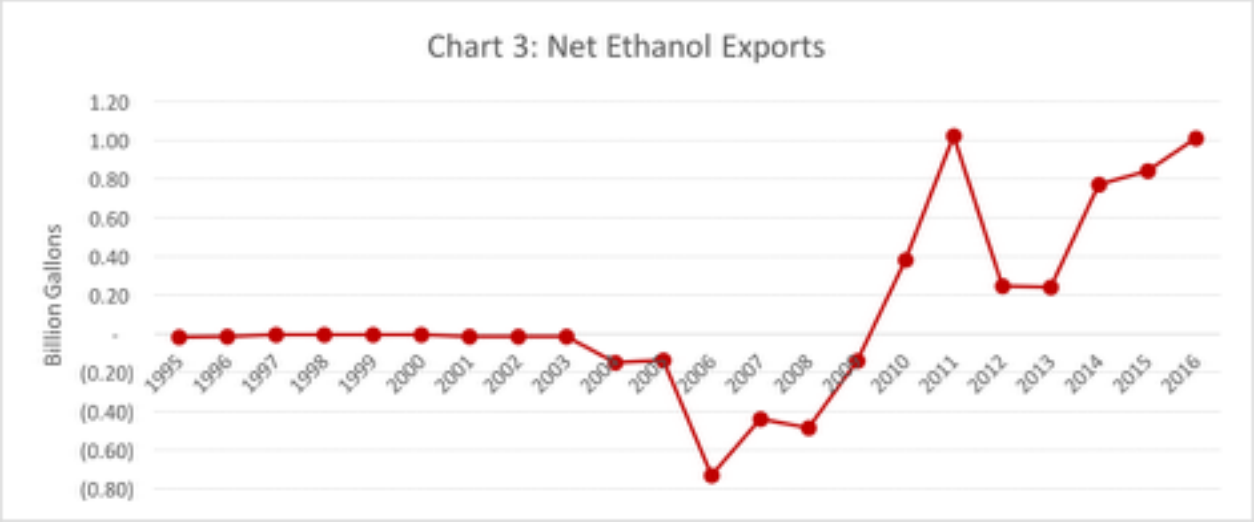

Chart 3 Source: U.S. Department of Energy, Energy Information Administration (USDOE/EIA). (2017). Retrieved from Independent Statistics and Analysis, Petroleum and Other Liquids: https://www.eia.gov/dnav/pet/pet_sum_snd_d_nus_mbbl_m_cur.htm

Consumption

While the ethanol has been blended into gasoline since the late 1970s, it represented a minimal portion of the overall finished gasoline until the 2000's. For example, in 2001 ethanol represented roughly 1 percent of finished gasoline by volume, growing to 10.04 percent of domestic gasoline consumption in 2016. The Energy Information Administration measures ethanol utilization by refiners and blenders of gasoline. As illustrated in Chart 4, the consumption of ethanol as an oxygenate blended in gasoline increased steadily since 1978, with significant growth between 2000 and 2010. The use of ethanol was prompted by various factors such as the by the phase-out of the use of lead in gasoline, the nationwide ban of Methyl Tertiary Butyl Ether (MTBE) as an Oxygenate in 2006, and the Renewable Fuel Standards.

