

CONTRIBUTION OF THE RENEWABLE FUELS INDUSTRY TO THE ECONOMY OF IOWA

Prepared for the Iowa Renewable Fuels Association

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Iowa's renewable fuels industry was affected by the same negative factors that impacted the national industry in 2019 and both ethanol and biodiesel suffered a speed bump on the path to growth. For the year, Iowa's 43 operating ethanol plants produced 4.23 billion gallons, 2.4 percent below 2018's record. This was the first recorded annual decline in Iowa ethanol production. Iowa remains the nation's leading ethanol producer, accounting for 27 percent of U.S. capacity. Iowa is also the nation's leading biodiesel manufacturer. Accounting for nearly 20 percent of total U.S. production, Iowa biodiesel production fell 6.4 percent in 2019 to 342 million gallons. The bleak economic and policy environment resulted in virtually no new construction activity or expansion for ethanol and biodiesel during 2019.

The overall environment for biofuels in 2019 was challenging in several respects. Federal policy uncertainty created by refinery exemptions to the Renewable Fuel Standard (RFS) granted by EPA and the lapsed biodiesel tax credit drove down the profitability of ethanol and biodiesel and damaged domestic demand. Ethanol profitability was pressured by the combination of higher feedstock (corn) prices and lower ethanol and co-product prices. Weak foreign economic demand and the trade dispute with China resulted in lower exports of ethanol and Distiller's Grains.

Renewable fuels plants purchase agricultural raw materials, other inputs, and a wide range of goods and services such as industrial chemicals; electricity, natural gas, and water; labor; and

services such as maintenance, insurance, and general overhead. The primary feedstock for ethanol remains corn while the biodiesel industry uses a wider variety of fats and oils as feedstocks. In addition, funding for biofuels research and development from various sources benefits the state's economy. The 4.23 billion gallons of ethanol produced in Iowa last year utilized nearly 1.5 billion bushels of corn, or 57 percent of Iowa's 2019 2.58 billion-bushel corn crop.

Expenditures on these goods and services represent the purchase of output of other industries. A substantial share of these dollars is spent in Iowa, and the economic impact stays in the state. Spending associated with ethanol production circulates throughout the entire economy several-fold. Consequently, this spending stimulates aggregate demand, supports jobs not only in ethanol production but also jobs throughout the entire economy, generates additional household income, and provides tax revenue for state and local government.

At the request of the Iowa Renewable Fuels Association (IRFA), ABF Economics developed models to estimate the economic impacts of ethanol and biodiesel production in Iowa. The following report summarizes our methods and results. This report: 1) summarizes current trends in the national biofuel industry, 2) outlines the methods used to estimate impacts, and 3) presents results of the analysis.

As described above the refinery exemptions granted by EPA significantly reduced blending requirements and affected the Iowa biofuel industries. In order to examine the potential impact of the exemptions we have prepared a scenario that examines what biofuel demand and resulting economic impact would have been in 2019 but for the high number of RFS exemptions. The difference between the scenario results and the baseline which reflects continuation of the program reflects the foregone benefits (loss) Iowa suffers as a result of the RFS refinery exemption.

1. National Trends in Ethanol

The U.S. ethanol industry was buffeted by several factors that forced producers to cut operating rates and, in some cases, shutter plants resulting in only the second decline in annual industry output in two decades (the last being 2012, when a severe drought was experienced). Chief among these was a sharp decline in industry profitability. This was primarily the result of regulatory concerns associated with the EPA's continued support for RFS refinery exemptions, effects of the U.S.-China trade war, and declining gasoline demand. Ethanol production for 2019 totaled 15.8 billion gallons, nearly two percent below 2018 levels. Nevertheless, the ethanol industry continues to make a substantial positive contribution to the American economy.

- Industry average ethanol margins fell an estimated 7.3 percent for 2019. Returns over operating costs averaged \$0.17 per gallon in 2019, \$0.07 per gallon below 2018 levels. Operating costs, led by feedstock prices, increased 4.3 percent per gallon while industry revenues fell by two percent per gallon. The deterioration was significant enough that many facilities cut operating rates and several plants were idled or closed during the year.
- On the revenue side, national level revenues from ethanol sales increased modestly in 2019. Ethanol prices (FOB plant) in Iowa increased 1.4 percent, Eastern Corn Belt plants were up 2.9 percent and Omaha rack prices increased 2 percent. The largest negative impact on industry revenues came from the co-products markets with distillers dried grain (DDGS) prices falling 4.5 percent at Eastern Corn Belt plants.
- The input markets were an impediment for the ethanol industry during 2019 with most input prices increasing during the year. Feedstocks (mainly corn) account for more than 70 percent of ethanol production costs. 2019 was a bizarre year for crop production. Heavy flooding in major corn producing states resulted in record levels of prevented plant acres and while total planted area for corn increased modestly in the spring, average

