International

The Economic Impact of the Biodiesel Industry on the U.S. Economy

Study for:

National Biodiesel Board
Washington, D.C.

June 2016

Research and analysis to inform your business decisions

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The Economic Impact of the Biodiesel Industry on the U.S. Economy

Introduction

The goal of this study is to assess the economic impacts of the biodiesel sector on the U.S. economy. Over the last four years, the market dynamics faced by the industry have changed considerably, most notably in the form of surging imports. The study examines how these dynamics were manifest in 2015 and presents economic impact scenarios looking forward.

This study evaluates the impact of the biodiesel industry across three metrics:

1. **Economic impact** — quantifying the value added to the U.S. economy across the biodiesel value chain.
2. **Employment impact** — estimating the number of full-time equivalent (FTE) jobs contributed by production, processing and distribution of biodiesel and its feedstocks.
3. **Wage impact** — evaluating the total wages for individuals employed along the biodiesel value chain.

Note: The model uses 2015/16 market conditions for commodity prices and wage rates.

The Bottom Line — The total impacts: economic, jobs & wages

- For the base case, we evaluated U.S. biodiesel supply of **2.1 billion gallons**, with U.S. production of 1.43 billion gallons and imports of 0.67 billion gallons. This reflects the actual market in 2015, based on estimates of biodiesel and renewable diesel domestic production and imports from the EPA Moderated Transaction System (EMTS).

  This generated **$8.4 billion in total U.S. economic impact, 47,400 U.S. jobs, and $1.9 billion in wages paid**. The average wage per worker translates to $39,300, which compares favorably to an average rural wage of $36,000 per year.

  By contrast, had all 2.1 billion gallons been domestically produced, the total economic impact would have been $12.3 billion, supporting 68,600 jobs and $2.7 billion in wages paid.

  The economic impact of the imported biodiesel under a 2.1-billion-gallon scenario is $60 million — a fraction of the impact of domestically sourced biodiesel — supporting 900 jobs and $36 million in wages paid.

- We then evaluated U.S. biodiesel supply of **2.5 billion gallons.**

  If the split between domestic production and imports continues at 2/3 vs. 1/3, 2.5 billion gallons would generate **$9.8 billion in total U.S. economic impact, 55,000 U.S. jobs, and $2.2 billion in U.S. wages paid**.

  By contrast, if all 2.5 billion gallons are produced in the U.S., the impacts would rise to $14.7 billion in total economic impact, 81,600 jobs, and $3.2 billion in wages paid. In other words:

  – **If the 2.5 billion gallons are produced entirely in the U.S., that would lead to $4.9 billion greater U.S. economic impact, 26,100 more U.S. jobs, and $1.0 billion more paid in U.S. wages.**

- **At 3.0 billion gallons of biodiesel — a feasible market size when looking out five years — the economic impacts of shifting supply from 67% domestic to 100%, of course, become magnified:**

  At this level of consumption, if 100% of biodiesel use were met by U.S. supplies, that would imply support for an additional $6 billion in economic activity, an additional 33,000 jobs, and $1.4 billion in wages paid, within the U.S., compared to a 33% / 67% split between imports and domestic production.

- **Given the sharp contrast in the economic activity associated with domestically sourced versus imported biodiesel, a move toward greater self-sufficiency in biodiesel sourcing and away from imports could have tremendous positive ramifications for the U.S. economy — ones that will only grow with market size.**

Key Findings

Even under the weight of low commodity prices, the economic benefits conferred by the biodiesel sector onto the U.S. economy are significant. For 2016, assuming unchanged **U.S. production of 1.43 billion gallons and imports of 670 million gallons**:

- The biodiesel sector will contribute **$8.4 billion in economic activity** to the U.S. economy, $8.33 billion of which is associated with domestic production.
- The biodiesel sector will support **47,400 jobs**, with all but 900 of those jobs associated with domestic production.
- In addition, the biodiesel sector will support **$1.9 billion dollars in wages paid**.

On a per-gallon basis, the economic impacts of domestic biodiesel production vastly surpass those of imported product for the simple fact that most of the value-added activity associated with imported biodiesel takes place overseas. Even if consumption levels remain flat in 2016 at 2.1 billion gallons, the potential gain from shifting to 100% domestic production *could add as much as*:

- $3.9 billion in economic activity,
- 21,000 jobs supported, and
- $0.84 billion in support to wages paid.