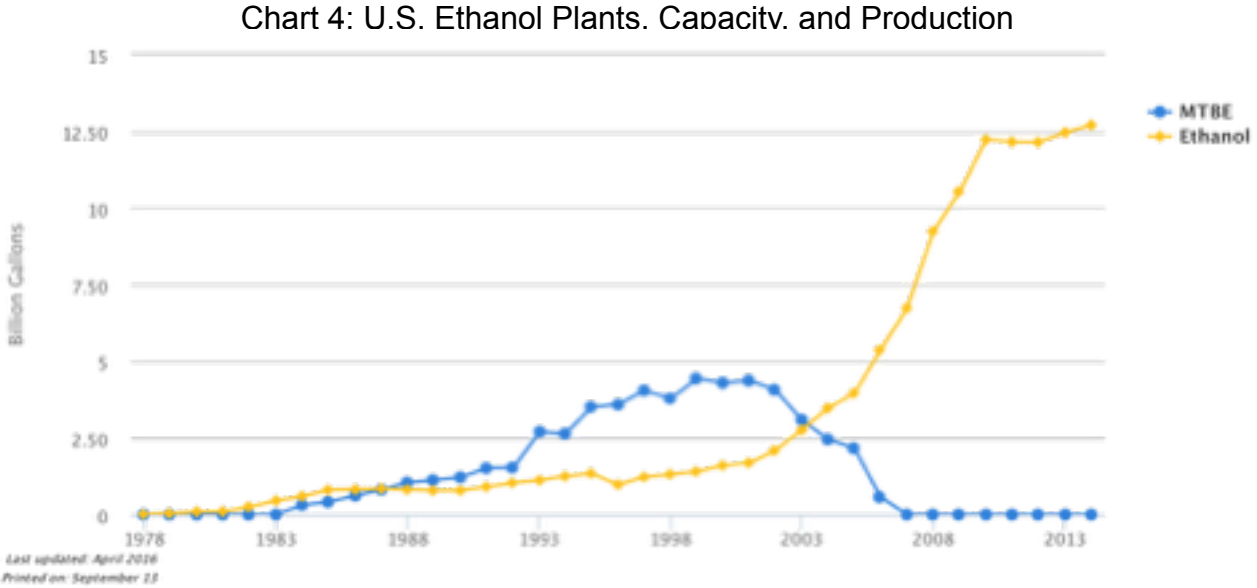

Chart 4 Source: U.S. Department of Energy, Energy Efficiency and Renewable Energy. (2017). *Maps and Data*. Retrieved from Alternative Fuels Data Center Fuel Trends: https://www.afdc.energy.gov/data/categories/biofuels-production

Some believe infrastructure and vehicle constraints will limit the amount of ethanol that is ultimately blended into finished gasoline to 9 or 10 percent. In this scenario, if the production of ethanol exceeds the amount that can be blended in gasoline, then it reaches the so-called "blend wall." As mentioned earlier, in 2016 ethanol represented 10.04 percent of domestic gasoline consumption, which is slightly above the blend wall. Several other factors that could limit the domestic consumption of ethanol include a reduction in vehicle miles traveled, increasing fuel efficiency of new vehicles, and limited access to alternative fueling stations.

While most ethanol in the United States is consumed as a of 10 percent blend of ethanol, in 2010 the EPA increased the blend limit to 15 percent for vehicles built after 2001, and Flexible fuel vehicles (FFVs) have engines capable of operating on E85, which is a gasoline-ethanol blend containing 51 to 83 percent ethanol. Flex Fuel Vehicles have been commercially available since the late 1990s, yet had a very small market presence until the mid 2000s. The U.S. Department of Energy Alternative Fuels Data Center estimates in 2015 there were nearly 20,000,000 flex fuel vehicles on U.S. roads, or 7.36 percent of the total U.S. vehicles registered (Chart 5). Furthermore, the number of flex fuel fueling stations is increasing as well. For example, the number of fueling stations that offer E85 has increased by 26.3 percent since 2000 from 113 fueling stations to 3,090 fueling stations in 2016 (USDOE/EERE, 2017).