yields fell resulting in a five percent decline in corn output. Stock levels for the 2018 crop year declined modestly and despite expected reduction in demand, stocks for the 2019 season are projected to fall again.¹ This situation led to a 10.7 percent increase in cash market corn (No. 2 Yellow, Iowa) prices for all of 2019.²

- World oil prices started the year substantially below year earlier levels and despite a modest strengthening, by midyear fell 12.6 percent for all of 2019. This decline was matched by gasoline prices. It is interesting to note that despite a strong consumer economy, lower gasoline prices were not sufficient to stimulate demand for finished gasoline, the principal market for ethanol. EIA reported that Americans consumed 143 billion gallons of finished gasoline in 2018 and year-to-date data suggests that gasoline consumption posted a small decline in 2019. Domestic ethanol demand was flat during 2019 because of both stagnant gasoline demand and the impact of refinery exemptions on reducing blending requirements. The share of ethanol in gasoline remains virtually unchanged at 10.1 percent.
- The trade arena in 2019 was disappointing for both ethanol and DDGS. Exports of ethanol declined 12 percent in volume terms while the value of ethanol exports fell 11 percent. Exports of DDGS experienced similar patterns with volumes declining 18 percent and export values falling nine percent. Larger ethanol supplies in Brazil, general weakness in other major importing economies, and the continuing trade dispute between the U.S and China were major factors underlying the weakness in trade.
- The regulatory environment continued to provide challenges for the industry. The EPA's final rule for 2019 renewable volume obligations (RVOs) under the RFS continued the requirement for 15 billion gallons of conventional renewable fuel (e.g., corn-starch

¹ <https://www.usda.gov/oce/commodity/wasde/wasde1219.pdf>

² <https://www.ers.usda.gov/data-products/feed-grains-database.aspx#UYr22794GZY>

ethanol) in 2019, nominally equal to the level established by Congress in the 2007 Energy Independence and Security Act.³ The major regulatory issue that continued to affect the ethanol industry in 2019 was the continued use of refinery exemptions by the EPA, which effectively reduced the required volumes. The RFS passed in 2005 gave the EPA authority to extend a temporary exemption from biofuel mandates to refineries. Under the exemption authority, the EPA has reinstated RINs (Renewable Identification Numbers, which are essentially credits under the RFS) to refiners.⁴ Refiners that receive exemptions can use these RINs to comply with the RFS requirements instead of blending physical gallons of biofuels. These exemptions effectively reduce the amount of biofuel required to enter the motor fuel supply. An EPA analysis published in October 2019 reported that the 31 exemption requests granted for the 2018 compliance year exempted 7.4 percent of the total RFS renewable fuel volume mandate, or about 1.43 billion gallons.⁵ EPA reports that 21 petitions were received for 2019.⁶

- In response to President Trump's 2018 direction for the EPA to initiate a rulemaking to expand the Reid Vapor Pressure (RVP) waiver to gasoline blended with up to 15 percent ethanol (E15), the EPA announced regulatory changes to allow E15 to take advantage of the 1-psi RVP waiver for the summer months that has historically been applied only to E10. E15 may now be sold year-round.

2. National Trends in Biodiesel

As was the case for ethanol, 2019 also was a challenging year for biodiesel producers.

According to the EIA, U.S. biodiesel production fell 7.1 percent in 2019 to 1.7 billion gallons.

³ Federal Register/Vol. 83, No. 237/Tuesday December 11, 2018

⁴ Renewable Fuels Association. "The Impact of Small Refinery Exemptions on Ethanol Demand" November 20, 2018.

⁵ "EPA refinery exemptions reduced renewable fuel blending requirements in 2018". EIA Today in Energy, October 25, 2018.

