

IMPORTANCE OF THE RENEWABLE FUELS INDUSTRY TO THE ECONOMY OF IOWA

Prepared for the Iowa Renewable Fuels Association

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January 20, 2012

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2011 was a revival year for renewable fuels. Both the ethanol and biodiesel industries experienced continued growth in 2011 despite high feedstock and input prices. The ethanol industry was stimulated by the requirements of the Renewable Fuels Standard (RFS); domestic demand increased despite a 3 percent drop in motor gasoline use, and the export market showed unexpected strength. Biodiesel production responded to reinstatement of the federal biodiesel excise tax credit through 2011 combined with the one billion gallon RFS2 target for biomass-based diesel and a sharp increase in low sulfur diesel sales. As a result, a number of biodiesel plants returned to production throughout the year. However, the year was not without its challenges to the industry. Sharply higher feedstock prices put pressure on both ethanol and biodiesel profitability. Early season expectations for a near record corn crop and reasonable feedstock prices were diminished by poor weather and lower than expected average yields. While the U.S. harvested the fourth largest corn crop on record and soybean production exceeded 3 billion bushels for only the sixth time, crop prices increased sharply.

The ethanol industry continued to grow and easily met the 12.6 billion gallon conventional biofuels portion of the RFS.¹ Nationally, total ethanol production increased 4.5 percent to an estimated 13.9 billion gallons.² Iowa leads the nation in

¹ The overall RFS target for 2011 was 13.95 billion gallons, 1.35 billion gallons of which was advanced biofuel.

² The 13.9 billion gallon estimate is based on annualized year-to-date ethanol production reported by the Energy Information Administration.

renewable fuels output accounting for nearly 30 percent of U.S. ethanol and more than 25 percent of national biodiesel production. At the end of 2011 Iowa's 41 operating ethanol plants were producing at an annual rate of about 3.7 billion gallons. Iowa's 10 operating biodiesel plants were producing at an annual rate of 264 million gallons.

Ethanol and biodiesel producers are part of a manufacturing sector that adds substantial value to agricultural commodities produced in Iowa and makes a significant contribution to the Iowa economy. Based on the size of the renewable fuels industry at year-end 2011, ethanol and biodiesel production:³

- Accounts for nearly \$6 billion, or 4 percent, of Iowa GDP;
- Generates \$3.7 billion of income for Iowa households; and
- Supports more than 82,000 jobs through the entire Iowa economy.

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: 2011

	Purchases (Mil 2011\$)	GDP (Mil 2011\$)	Household Earnings (Mil 2011\$)	Employment (Jobs)
Ethanol	\$11,009.4	\$5,197.2	\$3,349.1	74,700
Biodiesel	\$1,230.1	\$596.7	\$350.6	7,350
Total	\$12,239.5	\$5,793.8	\$3,699.7	82,150

Methodology

The spending associated with current renewable fuels production 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

³ This study estimates the annualized impact of producing 3.7 billion gallons of ethanol and 264 million gallons of biodiesel on Iowa's economy. These figures reflect the capacity of ethanol and biodiesel plants operating at year's end and not the actual production during the year.

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. To understand how the economy is affected by an industry such as renewable fuel production it is necessary to understand how different sectors or industries in the economy are linked to each other. For example, in the renewable fuels production sector, the ethanol industry buys corn from the agriculture sector, which in turn then buys crop production products and fertilizers from the agricultural chemicals industry, which in turn purchases 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 in manufacturing operations, is called a forward linkage. The 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 needed by each. In turn, changes that affect the incomes of the household sector typically have more significant impacts compared to a change in the sales of other sectors. This is because households typically spend most of their income in both retail and service industries.

This study utilizes an economic model known as IMPLAN (Impact Analysis for Planning) 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.⁴ 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 2010 IMPLAN software and data (the most recent available) and used to estimate economic impacts of the ethanol and biodiesel industry.

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

⁴Previous economic impact studies conducted by this author for IRFA utilized RIMS II economic impact multipliers published by the Bureau of Economic Analysis. Examination of the RIMS methodology suggests that the model overestimates value added.

- Value added is the total value of the goods and services produced by businesses in the county and are 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 supports farm income through higher crop receipts than would be the case without ethanol production. The impact of this higher farm income is evaluated on a gross basis in this analysis. That is, the model does not factor in the distributional effects on consumers from higher grain prices (i.e. reduced spending on non-food goods and services).
- Employment represents the annual average number of employees, whether full or part-time, of the businesses producing output. Income and employment represent the net economic benefits that accrue to the region as a result of increased economic output.

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

Contribution of the Renewable Fuels Industry

The contribution of the renewable fuels industry to the economy of Iowa is detailed in Table 2. This table reflects the direct, indirect and induced impact from ethanol and biodiesel manufacturing and the agriculture sector.