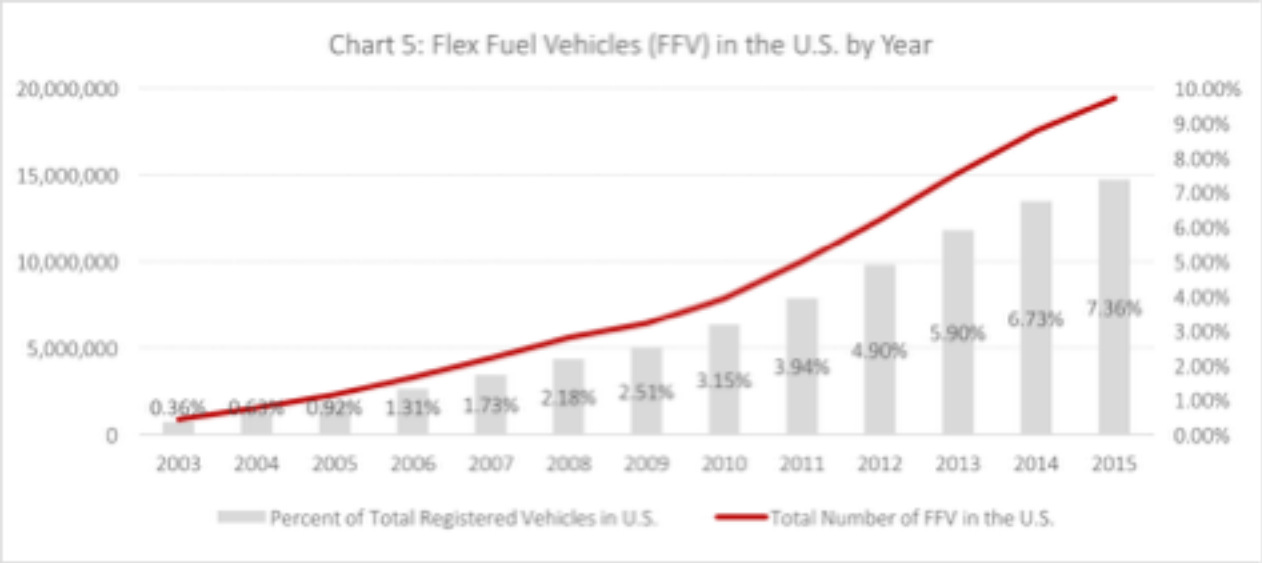

Chart 5 Source: Alternative Fuels Data Center, either directly (www.afdc.energy.gov/fuels/stations_counts.html) or from Transportation Energy Data Books (www.osti.gov/bridge/basicsearch.jsp); Bureau of Transportation Statistics. www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_11.html

The willingness of many consumers to purchase flex-fuel vehicles and use E85 instead of lower blends of ethanol will depend on the price of ethanol compared to traditional finished gasoline blended with 10 percent ethanol (E10). While historically, E85 prices have been greater than E10 prices on an energy equivalent basis, there does appear to be a trend emerging in some Midwestern States, where an increasing number of retailers are offering E85 at a discount to E10. If this trend continues and becomes more widespread, E85 consumption could increase (USDA, 2015). Opportunities to reduce the cost of biofuels are to reduce the cost of bioenergy feedstock, which constitutes a large portion of operating costs, increase the conversion efficiency from biomass to fuels, and reduce transportation and logistics costs (National Research Council. 2011).

I. Introduction and Methodology - Ohio Ethanol Industry Economic Impact Analysis

There are currently seven ethanol production facilities in Ohio. These facilities employ salaried and wage staff as well as purchase goods and services, including significant investments in materials for construction and upgrades. This analysis includes the following assumptions provided through a survey conducted of the seven plants in Ohio:

1. Over 90% of inputs (corn) purchased by Ohio farmers
2. Collectively, the seven plants employ 339 FTE employees (combined hourly and salaried)
3. Total original investment in seven ethanol plants was $849,625,000 between 2007-2008
4. Total plant upgrades between 2007-2017 for six of seven plants was $110,600,000
5. Four of the seven plants have expansion plans in place for investments totaling $145,500,000

The construction and operations investments are significant. Such investment contributes to additional economic activity in a variety of other sectors that comprise the larger economy well beyond the economic activity of the processing facilities themselves. Using input/output modeling, we can estimate the extent to which the construction and operation of Ohio's ethanol processing facilities contribute to other employment (measured in FTEs) and income (measured in dollars). Some of this investment goes toward the purchase of goods and services production. Additionally, some of the spending goes toward the payment of employee wages and benefits. These dollars represent the direct effect of the construction and operation of Ohio's ethanol processing facilities.

Any other direct ethanol processing facilities-related spending outside Ohio has no additional impact beyond the initial round of spending because those dollars do not stay within the study area. This spending 'leaks' from the study area economy in order to purchase goods and services production elsewhere. Table 2 estimates the total economic effect by impact type; direct, indirect or induced (see breakdown below for definitions of the effect types).

Table 2. Economic Contribution of the Ethanol Industry in Ohio by Impact Type

Impact Type	Employment	Labor Income ($)	Value Added ($)	Output ($)
Direct Effect	9,034	$510,717,682	$671,046,088	$1,905,179,056
Indirect Effect	3,722	$212,791,050	$368,142,901	$708,962,320
Induced Effect	4,942	$215,390,185	$395,010,040	$687,163,975
Total Effect	**17,698**	**$938,898,916**	**$1,434,199,028**	**$3,301,305,351**

A breakdown of impact types is illustrated in the following:

- The direct effect is felt when dollars used to build ethanol facilities and operate them are spent within the study area (Ohio). If these dollars are spent outside Ohio, there is no direct, indirect or induced effects.
- The indirect effect occurs as Ohio businesses provide goods and services used by ethanol plant builders and plant operators, and when these businesses, in turn, make additional purchases from Ohio businesses.
- The induced effect occurs as workers in the directly and indirectly affected industries receive income that they then use to purchase consumer goods and services from other businesses in Ohio.
- The total effect of ethanol plants' construction and operations is the sum of the direct, indirect, and induced effects.

