

## **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 2020. The ethanol sector was particularly hard hit by the COVID-19 pandemic. The widespread shelter-at-home orders in the Spring essentially shut the U.S. and Iowa economy down causing people to stop driving and leading to a sharp drop in gasoline and ethanol demand. The low point in demand was reached during April when motor gasoline and domestic ethanol demand fell by 38 and 42 percent from prior year levels, respectively. As the economy slowly reopened in the second half of the year demand picked up but didn't recover to pre-pandemic levels remaining about 12 percent below the prior year.

Ethanol producers responded to the collapse in demand by reducing operating rates, shutting plants, and idling capacity. For the year, Iowa's 41 operating ethanol plants operated at an average 83 percent capacity utilization rate and produced 3.7 billion gallons, 13 percent below 2019 production. Iowa remains the nation's leading ethanol producer, accounting for 27 percent of U.S. capacity.

The biodiesel industry fared much better since distillate represents a much smaller share of the passenger motor fuel pool. Biodiesel demand was supported by strong highway freight and rail activity as suppliers increased shipments of food and consumer goods. The \$1.00 per gallon federal biodiesel tax credit was reinstated for 2018 and 2019 production and was extended through 2022. This tax credit keeps biodiesel more price competitive with

conventional petroleum-based diesel. Iowa is the nation's leading biodiesel manufacturer, accounting for nearly 20 percent of total U.S. production. Iowa biodiesel production increased 2.7 percent in 2020 to 351 million gallons.

The weak and unsettled demand conditions undercut investment in the biofuels industry in 2020. Additionally, biofuels research and development activities were curtailed by COVID-related closures both in the public and private sectors.

The two other major factors impacting the biofuels industry in 2020 were weak export demand and regulatory issues.

- Ethanol exports dropped sharply during the second half of the year as COVID affected motor fuel use in importing countries. Exports to the two largest U.S. markets – Canada and Brazil – fell 6 percent and 34 percent, respectively. During the year, Brazil also instituted a 20 percent tariff on ethanol imported from the United States. Year-to-date exports of ethanol were 10 percent below 2019 levels through October. The decline in volume was somewhat offset by higher export prices but the net impact was still adverse.
- On the regulatory front, the use of Small Refinery Exemptions (SREs) continued to be an impediment to increasing demand. The RFS, which passed in 2005, gave the EPA authority to extend a temporary exemption from biofuel requirements to small refineries. These Small Refinery Exemptions (SREs) are waivers from RFS volume obligations. Refiners who receive exemptions are released from their RFS requirements instead of blending physical gallons of biofuels or acquiring RFS blending credits from entities that do blend. These waivers effectively reduced the amount of biofuel required to enter the motor fuel supply. During the Trump Administration, SREs totaled over four billion gallons of lost biofuels demand.

Despite these challenges, the biofuels industry continues to make a substantial positive contribution to the Iowa economy. This study estimates the contribution of the biofuels industry to the Iowa economy in 2020 in terms of employment, income, and Gross Domestic Product (GDP) directly and indirectly supported by the industry.

## **ECONOMIC IMPACT OF RENEWABLE FUELS ON IOWA**

Biofuels 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. The 3.7 billion gallons of ethanol produced in Iowa last year utilized more than 1.3 billion bushels of corn, or 57 percent of Iowa's 2020 2.3-billion-bushel corn crop. The 2.3 billion pounds of soybean oil used to produce biodiesel in Iowa were the equivalent of the oil from nearly 200 million bushels of soybeans, nearly 40 percent of Iowa's soybean 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.

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 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 2020.<sup>1</sup>

- Accounts for nearly \$4 billion, or about 2 percent, of Iowa GDP
- Generates \$1.8 billion of income for Iowa households; and
- Supports more than 37,000 jobs through the entire Iowa economy. This is equivalent to 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: 2020

	Purchases (Mil 2020\$)	GDP (Mil 2020\$)	Income (Mil 2020\$)	Employment (Jobs)
Ethanol*	\$5,912	\$3,372	\$1,579	32,633
Biodiesel	\$1,013	\$587	\$254	4,449
Total	\$6,925	\$3,959	\$1,833	37,083

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

<sup>1</sup> This study estimates the impact of producing 3.7 billion gallons of ethanol and 351 million gallons of biodiesel on Iowa’s economy.

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.

## **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 \$5.9 billion on raw materials, other inputs, goods and services to produce 3.7 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 distiller's corn oil.

The Iowa ethanol industry used nearly 1.3 billion bushels of corn, or 57 percent of Iowa's corn crop.<sup>2</sup> This amounts to more than \$4.6 billion of revenue to Iowa corn farmers. The Iowa biodiesel industry used more than 2.8 billion pounds of fats and oils to produce 351 million gallons of B100. Soybean oil accounted for 80 percent of biodiesel feedstocks.

As pointed out earlier, export volumes and values for ethanol declined in 2020. While exports provided a positive market for Iowa's biofuels the impact was smaller than in 2019. Exports contributed an estimated \$340 million to Iowa GDP and supported about 4,000 jobs in all sectors of the economy in 2020, 3.5 percent below 2019 levels.