As the size of the U.S. biodiesel market grows, so too will the potential upside from market share shifting to domestic producers. **At 3 billion gallons**, U.S. producers supplying 100% of the market, rather than the current share of roughly two-thirds, *could support an additional*:

- $5 billion in economic activity,
- 31,000 jobs, and
- $1.24 billion in wages paid.

Diagrams 1-6 on the following pages illustrate the results for 67%/33% domestic production/imports vs. 100% domestic production.

Diagram 1: Total economic impact from biodiesel, assuming market is 67% domestic and 33% imported

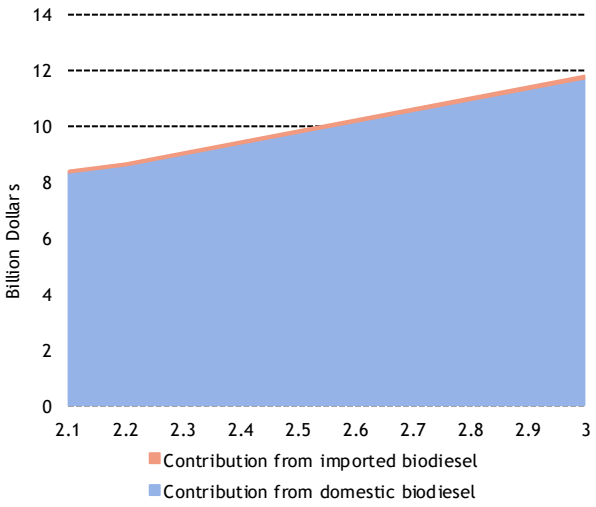


Diagram 2: Potential gains in economic impact, assuming domestic production fills 100% of market need

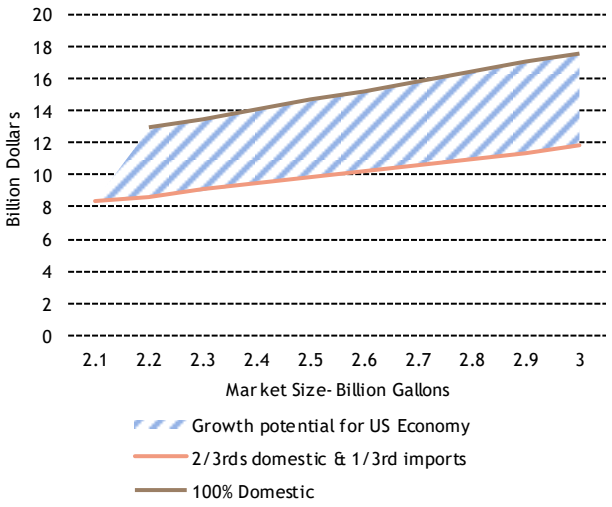


Diagram 3: Total employment impact from biodiesel, assuming market is 67% domestic and 33% imported

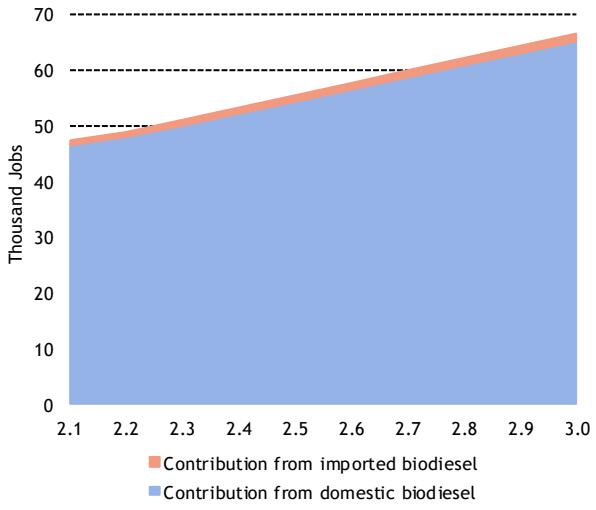


Diagram 4: Potential gains in jobs supported assuming domestic production fills 100% of market need