II. Economic Impact – Plant Operations

Employment

It is estimated that the ethanol plants' operation supported 2,174 jobs in Ohio. The top 20 sectors (accountable for 58% of the employment impact of annual operations of the seven ethanol plants in Ohio) are listed in Table 3.

The ethanol industry is more capital than labor intensive. Although only 339 direct jobs were created by the combined seven ethanol operations, the number of jobs supported by the industry operations accounts for 2,174, or over six times that number. When adding in temporary construction jobs, the ethanol industry has supported well over 17,000 jobs during the past decade in Ohio.

Distribution of employment supported by the ethanol industry is across the board, impacting at least 140 sectors of the economy. As would be expected, services jobs in restaurants, retail and wholesale trade businesses, management and real estate, hospitals and doctors' offices are among the top sectors impacted.

Table 3: Operations Employment

NAICS	Top Twenty Sectors	
Sector	Description	
165	Other basic organic chemical manufacturing	341
395	Wholesale trade (including bulk corn from agricultural sector)	163
461	Management of companies and enterprises	79
10	All other crop farming	77
411	Truck transportation	58
502	Limited-service restaurants	55
501	Full-service restaurants	54
468	Services to buildings	47
440	Real estate	45
471	Waste management and remediation	45
482	Hospitals	43
62	Maintenance and repair construction of nonresidential structures	40
464	Employment services	39
2	Grain farming	31
20	Extraction of natural gas and crude petroleum	30
405	Retail - General merchandise stores	25
449	Architectural, engineering, and related services	25
406	Retail - Miscellaneous store retailers	24
504	Automotive repair and maintenance	22
400	Retail - Food and beverage stores	22
Total		1,263

Labor Income

The total estimated labor income (employee compensation plus proprietor income) attributable to the ethanol plants' operation realized within the Ohio economy is estimated to be over $140 million. The most significant impact is felt in the basic organic chemical manufacturing sector at about $42.5 million. The distribution of income gains within the top 20 sectors are listed in Table 4.

Table 4: Operations Labor Income

NAICS	Top Twenty Sectors	Labor Income ($)
165	Other basic organic chemical manufacturing	$42,452,348
395	Wholesale trade (including bulk corn from agricultural sector)	$13,135,378
461	Management of companies and enterprises	$9,446,118
10	All other crop farming	$857,392
411	Truck transportation	$3,397,006
502	Limited-service restaurants	$996,869
501	Full-service restaurants	$1,133,983
468	Services to buildings	$1,147,281
440	Real estate	$1,629,100
471	Waste management and remediation	$3,116,368
482	Hospitals	$3,079,216
62	Maintenance and repair construction of nonresidential structures	$2,139,733
464	Employment services	$1,315,971
2	Grain farming	$441,253
20	Extraction of natural gas and crude petroleum	$1,025,829
405	Retail - General merchandise stores	$648,173
449	Architectural, engineering, and related services	$1,969,046
406	Retail - Miscellaneous store retailers	$468,399
504	Automotive repair and maintenance	$1,143,745
400	Retail - Food and beverage stores	$628,998
Total		$90,172,208

Annual ethanol industry operations are generating over $140M in income annually for Ohio households. The distribution of income gains is summarized in Table 4, showing widespread impact in services and retail sectors unrelated to construction or manufacturing.

Economic Value Added

The total economic value added attributable to operations realized within the Ohio economy is estimated to be over $250 million. The most significant impact is felt in the other basic organic chemical manufacturing industry at over $75 million. The top 20 sectors are listed in Table 5.