The impact of biofuels for the Iowa economy are detailed in Table 2.

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<sup>2</sup> The 3.7 billion gallons of ethanol production required 1.3 billion bushels of corn. This amounts to 57 percent of the 2020 Iowa corn crop. 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.

Table 2  
Contribution of the Renewable Fuels Industry to Iowa: 2020

	<b>GDP (Mil 2020\$)</b>	<b>Jobs</b>	<b>Income (Mil 2020\$)</b>
<b>Ethanol Manufacturing</b>			
Direct	\$436	2,000	\$111
Indirect	\$688	5,437	\$453
Induced	\$299	3,748	\$179
<b>Subtotal</b>	<b>\$1,424</b>	<b>11,185</b>	<b>\$743</b>
<b>Biodiesel Manufacturing</b>			
Direct	\$50	270	\$19
Indirect	\$400	2,725	\$171
Induced	\$137	1,454	\$64
<b>Subtotal</b>	<b>\$587</b>	<b>4,449</b>	<b>\$254</b>
<b>Agriculture</b>			
Direct	\$352	6,430	\$150
Indirect	\$1,260	10,684	\$509
Induced	\$270	3,647	\$132
<b>Subtotal</b>	<b>\$1,882</b>	<b>20,761</b>	<b>\$790</b>
<b>R&amp;D</b>			
Direct	\$27	224	\$20
Indirect	\$19	204	\$13
Induced	\$18	220	\$11
<b>Subtotal</b>	<b>\$63</b>	<b>648</b>	<b>\$44</b>
<b>Infrastructure CAPEX</b>			
Direct	\$2	24	\$2
Indirect	\$0	3	\$0
Induced	\$1	12	\$1
<b>Subtotal</b>	<b>\$3</b>	<b>39</b>	<b>\$2</b>
<b>Exports</b>	<b>\$340</b>	<b>4,080</b>	<b>\$190</b>
<b>Total</b>			
Direct	\$867	8,948	\$301
Indirect	\$2,367	19,053	\$1,146
Induced	\$725	9,082	\$385

## Ethanol

The ethanol industry provides an attractive domestic market for Iowa farmers as well as 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).<sup>3</sup> The Iowa ethanol industry produced an estimated 9.3 million short tons of DDGS and 848 million pounds of DCO in 2020 with an aggregate market value of nearly \$1.7 billion. A 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 \$6 billion. Based on the IMPLAN model, the ethanol and supporting agriculture industries account for \$3.3 billion of Iowa GDP.
- Jobs are created from the economic activity supported by ethanol production. While ethanol production is not a labor-intensive industry, accounting for about 2,000 full time equivalent direct jobs in Iowa<sup>4</sup>, the economic activity resulting from the full activities of

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<sup>3</sup> 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>.

<sup>4</sup> 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.

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 nearly 11,200 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 6,430 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 14,300 jobs throughout the entire Iowa economy for a total impact from agriculture of nearly 21,000 jobs.
- Increased economic activity and new jobs result in higher levels of income for Iowa households. The ethanol and supporting agriculture industry generated over \$1.8 billion of income for Iowans in 2020.

## Biodiesel

The Iowa biodiesel industry also makes sizable contributions to the Iowa economy. According to the Iowa Renewable Fuels Association (IRFA), Iowa's 9 operating biodiesel plants produced 351 million gallons of biodiesel in 2020, 2.7 percent more than in 2019.<sup>5</sup> The increase in output

<sup>5</sup> [http://www.iowarfa.org/biodiesel\\_refineries.php](http://www.iowarfa.org/biodiesel_refineries.php)

reflects a combination of factors but perhaps most significantly the reinstatement and extension of the federal biodiesel tax credit.

The Iowa biodiesel industry spent \$1 billion on raw materials, other inputs, goods and services in 2020. The largest share of this spending is for fats and oils used as the raw material to make biodiesel. The Iowa biodiesel industry used 2.3 billion pounds of soybean oil in 2020 to produce biodiesel, accounting for 80 percent of total feedstock use. Distiller's corn oil (supplied largely by Iowa ethanol producers) was the second largest biodiesel feedstock at 220 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 2020.

- The gross value of the biodiesel and glycerin produced in Iowa totaled nearly \$1.1 billion. When the impact of manufacturing and R&D are combined, the biodiesel industry accounts for \$587 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 more than 4,400 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 \$254 million of household income for Iowans.

## Conclusion

Despite challenges created by the COVID pandemic, 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 ensure America's ability to maintain and expand energy independence.

Further, policy and regulatory actions taken by Iowa, and other Midwestern states, to boost the use of biofuels locally will provide a buffer from the uncertainty of federal policy and export demand. By creating a larger and more stable local demand situation, Iowa can greatly enlarge the latent economic benefits of biofuels production represented by the more than 800 million gallons of unutilized ethanol production capacity and 50 million gallons of unutilized biodiesel production capacity. Putting this existing manufacturing infrastructure to work would greatly increase the GDP, household income and job benefits related to Iowa biofuels production.

## 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).