Table 2
Contribution of the Renewable Fuels Industry to Iowa: 2011

	GDP (Mil 2011 \$)	Employment (Jobs)	Income (Mil 2011 \$)
Ethanol Manufacturing			
Direct	\$181.3	1,900	\$181.30
Indirect	\$1,007.0	8,600	\$473.86
Induced	\$309.4	4,900	\$172.05
Subtotal	\$1,497.7	15,400	\$827.2
Biodiesel Manufacturing			
Direct	\$25.2	350	\$20.7
Indirect	\$440.1	4,900	\$257.1
Induced	\$131.4	2,100	\$72.8
Subtotal	\$596.7	7,350	\$350.6
Agriculture			
Direct	\$1,228.4	28,500	\$1,086.4
Indirect	\$1,524.8	15,800	\$912.0
Induced	\$946.3	15,100	\$523.5
Subtotal	\$3,699.5	59,400	\$2,521.9
Total Impact			
Direct	\$1,434.9	30,750	\$1,288.4
Indirect	\$2,971.9	29,300	\$1,642.9
Induced	\$1,387.0	22,100	\$768.4
Total	\$5,793.8	82,150	\$3,699.7

Ethanol and Agriculture

The ethanol industry provides a significant contribution to the Iowa economy, spending more than \$11 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. The Iowa ethanol industry currently uses more than 1.3 billion

bushels of corn, or about 60 percent of Iowa's corn crop.⁵ At 2011 Iowa farm gate prices this amounts to \$7.2 billion of revenue to Iowa corn farmers. In addition to providing a growing and reliable domestic market for Iowa farmers, the ethanol industry also provides the opportunity for farmers to enjoy some of the value added to their commodity by further processing. Locally owned ethanol plants account for more than half of Iowa fuel ethanol plants and nearly half of 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, and 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. The price assumptions used in estimating the value of expenditures for both ethanol and biodiesel are shown in Appendix Table 1.

- The gross value of the ethanol industry output (ethanol and co-products) amounts to \$11.2 billion. Based on the IMPLAN model, the ethanol industry accounts for nearly \$6 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 1,900 full time equivalent direct jobs in Iowa⁶, 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 are considered, the industry accounts for more than 15,000 full time equivalent jobs.
- Since renewable fuels production uses feedstocks produced by Iowa farmers, the ethanol and biodiesel industry has the largest impact on agriculture, supporting as many as 28,500 direct farm and farm-related jobs. Most of the agriculture jobs supported by

⁵ The 3.7 billion gallons of annual ethanol production required 1.3 billion bushels of corn. This amounts to 57 percent of the 2.36 billion bushels of corn harvested in Iowa in the 2011/12 marketing year. 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.

⁶ The Census Bureau does not report employment in ethanol production. The number of direct jobs associated with ethanol production is based on an estimated industry average of 45 jobs per plant.

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 industry 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 30,900 jobs throughout the entire Iowa economy.

- Increased economic activity and new jobs result in higher levels of income for Iowa households. The ethanol industry accounted for \$3.3 billion of income for Iowans in 2011.

Biodiesel

The Iowa biodiesel industry is not as mature or developed as the ethanol industry but the industry contributes substantially to the Iowa economy. The biodiesel industry recovered significantly in 2011 largely in response to reinstatement of the Federal biodiesel excise tax credit and RFS2 biomass-based diesel requirements. Census Bureau production estimates indicate that U.S. biodiesel production for 2011 will total about one billion gallons compared to 315 million gallons in 2010.⁷ At the end of 2011 Iowa's biodiesel industry was producing at an annual rate of 264 million gallon or about 26 percent of national output.

The Iowa biodiesel industry spends \$1.2 billion on raw materials, other inputs, goods and services to produce 264 million gallons of biodiesel. The largest share of this spending is for fats and oils (soybean oil, non-food grade corn oil, and other fats and oils) used as the raw material to make biodiesel. The Iowa biodiesel industry uses about 1.8 million pounds of soybean oil valued at \$946 million and 235 million pounds of other fats and oils (including corn oil sourced from Iowa ethanol plants) valued at \$121 million in the production of biodiesel. Virtually all 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, and water; labor; and services such as maintenance, insurance, and general

⁷ The Census Bureau publishes methyl ester production data monthly in the Current Industrial Report M311K – Fats and Oils: Production, Consumption and Stocks.

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 the creation of new jobs, generating additional household income, and creating new tax revenue. The following summarizes the economic contribution of the Iowa biodiesel industry at the end of 2011.

- The gross value of the biodiesel and glycerin produced in Iowa totaled \$1.4 billion and the biodiesel industry accounts for nearly \$600 million of Iowa GDP.
- New jobs are created as a consequence of increased economic activity caused by biodiesel production. The increase in economic activity generated by biodiesel production supports 7,350 full time equivalent jobs in all sectors of the Iowa economy.
- Increased economic activity and new jobs result in higher levels of income for Iowa households. The biodiesel industry accounts for \$351 million of household income for Iowans.