Table 5: Operations Value Added

NAICS	Top Twenty Sectors	Value Added ($)
165	Other basic organic chemical manufacturing	$75,289,098
395	Wholesale trade (including bulk corn from agricultural sector)	$23,694,620
461	Management of companies and enterprises	$11,585,956
10	All other crop farming	$1,188,360
411	Truck transportation	$4,147,293
502	Limited-service restaurants	$2,221,674
501	Full-service restaurants	$1,202,292
468	Services to buildings	$1,325,926
440	Real estate	$7,628,657
471	Waste management and remediation	$4,731,904
482	Hospitals	$3,430,464
62	Maintenance and repair construction of nonresidential structures	$2,734,910
464	Employment services	$2,037,979
2	Grain farming	$1,353,033
20	Extraction of natural gas and crude petroleum	$1,337,276
405	Retail - General merchandise stores	$1,126,026
449	Architectural, engineering, and related services	$1,980,349
406	Retail - Miscellaneous store retailers	$559,069
504	Automotive repair and maintenance	$1,363,034
400	Retail - Food and beverage stores	$954,846
Total		$149,892,768

III. Economic Impact – Construction (2007-2017)

Employment

It is estimated that the ethanol plants' construction activities between 2007-2017 supported 13,683 jobs in Ohio. The top 20 sectors impacted are listed in Table 6.

Table 6: Construction Employment

NAICS	Top Twenty Sectors	Employment
58	Construction of other new nonresidential structures	6,870
62	Maintenance and repair construction of nonresidential structures	825
395	Wholesale trade (including bulk corn from agricultural sector)	353
501	Full-service restaurants	227
502	Limited-service restaurants	218
482	Hospitals	212
440	Real estate	201
449	Architectural, engineering, and related services	155
411	Truck transportation	144
464	Employment services	143
406	Retail - Miscellaneous store retailers	141
405	Retail - General merchandise stores	136
399	Retail - Building material and garden equipment	116
401	Retail - Health and personal care	112
400	Retail - Food and beverage stores	111
407	Retail - Nonstore retailers	111
468	Services to buildings	107
475	Offices of physicians	105
403	Retail - Clothing and clothing...	100
503	All other food and drinking pl...	92

Employee Compensation

The total estimated employee compensation (i.e. payroll cost of the employee paid by the employer including: wage and salary, all health and retirement benefits and employer-paid payroll taxes) attributable to the ethanol plants' construction activities realized within the Ohio economy is estimated to be over $700 million. The most significant impact is felt in the Construction sector at about $370 million. The top 20 sectors are listed in Table 7.

Table 7: Construction Employee Compensation

NAICS	Top Twenty Sectors	Labor Income ($)
58	Construction of other new nonresidential structures	$370,265,421
62	Maintenance and repair construction of nonresidential structures	$44,334,131
395	Wholesale trade (including bulk corn from agricultural sector)	$28,476,043
501	Full-service restaurants	$4,793,873
502	Limited-service restaurants	$3,911,079
482	Hospitals	$15,312,931
440	Real estate	$7,324,334
449	Architectural, engineering, and related services	$12,374,920
411	Truck transportation	$8,424,831
464	Employment services	$4,887,220
406	Retail - Miscellaneous store retailers	$2,803,301
405	Retail - General merchandise stores	$3,524,640
399	Retail - Building material and garden equipment	$4,528,402
401	Retail - Health and personal care	$4,665,245
400	Retail - Food and beverage stores	$3,124,618
407	Retail - Nonstore retailers	$2,557,978
468	Services to buildings	$2,628,137
475	Offices of physicians	$11,378,358
403	Retail - Clothing and clothing...	$2,817,743
503	All other food and drinking pl...	$2,500,267

Economic Value Added

The total economic value added attributable to the original construction of plants and subsequent upgrades realized within the Ohio economy between 2007-2017 is estimated to be over $1 billion. The most significant impact is felt in the Construction sector (including new and upgrades) at $545 million. The top 20 sectors impacted by ethanol construction activities are listed in Table 8 below.

Table 8: Construction Value Added

Sector	Top Twenty Sectors	Value Added ($)
58	Construction of other new nonresidential structures	$470,956,424
62	Maintenance and repair construction of nonresidential structures	$56,665,882
395	Wholesale trade (including bulk corn from agricultural sector)	$51,367,309
501	Full-service restaurants	$5,082,643
502	Limited-service restaurants	$8,716,433
482	Hospitals	$17,059,687
440	Real estate	$34,297,974
449	Architectural, engineering, and related services	$12,445,958
411	Truck transportation	$10,285,599
464	Employment services	$7,568,597
406	Retail - Miscellaneous store retailers	$3,345,948
405	Retail - General merchandise stores	$6,123,113
399	Retail - Building material and garden equipment	$7,179,277
401	Retail - Health and personal care	$6,276,128
400	Retail - Food and beverage stores	$4,743,301
407	Retail - Nonstore retailers	$8,430,229
468	Services to buildings	$3,037,369
475	Offices of physicians	$10,987,471
403	Retail - Clothing and clothing...	$5,290,518
503	All other food and drinking pl...	$1,865,564

