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# Returns to Biofuel Production



March 2007

Food and Agricultural  
Policy Research Institute



College of Agriculture, Food and Natural Resources

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# Summary

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The biofuel industry is transforming US agriculture. Rapid expansion of ethanol and biodiesel production has contributed to higher prices for corn, soybean oil, and a wide range of other agricultural commodities.

This report summarizes biofuel-related findings of the Food and Agricultural Policy Research Institute (FAPRI) baseline released in early March 2007. That report can be found on the FAPRI website, under “publications” or go to [www.fapri.missouri.edu/outreach/publications/2007/FAPRI\\_UMC\\_Report\\_02\\_07.pdf](http://www.fapri.missouri.edu/outreach/publications/2007/FAPRI_UMC_Report_02_07.pdf).

The baseline assumes a continuation of current agricultural policies and an extension of existing federal tax credits and tariff provisions that support the biofuel industry. It assumes a \$10 per barrel reduction in petroleum prices between 2006 and 2016, but also examines a range of possible outcomes for petroleum prices, crop yields and a variety of other factors that could affect US agriculture in general and the biofuel sector in particular.

## Key findings for the biofuel industry

- The combination of high biofuel prices and relatively low prices for feedstocks contributed to record levels of net returns over operating costs for biofuel plants in the 2005/06 marketing year.
- High net returns to biofuel production have led to rapid expansion of biofuel production capacity. For example, ethanol plants under construction could double ethanol production capacity in the next two years.
- The combination of increased production and lower petroleum prices is likely to lead to weaker biofuel prices and lower net returns to biofuel producers.
- For corn-based ethanol, projected net returns over operating costs drop to an average of about \$0.20 per gallon after 2008/09. This level of returns is sufficient to keep most existing plants in operation, but may be too low to result in significant further expansion of capacity beyond that which is already underway.
- For soybean oil-based biodiesel, projected net returns over operating costs drop sharply and are actually negative beginning in 2010. Rising soybean oil prices are the principal cause of the deterioration in returns.

## What could make the story different?

- If current biofuel federal tax credits and tariff protection are allowed to expire, the result would be lower biofuel prices, less biofuel production, and lower prices for corn, soybean oil, and other agricultural commodities.
- On the other hand, policies that would provide additional subsidies for production or encourage higher levels of biofuel use could result in greater biofuel net returns and further increases in biofuel production.
- Results are very sensitive to petroleum prices. The biofuel industry is much more profitable when the average price of petroleum is \$70 per barrel than when it is \$35 per barrel.
- Technology could change in ways that would affect the economics of biofuel production. For example, if more vegetable oil can be extracted from soybeans, or if corn oil can be obtained from a dry mill ethanol plant, the result could be lower vegetable oil prices and a more viable biodiesel industry.
- Livestock producers could be more or less able to adjust feed rations to use increasing supplies of ethanol coproducts. The result could be significantly different prices for distillers grains and other coproducts.
- Finally, there is considerable uncertainty about consumer demand for biofuels. One key question is how low the price of ethanol must fall relative to gasoline to encourage consumers to buy more ethanol blends.

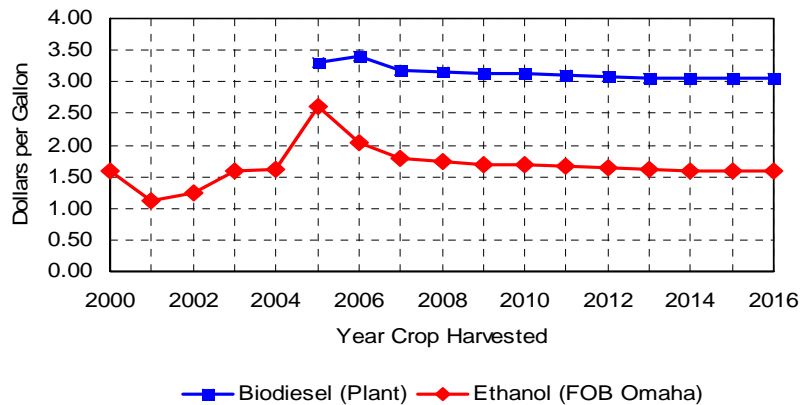
# Summary

- Petroleum prices, tax credits and production levels all influence plant prices for ethanol and biodiesel.

- FAPRI projections assume average petroleum prices fall by about \$10 per barrel between 2006 and 2016.