⁶ <https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rfs-small-refinery-exemptions>. Accessed January 6, 2020

- Due to the lapsed biodiesel tax credit, biodiesel producers sold their product under an environment of great uncertainty virtually all year. Extension of the biodiesel tax credit through 2023 was enacted by Congress in the final days of the year.
- Resolution of the anti-dumping trade dispute between the U.S. and Argentina and Indonesia protected the U.S. biodiesel industry by imposing final dumping rates ranging from 60.4 percent to 86.4 percent for Argentina and 92.5 percent to 276.7 percent for Indonesia.⁷ These duties have restrained imports and boosted demand from domestic production. In July 2019 the U.S. Commerce Department responded to a request from the U.S. Court of International Trade to explain how it found cause for anti-dumping duties on biodiesel from Argentina. In a recent filing with the court, the Commerce Department made “certain changes” to its calculations. However, the anti-dumping duty rates would remain the same for the two Argentine producers and exporters involved in the case. However, things could eventually be changed when it comes to imported biodiesel from Argentina. The Commerce Department is conducting a “changed circumstances review” that was requested by the Argentine government. Depending on what the review determines, it could potentially lead to lower countervailing duties on biodiesel imports from Argentina.⁸ Biodiesel exports posted a 9.7 percent gain in 2019 reaching 114 million gallons.

ECONOMIC IMPACT OF RENEWABLE FUELS ON IOWA

The renewable fuels industry is multifaceted. Ethanol and biodiesel producers are part of a manufacturing sector that adds substantial value to agricultural commodities produced in Iowa. The first and second-generation feedstocks used to produce renewable fuels are produced primarily by Iowa farmers, and the R&D expenditures for renewable fuels provide important

⁷ “ITC Vote Levels Playing in Biodiesel Trade Dispute” Biodiesel.org News Release, April 3, 2018

⁸ “Commerce Department Continues Argentina Anti-Dumping Duties” NAFB News Service. February 10, 2020

support for Iowa’s universities. Combined, these activities make a significant contribution to the Iowa economy. Based on its size and scope, the renewable fuels industry had the following impacts on Iowa’s economy in 2019.⁹

- Accounts for \$5 billion, or about 3 percent, of Iowa GDP;
- Generates \$2.4 billion of income for Iowa households; and
- Supports more than 48,000 jobs through the entire Iowa economy. This is equivalent to 2.2 percent of total state employment.

The annualized contribution of the ethanol and biodiesel industries is summarized in Table 1.

Table 1
 Total Economic Impact of the Renewable Fuels Industry for Iowa: 2019

	Purchases (Mil 2019\$)	GDP (Mil 2019\$)	Household Earnings (Mil 2019\$)	Employment (Jobs)
Ethanol*	\$7,286	\$4,532	\$2,186	44,421
Biodiesel	\$844	\$489	\$263	3,875
Total	\$8,130	\$5,021	\$2,449	48,296

* Includes agriculture, construction, investment in R&D, and exports

Methodology

The spending associated with renewable fuels production, construction, and R&D circulates throughout the entire Iowa economy several-fold. Consequently, this spending stimulates aggregate demand, supports the creation of new jobs, generates additional household income, and provides tax revenue for state and local governments. We estimate the impact of the renewable fuels industry on the Iowa economy by applying expenditures by the relevant

⁹ This study estimates the annualized impact of producing 4.23 billion gallons of ethanol and 342 million gallons of biodiesel on Iowa’s economy. These figures reflect the capacity of ethanol and biodiesel plants operating at year’s end.

supplying industry to the appropriate final demand multipliers for value added output, earnings, and employment.

This study utilizes the IMPLAN (Impact Analysis for Planning) economic model to develop this understanding of the economy, including the sectors that support the ethanol industry, the links between them, and the level of 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 within an economy are linked together; the output 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 Iowa economy was constructed using IMPLAN software and data to estimate economic impacts of the ethanol and biodiesel industries. Detail regarding the IMPLAN model and how it was used is presented in Appendix A.

In addition to using the updated IMPLAN data discussed above we continued to recognize the impact of income generated by locally owned renewable fuels firms. All corporations earn income that directly impacts GDP. However, the income earned by firms owned by Iowans largely stays in Iowa and has a more significant impact on the state economy than earnings that are transferred to firms domiciled outside of Iowa. A review of ownership of ethanol and biodiesel firms based on information provided by IRFA suggests that more than half of Iowa's ethanol and biodiesel plants are locally owned. The earnings of locally owned firms are treated as an addition to the household sector since the income is paid to Iowans and their impact is estimated using multipliers for the household sector. The earnings by firms domiciled outside of Iowa are treated as direct additions to GDP.