IV. Economic Impact – Future Expansion Plans (2017-2019)

Four of seven ethanol plants have expansion plans for the near future including major investments, new jobs and, in the case of one plant, a doubling in size. It was thought, due to the timing of this report, new plans should be included as one component of the ethanol industry's ongoing impact on Ohio.

Employment

New expansion plans are estimated to support another 1,840 temporary jobs during construction. Other sectors that will benefit from the indirect and induced effects of the 1,840 jobs are listed below in Table 9.

Table 9: Planned Construction Employment

NAICS	Top Twenty Sectors	
58	Construction of other new nonresidential structures	1,040
395	Wholesale trade (including bulk corn from agricultural sector)	47
501	Full-service restaurants	30
502	Limited-service restaurants	29
482	Hospitals	29
440	Real estate	27
449	Architectural, engineering, and related services	22
464	Employment services	19
411	Truck transportation	19
405	Retail - General merchandise stores	18
406	Retail - Miscellaneous store retailers	17
400	Retail - Food and beverage stores	15
468	Services to buildings	15
399	Retail - Building material and garden equipment	14
475	Offices of physicians	14
407	Retail - Nonstore retailers	14
401	Retail - Health and personal care	14
503	All other food and drinking places	12
403	Retail - Clothing and clothing accessories stores	12
504	Automotive repair and maintenance	11
Total		**1,420**

Employee Compensation

Labor income, which includes wages and benefits, is estimated to be almost $95 million in support of temporary construction positions for the expansion of four plants. Other sectors that would be impacted are listed below in Table 10.

Table 10: Planned Construction Employee Compensation

NAICS	Top Twenty Sectors	
58	Construction of other new nonresidential structures	56,026,568
395	Wholesale trade (including bulk corn from agricultural sector)	3,835,970
482	Hospitals	2,064,819
449	Architectural, engineering, and related services	1,730,685
475	Offices of physicians	1,534,084
461	Management of companies and enterprises	1,163,454
411	Truck transportation	1,127,223
440	Real estate	973,971
464	Employment services	662,199
445	Commercial and industrial machinery and equipment	645,049
501	Full-service restaurants	642,485
437	Insurance carriers	602,285
504	Automotive repair and maintenance	575,685
401	Retail - Health and personal care	570,887
399	Retail - Building material and garden equipment	557,807
502	Limited-service restaurants	525,490
433	Monetary authorities and depository credit institutions	507,415
447	Legal services	504,607
396	Retail - Motor vehicle and parts	503,062
405	Retail - General merchandise stores	464,479
Total		**75,218,225**

Economic Value Added

The total economic value added attributable to expansion plans within the near 2-3 year future is estimated to be over $140 million. The top 20 sectors impacted by ethanol construction activities are listed in Table 11 below.

Table 11: Planned Construction Value-Added

Sector	Top Twenty Sectors	
58	Construction of other new nonresidential structures	71,262,588
395	Wholesale trade (including bulk corn from agricultural sector)	6,919,623
441	Owner-occupied dwellings	5,403,589
440	Real estate	4,560,858
433	Monetary authorities and depository credit institutions	2,593,543
482	Hospitals	2,300,354
156	Petroleum refineries	1,988,968
449	Architectural, engineering, and related services	1,740,620
445	Commercial and industrial machinery equipment	1,553,919
437	Insurance carriers	1,529,438
475	Offices of physicians	1,481,382
461	Management of companies and enterprises	1,427,012
411	Truck transportation	1,376,190
502	Limited-service restaurants	1,171,135
407	Retail - Nonstore retailers	1,075,559
464	Employment services	1,025,515
399	Retail - Building material and garden equipment	884,341
396	Retail - Motor vehicle and parts	813,599
405	Retail - General merchandise stores	806,908
49	Electric power transmission and distribution	802,646
Total		**110,717,788**

V. Top Ten Sectors Impacted

Results from this analysis also produced the top ten sectors impacted by the combined operations and construction activities generated, or planned, by the ethanol industry in Ohio. Below are tables for the employment, labor income and value added by sector.