- Projected increases in biofuel production and reductions in petroleum prices put downward pressure on biofuel prices, even if tax credits remain in place.

Biofuel Prices at the Processing Plant

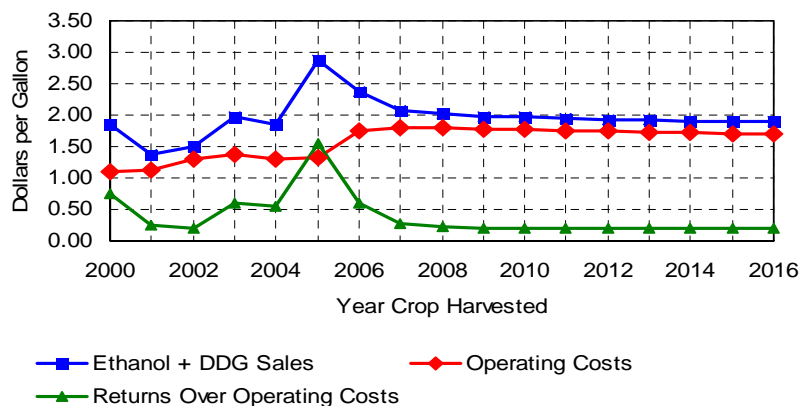


- Ethanol dry mill net returns reached a record \$1.56 per gallon in 2005/06.

- Falling ethanol prices and rising corn prices sharply reduce net returns in 2006/07 and 2007/08.

- From 2008-2016, net returns over operating costs average about \$0.20 per gallon. Operating costs exclude capital costs, so net profits would be lower.

Ethanol Dry Mill Costs and Returns



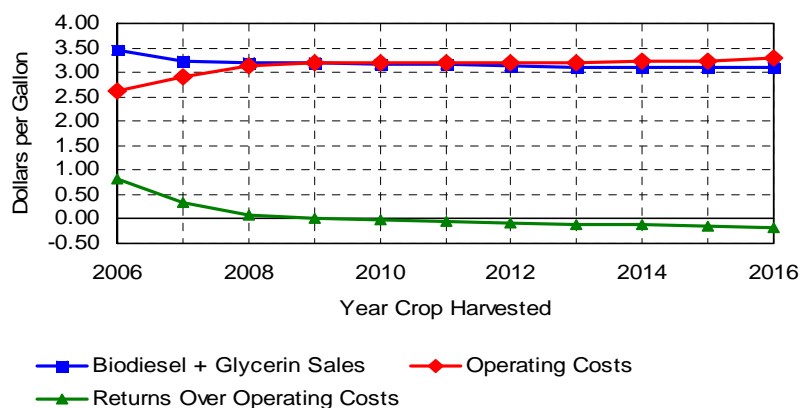
- Biodiesel sales account for most of the revenue for a typical biodiesel plant because glycerin values are low.

- Rising prices for soybean oil increase biodiesel production costs.

- Net returns over operating costs are very small, or even negative on average, beginning in 2008/09.

- If net returns are as low as projected, further investment may be limited and plants may not operate at full capacity.

Biodiesel Costs and Returns



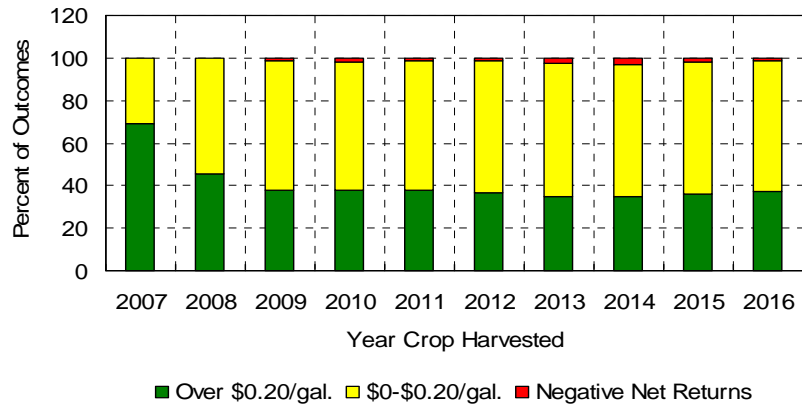
# Summary

- FAPRI's stochastic baseline examines 500 alternative outcomes for markets allowing crop yields, petroleum prices, etc. to vary, but holding policies constant.