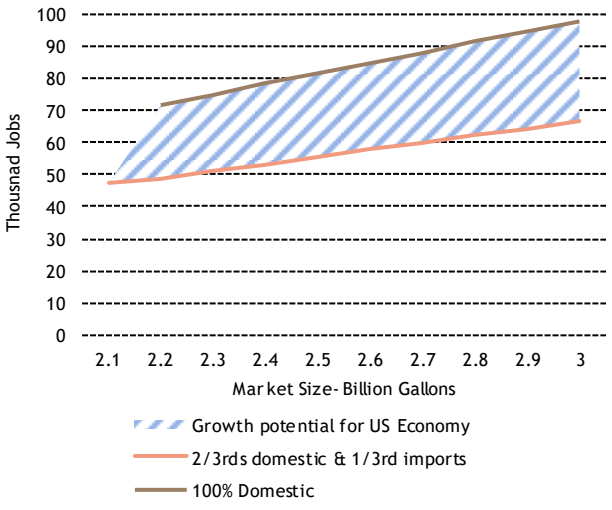


Diagram 5: Total wage impact from biodiesel, assuming market is 67% domestic and 33% imported

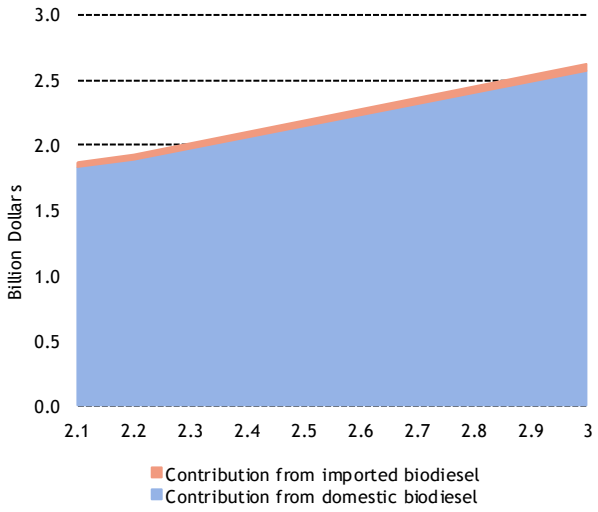


Diagram 6: Potential gains in wages supported assuming domestic production fills 100% of market need

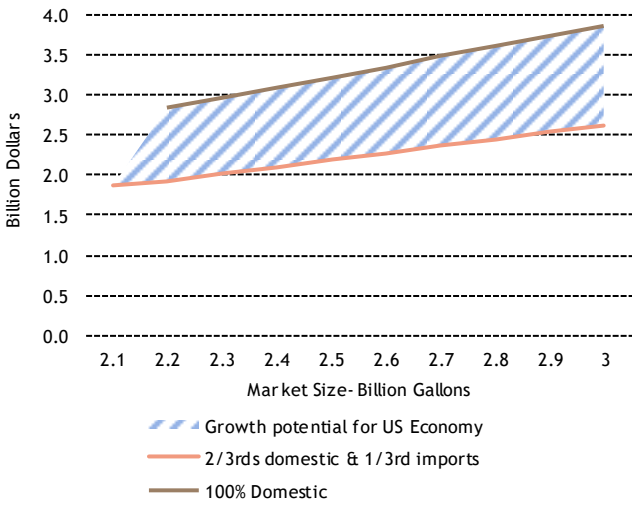


Table 1: Summary of total impacts of biodiesel on the U.S. economy

	Base Scenario	67%/33% Production/Imports		100% Production	
Biodiesel					
U.S. Production (billion gallons)	1.43	1.68	2.01	2.50	3.00
U.S. Imports (billion gallons)	0.67	0.83	0.99	0.00	0.00
Total U.S. Supply (billion gallons)	**2.10**	**2.50**	**3.00**	**2.50**	**3.00**
Impacts					
Economic (billion $)	**8.4**	**9.8**	**11.8**	**14.7**	**17.6**
Job (FTE)	**47,400**	**55,500**	**66,600**	**81,600**	**97,900**
Wage (billion $)	**1.9**	**2.2**	**2.6**	**3.2**	**3.9**
Increase					
Economic (billion $)				**4.8**	**5.8**
Job (FTE)				**26,100**	**31,300**
Wage (billion $)				**1.0**	**1.2**

Notes: (1) This table presents total impacts, taking account of direct, indirect & induced effects, using detailed multipliers provided by the U.S. Department of Commerce's Bureau of Economic Analysis.
(2) The Base Scenario reflects the actual market in 2015, based on estimates of biodiesel and renewable diesel domestic production and imports from the EPA Moderated Transaction System (EMTS).
(3) FTE = full-time equivalent

The value chain

To calculate the economic impact of biodiesel on the U.S. economy, we have evaluated its production and distribution along 16 distinct components of the value chain, spanning the production, collection and processing of raw materials — oilseeds, animal fats, and waste oils to biodiesel production, distribution, importation and exportation. These steps in the value chain, along with a brief description, are listed in Table 2.

