



CONTRIBUTION OF THE BIOFUELS INDUSTRY TO THE ECONOMY OF IOWA

Prepared for the Iowa Renewable Fuels Association

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January 20, 2010

2009 was a year of recovery for the biofuels industry. The combination of volatile commodity prices and weak motor fuel demand caused by the worst recession in decades presented a significant challenge for the biofuels industry. Commodity prices retreated from the record levels set during the 2008 commodity price bubble. Nevertheless new entrants to the ethanol industry acquired plants idled by bankrupt firms and both industry capacity and production increased. All of the Iowa ethanol plants idled in 2008 were brought back on line. The biodiesel industry was particularly hard hit during 2009 and the industry outlook is clouded by the failure of Congress to reauthorize the biodiesel excise tax credit that expired on December 31.

Despite the challenges to profitability the ethanol industry continued to grow and met the Renewable Fuel Standard target of 10.5 billion gallons for 2009. Nationally, total ethanol capacity expanded 20 percent to 13.2 billion gallons while production is estimated at 10.6 billion gallons. Iowa leads the Nation in biofuels output accounting for nearly 30 percent of U.S. ethanol and 15 percent of biodiesel production. At the end of 2009 Iowa's 39 operating ethanol plants had production capacity of about 3.3 billion gallons. In addition, two ethanol plants representing an additional 277 million gallons of capacity are under construction. Iowa's nine operating biodiesel plants produced an estimated 85 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 biofuels industry at year-end 2009, ethanol and biodiesel:¹

- Accounts for \$11.5 billion, or about 8 percent, of Iowa GDP

¹ This study estimates the annualized impact of producing 3.2 billion gallons of ethanol and 85 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.



- Generates \$2.3 billion of household income for Iowa households
- Supports more than 70,000 jobs through the entire Iowa economy (or 4.6% of private, non-farm employment), and
- Generates \$532 million in state tax revenue.

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

Table 1
Total Economic Impact of the Biofuels Industry for Iowa: 2009

	Purchases (Mil 2009\$)	GDP (Mil 2009\$)	Household Earnings (Mil 2009\$)	Employment (Jobs)	State Tax Revenue (Mil 2009\$)
Operations					
Ethanol	\$4,999.6	\$10,473.6	\$1,887.8	59,010	\$476.0
Biodiesel	\$224.3	\$471.2	\$103.0	2,911	\$22.3
Subtotal Operations	\$5,224.0	\$10,944.8	\$1,990.8	61,921	\$498.3
New Construction					
Ethanol	\$520.7	\$547.4	\$295.5	8,260	\$34.1
Biodiesel	\$0.0	\$0.0	\$0.0	0	\$0.0
Subtotal Construction	\$520.7	\$547.4	\$295.5	8,260	\$34.1
Total	\$5,744.7	\$11,492.2	\$2,286.3	70,181	\$532.4

These impacts result from the combination of ongoing operations and construction of new biofuel plants. The impact of production is permanent and increases as the industry grows while the impacts from construction are temporary and end when the plants come on line. Iowa is expected to benefit from continued expansion and evolution of the biofuels industry over the next decade.

Contribution of the Ethanol Industry

The ethanol industry provides a significant contribution to the Iowa economy, spending nearly \$5 billion on raw materials, other inputs, goods and services to produce 3.2 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 one billion bushels of corn, or about 46



percent of Iowa's corn crop.² At 2009 prices this amounts to nearly \$2.8 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 nearly half of Iowa fuel ethanol plants and a full third 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.

In addition, the construction of new ethanol plants results in spending for a wide range of goods and services. The capital expenditure for new plants and equipment includes specialized machinery and equipment such as pumps, tanks, pipes, etc. and engineering services that are likely supplied by out-of-state manufacturers and suppliers. Consequently only part of the spending for construction directly benefits Iowa businesses. The 277 million gallons of new construction under way at year's end 2009 represents the expenditure of an additional \$550 million in Iowa by the ethanol industry.

The spending associated with current ethanol production and construction of ethanol facilities 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. The impact of the ethanol industry on the Iowa economy was estimated by applying the appropriate final demand multipliers for output, earnings, and employment for the relevant supplying industry calculated by the U.S. Bureau of Economic Analysis (BEA) to the estimates of spending described above.³ The full impact of the industry is arrived at by adding the value of industry output to the results of the multiplier analysis.

² The 3.2 billion gallons of ethanol produced in 2009 required 1.1 billion bushels of corn. This amounts to 46 percent of the 2.4 billion bushels of corn produced in Iowa in 2009. 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.

³ The multipliers used in this analysis are the detailed industry RIMS II multipliers for Iowa estimated by the Regional Economic Analysis Division, Bureau of Economic Analysis. These multipliers are based on the 1997 Benchmark Input-Output Table for the Nation and 2006 regional data for Iowa. The distribution tables used to allocate output at producer prices among the components of manufacturing, transportation, and wholesale margins were for NAICS industry 325190: Other basic organic chemicals, which includes both ethanol and biodiesel.



