



## **CONTRIBUTION OF THE BIODIESEL INDUSTRY TO THE ECONOMY OF THE UNITED STATES**

**Prepared for the National Biodiesel Board  
With Funding Support from the United Soybean Board<sup>1</sup>**

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Biodiesel is a non-toxic, biodegradable diesel fuel made from soybean and other vegetable oils, animal fats, and used or recycled oils and fats. The biodiesel industry is in its infancy but is poised for significant growth. An estimated 75 million gallons of biodiesel were used in the U.S. last year, up from about 500 thousand gallons in 1999. According to the National Biodiesel Board the U.S. biodiesel industry is comprised of 65 manufacturing plants with annual capacity of 395 million gallons per year. Eight of these plants are in the process of expanding capacity and an additional 50 plants are currently under construction. If all of these projects are completed and come on line, they will add an estimated 714 million gallons of capacity.

Responding to record crude oil and highway fuel prices and incentives provided by the Energy Policy Act of 2005 (EPACT05) and by various States, national demand for biodiesel fuel is projected to increase significantly by 2015 as the nation's highway motor fuel supply incorporates renewable fuels. As shown in Table 1, we expect national demand for biodiesel fuel to increase from 75 million gallons in 2005 to nearly 650 million gallons by 2015.<sup>2</sup> Transportation (on- and off- highway) accounts for about 70 percent of total U.S. diesel fuel use.

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<sup>1</sup> The USB is made up of farmer-directors who oversee the investments of the soybean check-off on behalf of all U.S. soybean farmers. Check-off funds are invested in the areas of animal utilization, human utilization, industrial utilization, industry relations, market access and supply.

<sup>2</sup> Forecast prepared by LECG, LLC.

Table 1  
U.S. Diesel Fuel and Biodiesel Assumptions

	Highway Diesel Use /1 (Bil gal)	B100 Volume (Mil gal)	Biodiesel From Soybeans (Pct)	Biodiesel from Soybeans (Mil gal)	Biodiesel from other Feedstocks (Mil gal)	Soybean Oil Equiv /2 (Mil lb)	Soybean Equiv /3 (Mil Bu)
2005	43.2	75.0	91.5%	68.6	6.4	515	46
2006	44.4	150.0	90.8%	136.1	13.9	1,021	92
2007	45.5	172.5	90.0%	155.3	17.3	1,164	105
2008	46.4	215.6	89.3%	192.4	23.2	1,443	130
2009	47.4	269.5	88.5%	238.5	31.0	1,789	161
2010	48.4	323.4	87.8%	283.8	39.6	2,129	191
2011	49.4	388.1	87.0%	337.7	50.5	2,533	227
2012	50.2	465.8	86.3%	401.7	64.0	3,013	270
2013	51.0	535.6	85.5%	457.9	77.7	3,435	308
2014	51.6	589.2	84.8%	499.3	89.8	3,745	336
2015	52.3	648.1	84.0%	544.4	103.7	4,083	367

NOTES:

Forecast prepared by LECG, LLC

1. Annual Energy Outlook 2006. High Oil Price Case. Table 2.

Converted from btu at 138,690 btu/gal

2. Converted using 7.5 lb soybean oil = 1 gal biodiesel

3. Assumes 11.1 lbs sbo/bu soybeans

The main drivers for increased biodiesel demand will be projected high energy prices and incentives provided by the EPACT05 and individual States. As indicated earlier, EPACT05 mandates that a minimum of 7.5 billion gallons of renewable fuels (ethanol and biodiesel) be used in the nation's motor fuel by 2012. The legislation provides other significant incentives, specifically:

- Extension of the biodiesel tax credit through 2008 at one cent per gallon for agri-biodiesel and ½ cent per gallon for biodiesel from other sources such as recycled fats and oils
- Credit for installation of alternative fuel refueling infrastructure (B20 minimum)
- Creation of a small agri-biodiesel producer tax credit of \$0.10 per gallon up to 15 million gallons for producers up to 60 MGY

- Provision of \$5 million per year for research in testing biodiesel in advanced diesel engine fuel system technologies

## **Economic Impact of Biodiesel Production**

As stated earlier, the U.S. biodiesel industry is comprised of 65 manufacturing plants with annual capacity of 395 million gallons per year. If all new construction and expansion projects are completed and come on line, they will add an estimated 714 million gallons of capacity.

This expansion of biodiesel demand will have several direct impacts on the American economy:

- Biodiesel producers will invest nearly \$810 million (2005 dollars) in structures, machinery and equipment, and supplies to build the 714 million gallons of new biodiesel production under construction. Additional investment in plant expansions and new construction may occur but is not necessary to meet the projected 2015 demand level. The construction of new biodiesel plants results in spending for a wide range of goods and services produced by other sectors of the economy.
- The additional demand for soybean oil used to produce biodiesel will increase crush demand for soybeans, raise soybean prices, and keep land in soybean production. Consequently, the value of agricultural production will increase thereby stimulating the demand for goods and services produced by other sectors of the economy and delivered to agriculture. Analysis published by the USDA indicates that every 50 million gallons of biodiesel raises soybean prices one percent.<sup>3</sup> Consequently, the 498 million gallons of biodiesel that will be produced between 2006 and 2015 will increase farm level soybean prices nearly 10 percent by 2015. Using the USDA 2006 Long-Term Baseline forecast for soybean prices as a starting point, soybean farmers can expect increased biodiesel demand to increase average soybean prices \$0.58 per bushel by 2015.