We continued to incorporate the explicit impact of ethanol and DDGS exports into the analysis using USDA Agricultural Trade multipliers for output and employment to estimate the impact of exports. These results were added to the IMPLAN results. Since Iowa is the nation's largest

ethanol producer, the Iowa industry participates in the export market. Reflecting this, we applied Iowa's share of total production to the total national export impact.

This year's analysis includes revisions to ethanol and DDGS yields (to 2.85 gallons and 17 pounds per bushel, respectively) and an increase in Industrial Corn Oil (ICO) recovery to 90 percent. These revisions more accurately reflect current industry performance as reported by USDA.

Contribution of the Renewable Fuels Industry

The contribution of the renewable fuels industry to the economy of Iowa is detailed in Table 2. The ethanol industry provides a significant contribution to the Iowa economy, spending \$7.1 billion on raw materials, other inputs, goods and services to produce 4.35 billion gallons of ethanol. The largest share of this spending is for corn and other grains used as the raw material to make ethanol, distillers' grains and industrial corn oil.

The Iowa ethanol industry used nearly 1.5 billion bushels of corn, or 57 percent of Iowa's corn crop.¹⁰ This amounts to more than \$5.5 billion of revenue to Iowa corn farmers.

Ethanol

As pointed out earlier, U.S. ethanol exports have expanded significantly over the last decade. As a result of trade disputes with China and a slowing global economy, U.S. ethanol exports fell 13.6 percent in 2019 to 1.48 billion gallons. Despite the decline, 2019 was still the second largest export volume on record. 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. Exports of ethanol and DDGS

¹⁰ The 4.3 billion gallons of ethanol production required 1.5 billion bushels of corn. This amounts to 57 percent of the 2.58 billion bushels of corn harvested in Iowa in 2019. Without the demand for corn provided by the ethanol industry Iowa farmers would likely plant fewer acres to corn, purchase fewer inputs, and produce a smaller crop, thereby reducing the economic contribution provided by the corn industry.

are estimated to generate \$1.2 billion of GDP for the U.S. and support more than 7,500 jobs. Iowa's share of this amounts to more than \$351 million of GDP and nearly 4,200 jobs. The impact of biofuels for Iowa are detailed in Table 2.

In addition to providing a growing and reliable domestic market for Iowa farmers, the ethanol industry provides the opportunity for farmers to enjoy some of the value added to their commodity by further processing. Locally owned ethanol plants account for nearly half of Iowa fuel ethanol plants and production capacity.

The remainder of the spending by the ethanol industry is for a wide range of inputs such as industrial chemicals, electricity, natural gas, water, labor, transportation and services such as maintenance, insurance, and general overhead. Spending for these goods and services represents the purchase of output of other industries, mostly in Iowa.

Most ethanol produced in Iowa is by dry mills that also produce valuable co-products in the form of DDGS and Distiller's corn oil (DCO).¹¹ The Iowa ethanol industry produced an estimated 12.6 million short tons of DDGS and 935 million pounds of DCO in 2019 with an aggregate market value of nearly \$2 billion. A significant share of these co-products is used by Iowa livestock producers and the Iowa biodiesel industry. It is notable that these co-products are produced with little additional expenditure.

- The value of the ethanol industry output (ethanol and co-products) amounts to more than \$7.6 billion. Based on the IMPLAN model, the ethanol and supporting agriculture industries account for \$4.5 billion of Iowa GDP.

¹¹ DDGS and DCO production is reported monthly in the USDA Grain Crushings and Co-Products Production report. <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1899>.

Table 2
Contribution of the Renewable Fuels Industry to Iowa: 2019

	GDP (Mil 2019\$)	Jobs	Income (Mil 2019\$)
Ethanol Manufacturing	\$1,623	12,241	\$836
Direct	\$470	2,100	\$129
Indirect	\$809	5,872	\$503
Induced	\$343	4,269	\$204
Biodiesel Manufacturing	\$489	3,875	\$263
Direct	\$46	360	\$20
Indirect	\$343	2,225	\$190
Induced	\$100	1,289	\$53
Agriculture	\$2,265	24,988	\$951
Direct	\$423	7,739	\$180
Indirect	\$1,517	12,860	\$612
Induced	\$325	4,390	\$158
R&D	\$292	3,000	\$202
Direct	\$124	1,036	\$92
Indirect	\$87	944	\$61
Induced	\$81	1,020	\$49
Exports	\$352	4,191	\$197
Total			
Direct	\$1,064	11,235	\$421
Indirect	\$3,107	26,093	\$1,563
Induced	\$850	10,968	\$465
Grand Total	\$5,021	48,296	\$2,449
Change from Prev Year	-6.5%	-0.2%	-6.8%

- Jobs are created from the economic activity supported by ethanol production. While ethanol production is not a labor-intensive industry, accounting for about 2,100 full time

equivalent direct jobs in Iowa¹², the economic activity resulting from the full activities of the ethanol industry supports a much larger number of jobs in the economy. The direct jobs supported by the ethanol industry are concentrated primarily in manufacturing and agriculture. When the indirect and induced effects of ethanol manufacturing and associated R&D are considered, the industry accounts for more than 15,200 full-time equivalent jobs throughout the entire economy.