In the case of ethanol this includes the value of ethanol production as well as the value of co-products. About 70 percent of Iowa ethanol is produced in dry mill plants that also produce distillers dried grains as a co-product.⁴ The remaining ethanol is made in large wet mill plants that produce corn gluten feed, corn gluten meal, corn oil, and CO₂ as co-products. Ethanol and co-product output was valued at current (year-end) prices. The final demand multipliers for output, earnings, and employment for the selected industries are shown in Appendix Table 1. The price assumptions used in estimating the value of expenditures are shown in Appendix Table 2.

The following summarizes the current economic contribution of the Iowa ethanol industry. These impacts are detailed by industry segment in Table 2.

- The ethanol industry adds \$11 billion to Iowa GDP.⁵ This is made up by the impact of spending to produce and transport 3.2 billion gallons of ethanol which contributes \$4.5 billion to State GDP. The construction of new ethanol facilities contributes \$547 million and the value of the ethanol industry output (ethanol and co-products) accounts for \$6 billion.
- New jobs are created as a consequence of increased economic activity caused by ethanol production. The increase in aggregate economic activity generated by ongoing ethanol production supports 59,000 permanent jobs in all sectors of the Iowa economy. The economic activity generated by construction supports an additional 8,260 jobs statewide; however these jobs are not permanent. Put into context, the annual operations of the ethanol industry supports about 4 percent of the more than 1.5 million private non-farm jobs in Iowa.
- Increased economic activity and new jobs result in higher levels of income for Iowa households. The ethanol industry generated \$2.2 billion of income for Iowa consumers in 2009.
- The ethanol industry generates \$510 million of corporate and personal income and sales tax revenue for Iowa.

⁴ The dry mill process also produces CO₂ as a co-product. Based on local market conditions not all plants capture CO₂ for sale.

⁵ The BEA multipliers produce a calculation of value added which is a measure of GDP.

**Table 2
Contribution of the Ethanol Industry to Iowa: 2009**

Industry	Purchases (Mil 2009\$)	Impact		
		GDP (Mil 2009\$)	Earnings (Mil 2009\$)	Employment (Jobs)
Construction	\$520.7	\$547.4	\$295.5	8,260
Annual Operations				
Feed Grains (Corn)	\$2,822.6	\$2,507.6	\$862.9	35,029
Enzymes, chemicals	\$308.2	\$214.2	\$111.1	2,362
Denaturant	\$124.3	\$41.6	\$23.7	514
Natural gas	\$332.2	\$210.5	\$90.8	1,821
Electric, water, sewer	\$156.7	\$154.8	\$57.2	1,237
Repair & maintenance	\$81.9	\$103.6	\$54.3	1,583
Wholesale Trade	\$745.3	\$841.5	\$402.2	10,186
Administration	\$63.0	\$78.5	\$43.3	1,130
Earnings (Wages & salaries)	\$64.9	\$49.3	\$23.1	808
Transportation	\$300.6	\$319.2	\$154.2	4,340
Value of ethanol production		\$5,132.5	\$64.9	
Value of co-products		\$820.3		
Subtotal Operations	\$4,999.6	\$10,473.6	\$1,887.8	59,010
Grand Total	\$5,520.3	\$11,021.0	\$2,183.3	67,269

Contribution of the Biodiesel Industry

The Iowa biodiesel industry is not as mature or developed as the ethanol industry. Nonetheless, the biodiesel industry also contributes to the Iowa economy. The biodiesel industry has grown significantly over the past several years. However, the combination of volatile commodity prices and weak motor fuel demand caused by the worst recession in decades has severely impacted the biodiesel industry. The National Biodiesel Board (NBB) estimates that U.S. biodiesel sales for 2009 will total about 475 million gallons, 31 percent below 2008.⁶ Further, NBB reports that 173 American companies have invested in production capacity that currently approaches 2.7 billion gallons. However, as a result of weak industry economics, capacity utilization in the biodiesel

⁶ The Census Bureau reports that biodiesel production for the ten months ended in October 2009 totaled 409 million gallons, nearly 30 percent below the same period in 2008.



industry currently hovers around 15 percent. At the end of 2009 only nine of Iowa's 15 biodiesel plants were operating with production estimated at 85 million gallons.

The Iowa biodiesel industry spent \$224 million on raw materials, other inputs, goods and services to produce an estimated 85 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 currently uses about 353 million pounds of soybean oil valued at \$116.5 million, 218 million pounds of other fats and oils valued at \$53 million, and 71 million pounds of corn oil valued at \$25 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 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 current economic contribution of the Iowa biodiesel industry at the end of 2009. These impacts are detailed in Table 3.