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<sup>3</sup> Anton R. Ranases, Lewrene K. Glaser and J. Michael Price. "Potential Niche Fuel Markets for Biodiesel and Their Effects on Agriculture". USDA/ERS Industrial Uses/ISU-6 September 1996. Also see "Impacts of Increased Ethanol and Biodiesel Demand". Food and Agricultural Policy Research Institute. University of Missouri-Columbia. FAPRI-UMC Report #13-01. October 2001.

- The impact of increased biodiesel demand and production on the American economy will come from the direct effects of annual expenditures on soybean oil, other feedstocks, and inputs such as natural gas, other utilities, and labor to produce biodiesel. Spending for these goods and services represents the purchase of output of other industries. The spending associated with ongoing biodiesel production and investment spending on new plant capacity will circulate throughout the entire economy several fold. As this circulation progresses the spending will stimulate aggregate demand, support the creation of new jobs, generate additional household income, and provide tax revenue for government at all levels.

The impact of the biodiesel industry on the 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 estimates of expenditures for construction and annual operations described above.<sup>4</sup> The final demand multipliers for output, earnings, and employment for the sectors that supply the biodiesel industry are shown in Table 2.

Table 2  
U.S. Final Demand Multipliers

	Output	Earnings	Employment (Jobs)
Construction	3.4230	1.0521	28.5
Feedstocks	3.8385	0.7106	21.4
Electricity	2.4634	0.5944	12.9
Natural gas	3.0435	0.6499	14.0
Water	2.5899	0.7068	17.9
Industrial chemicals	3.3519	0.7101	16.0
Office administrative services	2.8359	1.0009	25.1
Business support services	2.6042	0.8097	27.0
Maintenance (facilities support)	2.6503	0.9423	28.4
Households (labor)	2.3296	0.6476	19.4

Expansion of the biodiesel industry will provide significant economic benefits in terms of additional Gross Domestic Product (GDP), household income, new jobs, and tax revenue

<sup>4</sup> The multipliers used in this analysis are the detailed industry RIMS II multipliers for the U.S. prepared by the Regional Economic Analysis Division, Bureau of Economic Analysis, U.S. Department of Commerce.



for government at all levels.<sup>5</sup> The estimates summarized below result from a static analysis of the impact of increasing biodiesel fuels demand and production on the American economy. That is, they reflect the combination of a series of snapshots of the economy rather than a dynamic flow analysis.

#### Temporary impacts from construction

As indicated earlier the biodiesel industry will invest nearly \$810 million (2005 dollars) in structures, machinery and equipment, and supplies to build the 714 million gallons of new biodiesel production under construction. This spending will increase demand for a wide range of goods and services produced by other sectors of the economy. However, these impacts are short-lived and will disappear after construction is finished.

The spending on plant expansions and new construction will increase gross output by \$2.8 billion (2005 dollars) to gross output, adding \$1.5 billion (2005 dollars) to GDP. Household income will increase by almost \$850 million (2005 dollars), and as many as 11,700 jobs will be created in all sectors of the economy.

#### Permanent impacts from ongoing operations

The most significant impact for the economy will be provided by the ongoing annual operations of biodiesel plants. The annual expenditures for biodiesel were estimated by multiplying the average cost per gallon for each major expenditure category by the projected number of gallons of production by year described in Table 1 above. The estimated costs to produce biodiesel are based on a process model for a new 10 million gallon biodiesel plant developed by USDA/ARS.<sup>6</sup>

As shown in Table 3, the existing and new biodiesel plants will spend \$7.6 billion (2005 dollars) on goods and services between 2006 and 2015. Feedstock costs (soybean oil and other feedstocks) are the largest component of operating costs, accounting for about 80

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<sup>5</sup> The GDP estimates were calculated by multiplying gross output by 0.55. Gross output represents the market value of an industry's production. Generally speaking, gross output is larger than GDP since it includes the value of intermediate goods and services, which are "netted out" of the GDP calculation. According to BEA accounts, GDP was 55 percent of gross output in 2004.

<sup>6</sup> Haas, Michael J., Andrew J. McAloon, Winnie C. Yee, and Thomas A. Foglia. "A process model to estimate biodiesel production costs". *Bioresource Technology*. 2005.



percent of production costs. These expenditures will add \$15.6 billion (2005 dollars) to GDP between 2006 and 2015, increase household income by almost \$5.4 billion (2005 dollars), and support the creation of as many as 27,400 jobs in all sectors of the economy.