Challenges for 2012

The outlook for renewable fuels is clouded by Congress' failure to extend the Volumetric Ethanol Excise Tax Credit (VEETC), the federal biodiesel tax credit, and the secondary tariff for ethanol for 2012. The potential impact of loss of the VEETC for the ethanol industry is unclear but is unlikely to have a significant negative impact as long as the RFS2 requirements remain in place. Similarly, loss of the ethanol tariff will not have a substantial impact until Brazilian sugar production recovers from two years of prolonged drought.

The situation for biodiesel is considerably less clear. When the U.S. Congress failed to reauthorize the \$1.00 per gallon biodiesel excise tax credit that expired at the end of 2009, it was a significant blow to the industry. Iowa biodiesel production fell nearly 60 percent, from 85 million gallons in 2009 to 48 million gallons in 2010. Biodiesel production recovered significantly in 2011 following reinstatement of the tax credit, but loss of the credit for 2012 threatens the economic gains realized in 2011.

The tax credit levels the playing field between petroleum diesel and biodiesel by offsetting the higher cost of producing biodiesel compared to petroleum diesel. The biodiesel production process is very efficient with methyl esters accounting for nearly 90 percent of total output. As such, biodiesel bears nearly the full cost of production. No. 2 diesel fuel is a joint product of the refining of crude oil and its price reflects the relative share of a barrel of crude oil. Energy Information Administration statistics on refinery yields indicate that distillate fuel oil accounts for 28 percent of the product yield of a barrel of crude oil.⁸

It is difficult to predict precisely what decisions biodiesel producers will make in the wake of loss of the tax credit for 2012 and beyond. However, if we assume that producers respond as they did in 2010 by reducing production by the same proportion (60 percent), the economic gains for Iowa will be sharply reduced. This is illustrated in Table 3, which compares the estimated economic benefits to Iowa of a 60 percent reduction in output to the benefits provided by 2011 year-end production level of 264 million gallons of biodiesel.

Table 3
Potential Economic Implications
Resulting from Loss of the Biodiesel Tax Credit

	2011 264 MG	No Tax Credit 149 MG	Diff
GDP	\$596.7	\$334.5	-\$262.2
Income	\$350.6	\$196.6	-\$154.1
Jobs	7,350	4,120	-3,230

The industry has been down this road before and has responded to loss of this important incentive. A reduction in industry output of a similar magnitude to the 2010 experience would result in the loss of more than 3,200 jobs throughout the State economy and would trim household income.

⁸ EIA Refinery Yield. http://tonto.eia.doe.gov/dnav/pet/pet_pnp_pct_dc_nus_pct_m.htm.

Appendix Table 1. 2011 Prices					
	Corn Price Farm IA (\$/bu)	Corn Price No 2. Yel Central III (\$/bu)	Distillers Grains 10% Iowa (\$/ton)	Distillers Grains 65% Iowa (\$/ton)	Ethanol FOB Plant Iowa (\$/gal)
Jan	\$6.09	\$6.10	\$182.50	\$57.75	\$2.25
Feb	\$6.62	\$6.69	\$193.75	\$61.13	\$2.30
Mar	\$6.59	\$6.59	\$199.80	\$66.00	\$2.44
Apr	\$7.16	\$7.33	\$208.00	\$71.88	\$2.60
May	\$6.90	\$7.08	\$195.50	\$74.15	\$2.55
Jun	\$6.98	\$7.17	\$192.88	\$72.78	\$2.61
Jul	\$6.81	\$6.96	\$191.38	\$71.50	\$2.80
Aug	\$7.14	\$7.30	\$191.90	\$69.55	\$2.81
Sep	\$6.59	\$6.77	\$197.00	\$75.25	\$2.68
Oct	\$6.16	\$6.23	\$202.13	\$70.97	\$2.62
Nov	\$6.07	\$6.26	\$212.40	\$73.21	\$2.80
Dec	\$5.97	\$5.88	\$186.38	\$65.48	\$2.15
Average	\$6.59	\$6.70	\$196.13	\$69.14	\$2.55

	Crude Soy Oil Iowa (cents/lb)	Crude Corn Oil Midwest (cents/lb)	Choice W. Grease Central US (cents/lb)	Yellow Grease Midwest (cents/lb)	B100 FOB Plant Iowa (\$/gal)
Jan	53.88	58.00	41.31	38.94	\$4.49
Feb	54.32	63.63	43.38	40.88	\$4.59
Mar	54.45	67.95	50.15	46.25	\$4.88
Apr	55.91	68.69	50.69	45.78	\$5.11
May	56.04	68.10	50.55	46.00	\$5.21
Jun	54.28	66.13	52.05	46.58	\$5.40
Jul	55.25	61.88	51.53	46.31	\$5.47
Aug	54.80	59.40	46.30	43.83	\$5.47
Sep	54.55	57.81	45.16	43.09	\$5.78
Oct	51.40	53.88	43.25	42.28	\$5.57
Nov	51.71	54.00	37.13	35.19	\$5.27
Dec	50.23	53.40	38.05	34.15	\$4.90
Average	53.90	61.07	45.79	42.44	\$5.18