- Since renewable fuels production uses feedstocks produced by Iowa farmers, the ethanol and biodiesel industries have the largest impact on agriculture, supporting 7,739 direct farm and farm-related jobs. Most of the agriculture jobs supported by the ethanol industry are farm workers and laborers associated with grain production. However, a wide range of jobs in support activities related to crop production ranging from farm managers and bookkeepers to farm equipment operators are supported by ethanol production. As the impact of the direct spending by the ethanol and biodiesel industries expands throughout the economy, the employment impact expands significantly and is spread over a large number of sectors. The indirect and induced jobs supported by the agriculture output used by renewable fuels amount to an additional 17,200 jobs throughout the entire Iowa economy for a total impact from agriculture of nearly 25,000 jobs.
- Increased economic activity and new jobs result in higher levels of income for Iowa households. The ethanol and supporting agriculture industry generated over \$2.4 billion of income for Iowans in 2019.

¹² The Census Bureau does not report employment in ethanol production. The number of direct jobs associated with ethanol production is based on a conservative estimated industry average of 50 jobs per plant.

Biodiesel

The Iowa biodiesel industry also makes sizable contributions to the Iowa economy. According to the Iowa Renewable Fuels Association (IRFA), Iowa's 11 operating biodiesel plants produced 342 million gallons of biodiesel in 2019, 6.4 percent less than in 2018.¹³ The decline in output reflects a combination of factors but perhaps most significantly absence of the biodiesel tax credit, lower biodiesel prices which led to a decline in revenue, and a sharp 20 percent decline in profitability.

The Iowa biodiesel industry spent \$844 million on raw materials, other inputs, goods and services in 2019. The largest share of this spending is for fats and oils used as the raw material to make biodiesel. The Iowa biodiesel industry used 2.15 billion pounds of soybean oil in 2019 to produce biodiesel, accounting for 83 percent of total feedstock use. For the second time in several years, Iowa biodiesel producers used virtually no canola oil. Distiller's corn oil (supplied largely by Iowa ethanol producers) was the second largest biodiesel feedstock at 283 million pounds. Smaller amounts of animal fats and used cooking oil were also used. The majority of the raw material for biodiesel production in Iowa is procured locally. The remainder of the spending by the biodiesel industry is for a wide range of inputs such as industrial chemicals, electricity, natural gas, water, labor, and services such as maintenance, insurance, and general overhead. As with ethanol, spending for these goods and services represents the purchase of output of other industries.

The spending associated with biodiesel production also circulates throughout the entire Iowa economy stimulating aggregate demand, supporting jobs, generating additional household income, and creating tax revenue. The following summarizes the economic contribution of the Iowa biodiesel industry at the end of 2019.

¹³ http://www.iowarfa.org/biodiesel_refineries.php

- The gross value of the biodiesel and glycerin produced in Iowa totaled more than \$970 million. When the impact of manufacturing and R&D are combined the biodiesel industry accounts for \$489 million of Iowa GDP.
- Jobs are created as a consequence of increased economic activity caused by biodiesel production. The increase in economic activity generated by biodiesel production supports nearly 3,900 full time equivalent jobs in all sectors of the Iowa economy.
- Increased economic activity and jobs result in higher levels of income for Iowa households. The biodiesel industry accounts for about \$263 million of household income for Iowans.

No RFS Refinery Exemption Scenario Analysis

As pointed out earlier the major regulatory issue that continued to affect the biofuels industry in 2019 was the continued use of RFS refinery exemptions by the EPA, which effectively reduced the required volumes by exempting refineries from the requirement to blend biofuels. Refiners that receive exemptions can use RINs to comply with the RFS requirements instead of blending physical gallons of biofuels. An EPA analysis published in October 2019 reported that the 31 refinery exemption requests granted for the 2018 compliance year exempted 7.4 percent of the total RFS renewable fuel volume mandate, or about 1.43 billion gallons.