The results demonstrate biodiesel's significant impact across a variety of sectors, most profoundly in oilseed production, biodiesel processing and manufacturing, animal processing and transportation.

Table 2: The biodiesel value chain

Seed Production	Value of the oil produced for biodiesel feedstock in seed. Given that meal is outside the scope of the biodiesel chain, its value is excluded
Animal Processing	Processing and rendering of animal carcasses and fats into feedstocks for biodiesel use
Local seed delivery	Delivery of oil share of seeds used in biodiesel to local elevation facility
Elevation	Elevation and storage of oil component of seed used in biodiesel production
Oilseed crush	Value of removing oil from seed in the crush process for use as a biodiesel feedstock
Feedstock delivery by barge	Long range delivery of oil share of biodiesel feedstocks by barge
Feedstock delivery by rail	Long range delivery of oil share of biodiesel feedstocks by rail
Biodiesel processing, with feedstock collection	Collection and processing of feedstocks, including waste greases, into biodiesel
Rail deliveries of domestic Biodiesel used domestically	Rail shipments of domestic biodiesel from surplus to deficit states with most traffic originating in the Midwest
Rail deliveries of glycerin	Rail shipments of domestic glycerin from surplus to deficit states with most traffic originating in the Midwest
Rail deliveries of imported Biodiesel	Rail shipments of imported biodiesel from surplus to deficit states with most traffic originating in Gulf
Rail deliveries of exported Biodiesel	Rail shipments of domestic biodiesel from surplus states to port of export with most traffic originating in the Midwest
Trucking domestic to sale	Trucking of domestically produced biodiesel (mostly blended with conventional diesel) from terminal to dealer outlet
Trucking imports to sale	Trucking of imported biodiesel (mostly blended with conventional diesel) from terminal to dealer outlet
Import port activities	Unloading ocean-going vessels laden with biodiesel imports
Export port activities	Loading ocean-going vessels with biodiesel for shipments to the export market

In evaluating impacts from production of seed, we have focused only on the oil share of value generated in oilseed (and inedible oil for corn), given that this is what is used in feedstock, and excluded the contribution from meal.

Even when using this conservative approach, for the base scenario of 2015 levels of U.S. biodiesel supply (2.1 billion gallons, of which two-thirds is supplied by domestic product[1]), **oilseed production supports:**

- 3.6 billion in economic activity, more than 40% of the total economic impact of biodiesel,
- 15,100 jobs, one-third of the total, and
- $560 million, 30% of the total support to wages paid.

[1] Based on estimates from the EPA Moderated Transaction System (EMTS)

Critically, the vast majority of the benefits of these activities is captured at the farm-level and in the immediate vicinity of the rural communities in which they operate.

Following oilseed production, the processing of oilseeds, first through crushing and then through biodiesel production, has the greatest impact in terms of specific steps in the value chain. As was the case for farming activities, we focus solely on the oil share of value added for crushing.

Under the base scenario, we find that **crushing for biodiesel feedstock supports**:

- $1.48 billion in economic activity, 18% of the total,
- 2,400 jobs, 5% of the total, and
- $85 million, or 5% of wages paid.

Unlike oilseed crushing, wherein a significant share of the incentive lies outside of oils and biodiesel (i.e., meal), the further processing of vegetable oils (as well as animal-based feedstocks and waste greases) into fuel can be *entirely* attributed to a healthy biodiesel sector.

Processing the feedstocks into biodiesel supports:

- $2.48 billion in economic activity,
- 14,200 jobs, and
- $670 million in wages paid,

which is between 30-35% of the total for each metric.

In terms of employment:

- Biodiesel's contribution to animal processing has no calculable impact on *economic* activity, but nonetheless supports a significant number of *jobs*: 9,500, 20% of the total under the base scenario.
- The average wage of each job supported by the sector is just under $40,000 per year, in part a reflection of the drop in farm wages associated with lower commodity prices, but still higher than the average 2016 rural salary of $36,000 per year.