Table 3  
Annual Economic Impact of Biodiesel Production

	Biodiesel Production (Mil gal)	New Spending (Mil 2005\$)	GDP Impact (Mil 2005\$)	Earnings Impact (Mil 2005\$)	Employment Impact Jobs
2006	150	\$305	\$621	\$216	6,338
2007	173	\$351	\$714	\$249	7,288
2008	216	\$438	\$893	\$311	9,110
2009	270	\$548	\$1,116	\$389	11,388
2010	323	\$658	\$1,339	\$466	13,665
2011	388	\$789	\$1,607	\$560	16,398
2012	466	\$947	\$1,928	\$672	19,678
2013	536	\$1,089	\$2,217	\$772	22,630
2014	589	\$1,198	\$2,439	\$850	24,893
2015	648	\$1,318	\$2,683	\$935	27,382
2006-2015	3,785	\$7,641	\$15,558	\$5,419	27,382

#### Aggregate Economic Impact of Biodiesel

The total impact of biodiesel includes the temporary impacts of construction, the permanent impacts of ongoing annual operations, and the direct value added by the production of biodiesel and co-products (glycerin). The biodiesel industry will produce 3.8 billion gallons of biodiesel valued at \$12.3 billion (2005 dollars) and an estimated 1.4 billion pounds of glycerin valued at \$289 million (2005 dollars) between 2006 and 2015.

When the value of biodiesel and glycerin is added to the indirect impacts generated by the spending to create this output, the biodiesel industry will increase gross output by \$43.6 billion (2005 dollars) between 2006 and 2015. Gross output represents the market value of an industry's production, and it differs from Gross Domestic Product (GDP). Generally speaking, gross output is larger than GDP since it includes the value of intermediate goods and services, which are "netted out" of the GDP calculation. According to the Bureau of Economic Analysis GDP was 55 percent of gross output in 2004. When this adjustment is made, the biodiesel industry will add \$24 billion to the American economy. In other words,



the U.S. economy will be \$24 billion (2005 dollars) larger in 2015 than would be the case without the biodiesel industry. The full impact of the biodiesel industry on the American economy is summarized in Table 4.

Table 4  
Economic Contribution of Biodiesel by Industry  
2006-2015

Industry	Spending (Mil 2005\$)	Gross Output (Mil 2005\$)	GDP (Mil 2005\$)	Impact Earnings (Mil 2005\$)	Employment (Jobs)
Construction	\$807	\$2,762	\$1,519	\$849	11,720
Annual Operations					
Feedstocks	\$6,413	\$24,617	\$13,539	\$4,557	23,715
Industrial chemicals	\$589	\$1,973	\$1,085	\$418	1,624
Electric, natural gas, water	\$276	\$815	\$448	\$181	685
Maintenance and repair	\$57	\$152	\$84	\$54	282
Business Services	\$47	\$126	\$69	\$42	210
Earnings paid to households	\$259	\$603	\$332	\$168	866
Subtotal	\$8,448	\$31,048	\$17,076	\$6,268	39,102
Plus Value of output					
Biodiesel		\$12,251	\$6,738		
Co-products (glycerin)		\$289	\$159		
Total		\$43,588	\$23,973	\$6,268	39,102

- Biodiesel will create permanent new jobs. The increase in final demand resulting from the combination of new construction and ongoing biodiesel production will support the creation of more than 39,100 new jobs in all sectors of the economy by 2015.
- Increased economic activity and new jobs result in higher levels of income. The biodiesel industry will put an additional \$627 million (2005 dollars) into the pockets of American households each year for a total impact of \$6.3 billion (2005 dollars) between 2006 and 2015.
- Expansion of the biodiesel industry will generate additional tax revenues for government at all levels from personal and corporate income taxes that increase in line with higher output levels and larger GDP. Expansion of the biodiesel industry



as described above can be expected to generate an estimated \$8.3 billion (2005 dollars) of additional tax revenue for the Federal government and \$650 million (2005 dollars) of revenue for State and local governments between 2006 and 2015.

- The biodiesel industry will more than pay for itself. The additional tax revenues generated by a profitable biodiesel industry will be significantly larger than the value of the Federal tax incentives provided to the industry. Assuming that the biodiesel tax credit of one cent per gallon for agri-biodiesel and ½ cent per gallon for biodiesel from other sources is extended past 2008, this program would cost \$3.5 billion by 2015. However, as indicated above the industry will generate \$8.3 billion of new revenue for the Federal Treasury for a positive net balance of \$4.8 billion.
- The biodiesel industry will play a significant role in improving America's energy security. Expansion of the biodiesel industry as discussed above will displace 242 million barrels of crude oil between 2006 and 2015. Since the U.S. is a net importer of oil, this means that less oil will need to be imported. As a consequence, \$13.6 billion (2005 dollars) will remain in the American economy instead of being sent abroad to finance oil imports.