Table 12: Top Ten for Employment		
NACIS	**Top Ten Sectors for Employment**	**Employment**
58	Construction of other new nonresidential structures	7,909
62	Maintenance and repair construction of nonresidential structures	870
395	Wholesale trade (including bulk corn from agricultural sector)	563
165	Other basic organic chemical manufacturing	341
501	Full-service restaurants	312
502	Limited-service restaurants	302
482	Hospitals	283
440	Real estate	273
411	Truck transportation	222
464	Employment services	201

Table 13 Top Ten for Labor Income		
NACIS	**Top Ten Sectors for Labor Income**	**Labor Income ($)**
58	Construction of other new nonresidential structures	$426,291,989
62	Maintenance and repair construction of nonresidential structures	$46,758,304
395	Wholesale trade (including bulk corn from agricultural sector)	$45,447,391
165	Other basic organic chemical manufacturing	$42,462,181
501	Full-service restaurants	$6,570,341
502	Limited-service restaurants	$5,433,438
482	Hospitals	$20,456,966
440	Real estate	$9,927,405
411	Truck transportation	$12,949,061
464	Employment services	$6,865,390

Table 14: Top Ten for Value Added		
NACIS	**Top Ten Sectors for Value Added**	**Value Added ($)**
58	Construction of other new nonresidential structures	$542,219,012
62	Maintenance and repair construction of nonresidential structures	$59,764,350
395	Wholesale trade (including bulk corn from agricultural sector)	$81,981,552
165	Other basic organic chemical manufacturing	$75,306,538
501	Full-service restaurants	$6,966,122
502	Limited-service restaurants	$12,109,242
482	Hospitals	$22,790,505
440	Real estate	$46,487,489
411	Truck transportation	$15,809,083
464	Employment services	$10,632,092

As demonstrated in the Top Ten tables, wholesale trade businesses consistently land in the top two or three sectors benefiting most greatly from the direct investment and operation of ethanol plants. Wholesale businesses supply goods to build and operate the plants, including bulk quantities of corn or single units of big ticket items like heavy equipment and vehicles. The largest share of wholesale spending by the ethanol industry is for corn used as the raw material to make ethanol. The ethanol industry purchases over 90% of its' over 167 million bushels directly or indirectly (through wholesalers) from farmers in Ohio. The production of ethanol in Ohio is a major source of support for agricultural output and farm income.

IV. Conclusion

The ethanol industry contributes jobs, income, and value-added economic benefits to the Ohio economy. After short term economic impact associated with initial construction, the greatest contributions are to the various sectors that comprise the agricultural economy. Innovation is creating new technologies that promise continued growth, productivity and product diversification. In addition to production of about 613 million gallons of ethanol annually, plants are also now producing over 76 million gallons of corn oil and 1.25 million tons of distillers dried grains, with continued diversification into other product lines. As the ethanol industry continues to grow and expand, it contributes both economically and environmentally by producing a renewable, clean source of energy.

Appendix

Glossary of terms below adapted from the IMPLAN Glossary at http://implan.com/v3/index.php?option=com_glossary&Itemid=164

Employee Compensation
Employee Compensation in IMPLAN is the total payroll cost of the employee paid by the employer. This includes, wage and salary, all benefits (e.g., health, retirement, etc) and employer- paid payroll taxes (e.g., employer side of social security, unemployment taxes, etc).

Full Time Equivalent Employment (FTE)
Full-time equivalent employment is the number of full-time equivalent jobs, as determined by total hours worked divided by average annual hours worked in fulltime jobs.

GDP (or 'Value-added')
GDP or 'value added' is the contribution of each private industry and of government to the nation's output, or GDP. It represents total output of an industry or establishment (which consists of sales or receipts and other operating income, commodity taxes, and inventory change) less the cost of its intermediate inputs (which consist of energy, raw materials, semi-finished goods, and services that are purchased from domestic industries or from foreign sources).

Output
Output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set and are in producer prices.

Manufacturing	output = sales +/- change in inventory
Service Sector	output = sales
Retail and wholesale trade	output = gross margin (not gross sales)

Labor Income = employee compensation + proprietor income
Other Property Type Income = property income - proprietor income (Other property type income includes corporate profits, capital consumption allowance, payments for rent, dividends, royalties and interest income.)

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