On the following pages, we provide the detailed analysis of economic, job and wage impacts by step in the value chain.

Economic Impacts

Table 3: Economic activity supported by the U.S. biodiesel sector assuming a 67% /33% split between domestic production and imports, under 2015/16 market conditions

SUPPLY (Billion Gallons)	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**3.0**
Production	1.43	1.47	1.54	1.61	1.68	1.74	1.81	1.88	1.94	2.01
Imports	0.67	0.73	0.76	0.79	0.83	0.86	0.89	0.92	0.96	0.99
IMPACT (Billion Dollars)	**8.40**	**8.67**	**9.06**	**9.45**	**9.84**	**10.24**	**10.63**	**11.02**	**11.42**	**11.81**
Seed Production	3.60	3.71	3.88	4.05	4.22	4.39	4.56	4.73	4.90	5.07
Animal Processing	na	na	na	na	na	na	na	na	na	na
Local seed delivery	0.10	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.14	0.14
Elevation	0.29	0.30	0.31	0.33	0.34	0.36	0.37	0.38	0.40	0.41
Oilseed crush	1.48	1.53	1.60	1.67	1.74	1.81	1.88	1.95	2.02	2.09
Feedstock delivery by barge	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Feedstock delivery by rail	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05
Biodiesel processing	2.48	2.56	2.67	2.79	2.90	3.02	3.14	3.25	3.37	3.49
Rail deliveries of domestic Biodiesel used domestically	0.19	0.20	0.21	0.21	0.22	0.23	0.24	0.25	0.26	0.27
Rail deliveries of glycerin	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Rail deliveries of imported Biodiesel	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
Rail deliveries of exported Biodiesel	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Trucking domestic to sale	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.11
Trucking imports to sale	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05
Import port activities	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Export port activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 4: Economic activity supported by the U.S. biodiesel sector assuming domestic production captures 100% market share, under 2015/16 market conditions

SUPPLY (Billion Gallons)	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**3.0**
Production	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.00
Imports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IMPACT (Billion Dollars)	**12.34**	**12.92**	**13.51**	**14.09**	**14.68**	**15.27**	**15.85**	**16.44**	**17.03**	**17.61**
Seed Production	5.29	5.54	5.80	6.05	6.30	6.55	6.80	7.06	7.31	7.56
Animal Processing	na	na	na	na	na	na	na	na	na	na
Local seed delivery	0.15	0.16	0.16	0.17	0.18	0.19	0.19	0.20	0.21	0.22
Elevation	0.43	0.45	0.47	0.49	0.51	0.53	0.55	0.57	0.59	0.61
Oilseed crush	2.18	2.28	2.39	2.49	2.59	2.70	2.80	2.91	3.01	3.11
Feedstock delivery by barge	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Feedstock delivery by rail	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07
Biodiesel processing	3.64	3.81	3.99	4.16	4.34	4.51	4.68	4.86	5.03	5.20
Rail deliveries of domestic Biodiesel used domestically	0.39	0.41	0.43	0.45	0.47	0.49	0.50	0.52	0.54	0.56
Rail deliveries of glycerin	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
Rail deliveries of imported Biodiesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail deliveries of exported Biodiesel	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Trucking domestic to sale	0.12	0.12	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.17
Trucking imports to sale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Import port activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Export port activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Employment Impacts

Table 5: Jobs supported by the U.S. biodiesel sector assuming a 67% / 33% split between domestic production and imports, under 2015/16 market conditions