In order to evaluate the impact of the refinery exemptions on the Iowa biofuel industry we adjusted to a 7.4 percent, 1.43 billion-gallon, reduction in refiner volumes estimated by EPA for Iowa's share of total U.S. production (27 percent for ethanol and 20 percent for biodiesel). Since refinery exemptions apply to ethanol and biodiesel, we further allocated the reduction among ethanol and biomass-based biodiesel based on their share of the announced RVO. This amounted to a loss of 345 million gallons of ethanol and 30 million gallons of biodiesel. Another way of looking at this is that but for the refinery exemption, Iowa ethanol production would be

345 million gallons higher in 2019 and biodiesel output would gain an additional 30 million gallons.

We added these additional volumes of ethanol and biodiesel to the base 2019 economic model to estimate the impacts to GDP, employment and household income. One additional change was made to the analysis. The adjusted ethanol production would require an additional 63 million gallons of industry capacity. Reflecting this, the “No Refinery Exemption Scenario” provides an economic contribution from construction.

The results of this analysis are detailed in Table 3. Our base analysis assumes continuation of refinery exemptions. Iowa ethanol and biodiesel production would be higher if the refinery exemptions were eliminated as would be the economic impacts. Specifically, without the RFS refinery exemption:

- Iowa GDP would be \$461 million larger
- An additional 4,433 jobs would be supported in all sectors of the economy
- Iowa household income would increase \$243 million

Table 3
Impact on Iowa of Removal of the RFS Refinery Exemption

	BASE			NO REFINERY EXEMPTIONS		
	2019	Pct Chg		2019	Diff	% vs Base
Ethanol Prod (Mil Gal)	4,231	-2.4%		4,576	345	8.2%
Biodiesel Prod (Mil Gal)	342	-6.4%		372	30	8.9%
	GDP (Mil 2019\$)	Jobs	Income (Mil 2019\$)	GDP (Mil 2019\$)	Jobs	Income (Mil 2019\$)
Ethanol Mfg	\$1,623	12,241	\$836	\$1,756	13,069	\$904
Direct	\$470	2,100	\$129	\$509	2,100	\$139
Indirect	\$809	5,872	\$503	\$875	6,352	\$544
Induced	\$343	4,269	\$204	\$371	4,617	\$221
Biodiesel Mfg	\$489	3,875	\$263	\$530	4,188	\$285
Direct	\$46	360	\$20	\$48	360	\$20
Indirect	\$343	2,225	\$190	\$373	2,424	\$207
Induced	\$100	1,289	\$53	\$109	1,404	\$58
Agriculture	\$2,265	24,988	\$951	\$2,450	27,028	\$1,028
Direct	\$423	7,739	\$180	\$458	8,371	\$195
Indirect	\$1,517	12,860	\$612	\$1,641	13,909	\$662
Induced	\$325	4,390	\$158	\$352	4,748	\$171
New Construction	\$0	0	\$0	\$101	1,252	\$75
R&D	\$292	3,000	\$202	\$292	3,000	\$202
Exports	\$352	4,191	\$197	\$352	4,191	\$197
Total						
Direct	\$1,064	11,235	\$421	\$1,199	12,635	\$496
Indirect	\$3,107	26,093	\$1,563	\$3,339	27,925	\$1,678
Induced	\$850	10,968	\$465	\$943	12,169	\$517
Grand Total	\$5,021	48,296	\$2,449	\$5,482	52,728	\$2,692
Percent Change				9.2%	9.2%	9.9%

Conclusion

Despite a challenging economic, policy and trade environment, the renewable fuels industry continues to make a significant contribution to the Iowa economy in terms of job creation, household earnings, and state and local tax revenue. The importance of the biofuels industry to agriculture and rural economies is particularly notable. Continued growth and expansion of the renewable fuels 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. However, policy stability is essential to maximize these benefits. Uncertainty surrounding issues like RFS refinery exemptions, tax credit extensions, and trade with China, will impede the ability of the industry to provide these societal benefits.

RFS refinery exemptions adversely affect ethanol and biodiesel production in Iowa and reduce their positive benefits to Iowa's economy.

APPENDIX A

IMPLAN Methodology

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

To understand how the economy is affected by an industry such as renewable fuels 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 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 Iowa economy was constructed using current IMPLAN software and the most recent data available.

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 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 feedstocks to produce ethanol and biodiesel supports farm income through higher crop receipts than would be the case without ethanol and biodiesel 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 represent 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).