- The biodiesel industry accounts for \$471 million of Iowa GDP. This is made up by the impact of spending to produce and transport 85 million gallons of biodiesel which adds \$209 million to Iowa GDP. The value of the biodiesel and glycerin produced in Iowa accounts for \$261 million.
- 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 more than 2,900 permanent 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 puts \$103 million into the pockets of Iowa consumers on an annual basis.
- The biodiesel industry generates \$22 million of tax revenue for Iowa.

**Table 3
Contribution of the Biodiesel Industry to Iowa: 2009**

Industry	Spending (Mil 2009\$)	Impact		
		GDP	Earnings	Employment
		(Mil 2009\$)	(Mil 2009\$)	(Jobs)
Feedstocks (soybean oil and other fats)	\$172.0	\$158.5	\$73.9	2,251
Industrial chemicals	\$10.6	\$7.4	\$3.5	83
Electric, natural gas, water	\$6.3	\$5.1	\$2.0	42
Maintenance and repair	\$5.1	\$6.5	\$3.4	100
Wholesale Trade	\$12.8	\$14.5	\$6.9	178
Administration	\$2.9	\$3.6	\$2.0	53
Earnings (Wages and salaries)	\$4.6	\$3.5	\$1.6	58
Transportation	\$10.0	\$10.7	\$5.2	147
Subtotal	\$224.3	\$209.6	\$98.5	2,911
Plus Value of biodiesel output				
Biodiesel		\$259.3	\$4.6	
Co-products (glycerin)		\$2.3		
Total Impact		\$471.2	\$103.0	2,911

Failure by the U.S. Congress to reauthorize the \$1.00 per gallon biodiesel excise tax credit that expired at the end of 2009 is a significant blow to the biodiesel industry. The credit is claimed at the time when biodiesel meeting the ASTM D6751 fuel specification and the Environmental Protection Agency's (EPA) Clean Air Act registration requirements is first blended with conventional diesel fuel. The credit can be used to offset the federal diesel fuel excise tax, and is refundable if the credit amount exceeds excise tax liability. The incentive is structured in a manner that allows the value of the credit to be reflected in the market price of the fuel. Consequently, the tax credit effectively reduces the price of neat biodiesel (B100) by \$1.00 per gallon. Looked at another way, the tax credit allows the price paid to the biodiesel producer to be \$1.00 per gallon higher than the price of petroleum diesel with little or no impact on the retail price of the blended fuel.

An incentive such as the biodiesel tax credit is necessary to offset 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. All co-products, including glycerin,



make up the remaining 10 percent.⁷ 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 27 percent of the product yield of a barrel of crude oil.⁸

Over the past two and a half years the cost of soybean oil needed to produce a gallon of biodiesel averaged \$3.01 per gallon while the equivalent cost of crude oil to produce a gallon of distillate fuel was \$1.82 per gallon, a difference of \$1.20 per gallon.

Feedstock costs account for 87 percent of variable production costs for a biodiesel producer. Revenue is provided by the value of biodiesel and co-product glycerin sold represented by their price per gallon. Since its inception the tax credit has become imbedded into the price of biodiesel and helps determine the profitability of producing biodiesel. Over the April 2007 through October 2009 period the price of B100 (FOB plant, Iowa) averaged \$3.69 while glycerin added 3 cents per gallon to total revenue. Iowa State University economists estimate that a typical 30 million gallon per year biodiesel plant using soybean oil as the feedstock provided an average return over variable costs of 26 cents per gallon between April 2007 and October 2009.⁹

The immediate impact of removing the credit is to increase the price buyers would have to pay for biodiesel, thereby reducing their demand. In response to the initial fall in demand, the market price of biodiesel would fall to a new equilibrium level further reducing the incentive to increase capacity utilization and biodiesel production.

Economic theory tells us that producers will stay in business as long as they cover their variable costs of production. Without the tax credit, this will more than likely not be possible and most Iowa

⁷ According to the Census Bureau (Current Industrial Report M311K) soybean oil was the primary feedstock for about 44 percent of biodiesel produced during the ten months ending in October 2009. The economic model used by Iowa State University to estimate biodiesel costs and returns assumes that it takes 7.55 pounds of soybean oil to produce one gallon of biodiesel and 0.9 pounds of glycerin. Feedstocks (soybean oil) account for 87 percent of the variable cost of producing biodiesel.

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

⁹ Hofstrand, D. January 2010 "AgMRC Renewable Energy Newsletter". Agricultural Marketing Resource Center Iowa State University Extension. Available at http://www.agmrc.org/renewable_energy/ and Biodiesel Profitability Spreadsheet. Available at <http://extension.iastate.edu/agdm/energy/xls/d1-d10ethanolprofitability.xls>



biodiesel producers are expected to cease operations until the tax credit is reinstated. As a result, the economic benefits provided by the biodiesel industry will be lost.