SUPPLY (Billion Gallons)	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Production	1.43	1.47	1.54	1.61	1.68	1.74	1.81	1.88	1.94	2.01
Imports	0.67	0.73	0.76	0.79	0.83	0.86	0.89	0.92	0.96	0.99
IMPACT (Total Jobs)	**47,400**	**48,900**	**51,100**	**53,300**	**55,500**	**57,700**	**60,000**	**62,200**	**64,400**	**66,600**
Seed Production	15,100	15,600	16,300	17,000	17,700	18,400	19,100	19,800	20,500	21,300
Animal Processing	9,500	9,800	10,200	10,700	11,100	11,600	12,000	12,500	12,900	13,400
Local seed delivery	500	500	600	600	600	600	700	700	700	700
Elevation	1,300	1,300	1,400	1,400	1,500	1,600	1,600	1,700	1,700	1,800
Oilseed crush	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,400
Feedstock delivery by barge	400	400	400	400	400	500	500	500	500	500
Feedstock delivery by rail	100	100	100	100	100	100	100	100	100	200
Biodiesel processing	14,200	14,700	15,300	16,000	16,700	17,300	18,000	18,700	19,300	20,000
Rail deliveries of domestic Biodiesel used domestically	800	800	900	900	900	1,000	1,000	1,000	1,100	1,100
Rail deliveries of glycerin	800	800	900	900	900	1,000	1,000	1,000	1,100	1,100
Rail deliveries of imported Biodiesel	0	0	0	0	100	100	100	100	100	100
Rail deliveries of exported Biodiesel	100	100	100	100	100	100	100	100	100	100
Trucking domestic to sale	1,100	1,100	1,200	1,200	1,300	1,400	1,400	1,500	1,500	1,600
Trucking imports to sale	500	500	600	600	600	600	700	700	700	700
Import port activities	400	400	500	500	500	500	500	500	600	600
Export port activities	100	100	100	100	100	100	100	100	100	100

Table 6: Jobs supported by the U.S. biodiesel sector assuming domestic production captures 100% market share, under 2015/16 market conditions

SUPPLY (Billion Gallons)	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Production	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.00
Imports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IMPACT (Total Jobs)	**68,600**	**71,800**	**75,100**	**78,400**	**81,600**	**84,900**	**88,100**	**91,400**	**94,600**	**97,900**
Seed Production	22,200	23,300	24,300	25,400	26,400	27,500	28,600	29,600	30,700	31,700
Animal Processing	14,000	14,600	15,300	15,900	16,600	17,300	17,900	18,600	19,300	19,900
Local seed delivery	800	800	800	900	900	900	1,000	1,000	1,100	1,100
Elevation	1,900	2,000	2,100	2,200	2,200	2,300	2,400	2,500	2,600	2,700
Oilseed crush	3,500	3,700	3,800	4,000	4,200	4,300	4,500	4,700	4,800	5,000
Feedstock delivery by barge	600	600	600	600	700	700	700	700	800	800
Feedstock delivery by rail	200	200	200	200	200	200	200	200	200	200
Biodiesel processing	20,900	21,900	22,900	23,900	24,900	25,900	26,900	27,900	28,900	29,900
Rail deliveries of domestic Biodiesel used domestically	1,600	1,700	1,800	1,900	2,000	2,000	2,100	2,200	2,300	2,300
Rail deliveries of glycerin	1,200	1,200	1,300	1,300	1,400	1,400	1,500	1,600	1,600	1,700
Rail deliveries of imported Biodiesel	0	0	0	0	0	0	0	0	0	0
Rail deliveries of exported Biodiesel	100	100	100	100	100	100	100	100	100	100
Trucking domestic to sale	1,600	1,700	1,800	1,900	1,900	2,000	2,100	2,200	2,300	2,300
Trucking imports to sale	0	0	0	0	0	0	0	0	0	0
Import port activities	0	0	0	0	0	0	0	0	0	0
Export port activities	100	100	100	100	100	100	100	100	100	100

Wage Impacts

Table 7: Wages supported by the U.S. biodiesel sector assuming a 67% / 33% split between domestic production and imports, under 2015/16 market conditions

SUPPLY (Billion Gallons)	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Production	1.43	1.47	1.54	1.61	1.68	1.74	1.81	1.88	1.94	2.01
Imports	0.67	0.73	0.76	0.79	0.83	0.86	0.89	0.92	0.96	0.99
IMPACT (Billion Dollars)	**1.87**	**1.93**	**2.01**	**2.10**	**2.19**	**2.27**	**2.36**	**2.45**	**2.54**	**2.62**
Seed Production	0.56	0.58	0.60	0.63	0.66	0.68	0.71	0.74	0.76	0.79
Animal Processing	0.30	0.31	0.32	0.33	0.35	0.36	0.38	0.39	0.40	0.42
Local seed delivery	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Elevation	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07
Oilseed crush	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.12	0.12
Feedstock delivery by barge	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Feedstock delivery by rail	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Biodiesel processing	0.67	0.69	0.72	0.75	0.78	0.81	0.84	0.87	0.90	0.94
Rail deliveries of domestic Biodiesel used domestically	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06
Rail deliveries of glycerin	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06
Rail deliveries of imported Biodiesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail deliveries of exported Biodiesel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Trucking domestic to sale	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
Trucking imports to sale	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Import port activities	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03
Export port activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 8: Wages supported by the U.S. biodiesel sector assuming domestic production captures 100% market share, under 2015/16 market conditions

SUPPLY (Billion Gallons)	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Production	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.00
Imports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IMPACT (Billion Dollars)	**2.71**	**2.84**	**2.97**	**3.10**	**3.22**	**3.35**	**3.48**	**3.61**	**3.74**	**3.87**
Seed Production	0.82	0.86	0.90	0.94	0.98	1.02	1.06	1.10	1.14	1.18
Animal Processing	0.44	0.46	0.48	0.50	0.52	0.54	0.56	0.58	0.60	0.62
Local seed delivery	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Elevation	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.11
Oilseed crush	0.13	0.13	0.14	0.14	0.15	0.16	0.16	0.17	0.17	0.18
Feedstock delivery by barge	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04
Feedstock delivery by rail	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Biodiesel processing	0.98	1.02	1.07	1.12	1.16	1.21	1.26	1.30	1.35	1.40
Rail deliveries of domestic Biodiesel used domestically	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.12	0.13
Rail deliveries of glycerin	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09
Rail deliveries of imported Biodiesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail deliveries of exported Biodiesel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Trucking domestic to sale	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07
Trucking imports to sale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Import port activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Export port activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Current market conditions

2015 and 2016 have delivered a number of changes to the market dynamics confronted by the biodiesel sector — some of which apply to value-added agricultural products more generally, and some of which are specific to biodiesel.

In terms of broader trends, the biodiesel industry has not been immune to the recent spate of lower commodity prices, which have impacted the biodiesel sector by reducing costs of purchased inputs while also reducing the selling price of their finished products, biodiesel and glycerin (Diagram 8). Meanwhile, biodiesel has also been uniquely affected by a number of specific developments, most notably:

- **An upward push in biodiesel usage mandates from 1.28 billion gallons in 2013 to 1.73 billion gallons in 2015 and 1.9 billion gallons in 2016** — on its face, a boon to the industry, but well short of installed capacity and the industry's proven ability to produce.

- And, **a surge in biodiesel imports into the U.S. beginning in 2013, initially due to the EU placing anti-dumping duties on Argentine biodiesel and then buoyed by the January 2015 decision of the EPA to allow Argentine biodiesel to qualify for RINs** (Diagram 7)**.**

Diagram 7: U.S. imports of biodiesel and renewable diesel by source (EIA)

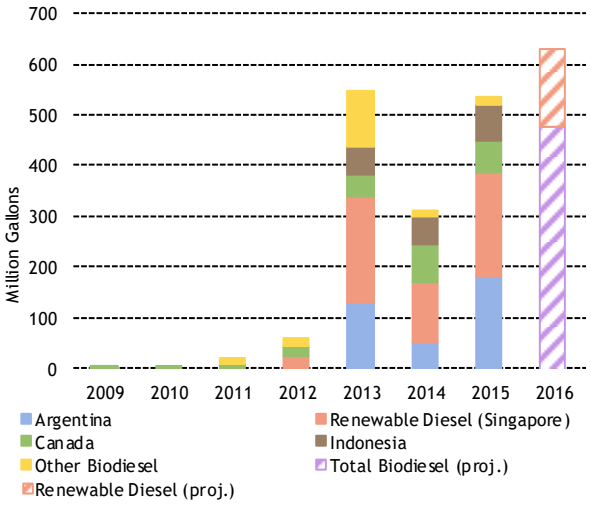
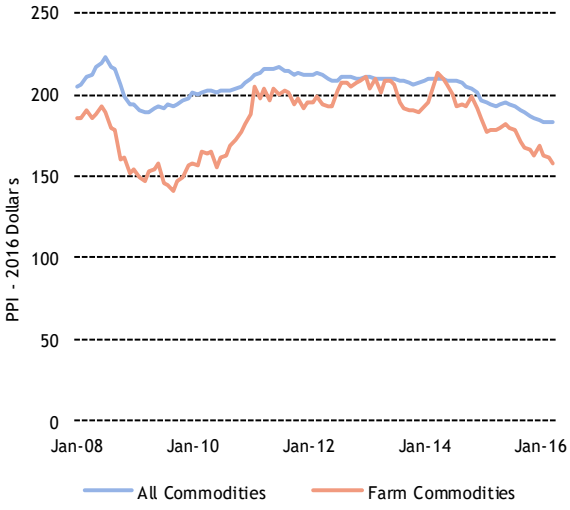