Economic cost of underutilized biodiesel potential for Iowa

As indicated earlier only nine of Iowa's 15 biodiesel plants were producing at the end of 2009, and these plants were operating at an aggregate utilization rate of 22.6 percent. Under ideal conditions characterized by supportive government policy (e.g. reauthorization of the biodiesel tax credit at the Federal level and a B5 standard at the State level) and a favorable market environment, it is not unreasonable to expect that all 15 of Iowa's biodiesel plants could operate at, or near, capacity of 322 million gallons per year.

By not operating at full capacity, Iowa's economy suffers a loss from forgone economic activity. Continued underutilization of Iowa's biodiesel industry means that Iowa's GDP is \$1.4 billion lower than would be the case if all 322 million gallons of biodiesel were produced. In addition, Iowa households are deprived of \$304 million in earnings, and nearly 8,600 fewer jobs in all sectors of the State economy. Finally the underutilization of the industry reduces tax revenue by nearly \$66 million.

Appendix Table 1
BEA RIMS II Final Demand Multipliers, Iowa¹⁰

NAICS	Industry	Value Added	Earnings	Employment (Jobs)
230000	Construction	1.1221	0.6829	21.3966
	Annual Operations			
1111B0	Feed Grains (Corn)	0.8884	0.3057	13.1838
325190	Other basic organic chemicals	0.6950	0.3604	8.1419
311222	Soybean processing	0.9874	0.4445	14.0879
311225	Fats and oils refining and blending	0.8220	0.4067	13.1554
2211A0	Power generation and supply	0.9456	0.3326	7.0995
221200	Natural gas distribution	0.6337	0.2733	5.8240
221300	Water, sewage	1.1176	0.4656	12.3302
561200	Facilities support services	1.2653	0.6636	20.5388
420000	Wholesale Trade	1.1291	0.5397	14.5182
541200	Office administrative services	1.2458	0.6883	19.0660
H00000	Households	0.7603	0.3567	13.2268
482000	Rail Transportation	0.9742	0.4138	9.5318
483000	Water Transportation	0.7090	0.3444	8.7607
484000	Truck Transportation	1.0655	0.5156	15.4826

*Source: Regional Input-Output Modeling System (RIMS II)
Regional Economic Analysis Division, BEA.
Multipliers based on 1997 Benchmark I-O Table; 2006 regional data.*

¹⁰ The multipliers represent the effect on output, income and employment of every \$1 million of expenditures.

**Appendix Table 2
2009 Price Assumptions**

	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	\$3.62	\$3.61	\$126.38	\$38.06	\$1.51
Feb	\$3.50	\$3.46	\$124.38	\$37.38	\$1.49
Mar	\$3.47	\$3.59	\$120.90	\$35.60	\$1.46
Apr	\$3.52	\$3.69	\$119.63	\$38.75	\$1.50
May	\$3.61	\$3.98	\$132.75	\$40.31	\$1.57
Jun	\$3.68	\$3.98	\$131.80	\$41.35	\$1.68
Jul	\$3.79	\$3.22	\$85.00	\$30.13	\$1.57
Aug	\$3.80	\$3.22	\$76.90	\$27.00	\$1.53
Sep	\$3.20	\$3.08	\$84.25	\$29.88	\$1.56
Oct	\$3.71	\$3.52	\$108.63	\$33.94	\$1.88
Nov	\$3.67	\$3.61	\$116.88	\$35.75	\$2.01
Dec	\$3.67	\$3.59	\$108.70	\$36.00	\$1.93
Average	\$3.60	\$3.55	\$111.35	\$35.34	\$1.64

	Crude Soy Oil Iowa (cents/lb)	Crude Corn Oil Midwest (cents/lb)	Choice W. Grease Central US (cents/lb)	Yel Grease Midwest (cents/lb)	B100 FOB Plant Iowa (\$/gal)
Jan	31.77	25.25	20.38	18.31	\$3.10
Feb	29.27	29.19	16.56	16.30	\$2.82
Mar	28.90	29.60	16.50	14.20	\$2.68
Apr	33.40	32.00	22.28	19.81	\$2.98
May	35.83	37.50	26.00	23.30	\$3.13
Jun	35.24	39.45	27.88	26.38	\$3.09
Jul	31.28	35.88	25.47	22.00	\$2.85
Aug	33.36	35.34	28.06	23.06	\$3.11
Sep	31.03	36.85	24.80	21.18	\$3.00
Oct	34.23	37.63	20.63	18.88	\$3.16
Nov	36.56	38.13	24.81	20.38	\$3.37
Dec	36.72	40.00	24.23	21.63	\$3.38
Average	33.13	34.73	23.13	20.45	\$3.06

Sources: USDA/AMS Weekly Ethanol Summary
Weekly Ag Energy Roundup