Diagram 8: 2016 — a trough in the commodity price cycle



Methodology for this study — *Summary*

We have evaluated the impact of biodiesel in the U.S., including both domestic production and imports, across the value chain via the three different metrics above:

1. **Economic impact**
2. **Employment impact**
3. **Wage impact**

The economic indicators for each step of the biodiesel value chain are evaluated at three different levels, Direct, Indirect, and Induced*:*

- The starting point is **Direct effects.** As the name suggests, the direct effect is composed of the economic, employment, and wage impacts that can be directly attributed to the biodiesel value chain.

  These results have been calculated first-hand by LMC International, using models populated with data from public and private sources, our in-house industry knowledge and databases, and interviews with industry stakeholders.

The direct effects of biodiesel on the U.S. economy are significant, but they fail to capture the full impact of the sector. There is a ripple effect that the biofuel has on supporting industries. This is known as the indirect effect:

- **Indirect effects** are the economic, employment, and wage impacts created by those industries that supply the biodiesel value chain, or by individuals who work at the periphery of the sector.

  For some steps in the biodiesel value chain, the indirect effect can be quite large. This is especially true for capital-intensive aspects of the sector like oilseed crushing and refining crude oil to a usable fuel. To illustrate this point, consider the typical biodiesel facility in the U.S., with an average capacity of 40-60 million gallons annually, which *directly* employs between 40 and 50 people (although there is considerable variation across the capacity and staffing rates of the country's 100+ operational facilities). *This does not include the many jobs associated with keeping that facility operational*, from white collar jobs in engineering to trade professions like electricians, plumbers, and pipefitters, which are done on a contractual basis, making the true impact of that facility much higher.

Direct effects also fail to capture the economic activity stemming from expenditures of households drawing a salary from a given sector:

- **Induced effects** are those economic, employment, and wage impacts that stem from household spending of the income earned from the biodiesel sector.

  While these "induced" effects are typically smaller than indirect effects, they can still constitute a sizeable economic force, particularly when the sector being evaluated is large, as is the case for biodiesel.

Use of multipliers to evaluate indirect and induced impacts

To capture indirect and induced effects, economists use multipliers, which are developed from "input-output" tables and measure the impact on the broader economy from some kind of exogenous shock to a specific sector of the economy. Because input-output tables and economic multipliers are the convention when estimating indirect and induced effects, they are available for many economies globally. In the case of the United States, multipliers are made available by the U.S. Department of Commerce's Bureau of Economic Analysis across 406 detailed industries and, in most cases, all 50 states.

Table 9 presents the most important multipliers used in this study, along with the industry classification NAICS code. To capture indirect and induced effects these multipliers are applied to the direct effects that LMC has calculated.

We have then combined the direct, indirect, and induced effects to arrive at the total effects.

Our results are presented in terms of Total effects, which are the sum of direct, indirect, and induced effects.

Table 9: Effective multipliers (state-weighted averages) used to calculate results for this study

		TOTAL = Direct+Indirect+Induced		
NAICS	Codes & Activities	Economic	Employment	Wage
31122A	**Crushing**	2.86	5.39	4.11
311225	**Refining**	2.71	4.80	3.91
482000	**Rail**	1.87	3.78	2.41
31161A	**Animal Processing**	na	4.20	4.05
1111C0	**Oilseed Farm**	2.05	3.43	3.09
484000	**Trucking**	2.05	3.45	2.18

Estimating impacts at various levels of production and imports

After calculating direct impacts based on 2015/16 market conditions and applying multipliers to estimate *total* impacts, the next step for this study was to estimate impacts at various levels of production and imports. For most steps within the value chain, with feedstock production being a good example, the relationship between production and economic impacts would be linear, which we have modeled accordingly. While for some categories, most notably biodiesel processing, there are clearly economies of scale at the factory level, it is reasonable to assume that as biodiesel production grows, new capacity will be built, leaving capacity-utilization comparable to where it is today.