- In very few of the alternative outcomes are net returns over operating costs negative for ethanol plants. This suggests most capacity should be utilized.

- In more than 60% of the outcomes for 2009 and later years, net returns are less than \$0.20 per gallon. This could slow new investment in ethanol capacity.

Ethanol Dry Mill Returns over Operating Costs

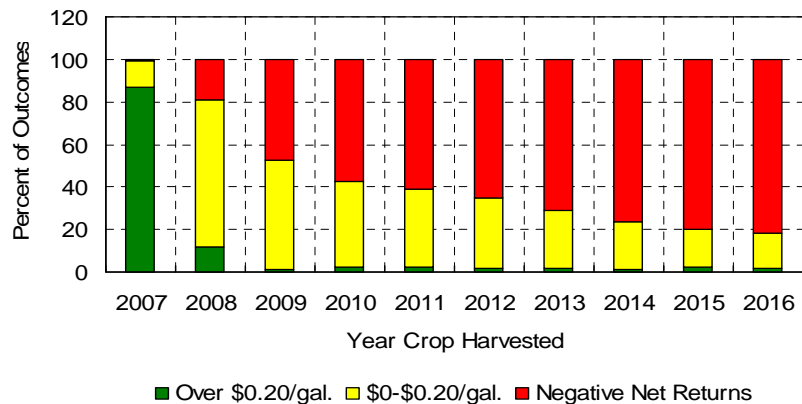


- In contrast to ethanol, net operating returns to biodiesel plants are negative in most of the alternative outcomes after 2009.

- If net returns are as low as projected, further investment may be limited and plants may not operate at full capacity.

- Projected increases in soybean oil prices are a major cause of the unfavorable outlook for biodiesel returns.

Biodiesel Returns over Operating Costs

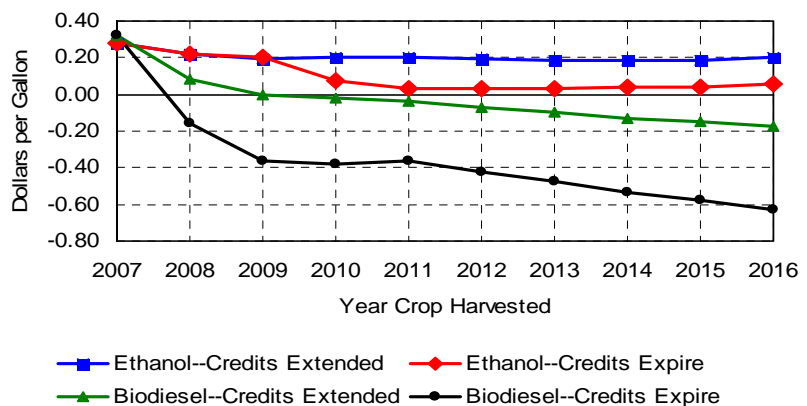


- The federal biodiesel and ethanol tax credits are scheduled to expire at the end of 2008 and 2010, respectively.

- If the credits expire as scheduled, the result would be lower returns to biofuel producers, less biofuel production, and lower prices for corn, soybean oil, and many other agricultural commodities.

- Unless otherwise noted, figures in this publication assume tax credits are extended.

Biofuel Returns over Operating Costs





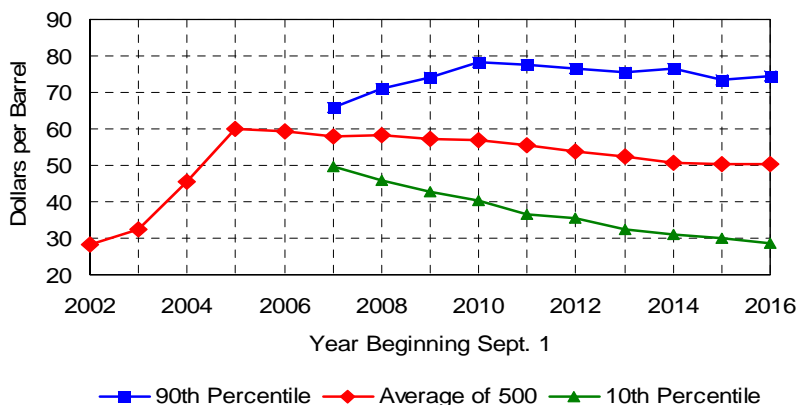
# Assumptions

- Global Insight, Inc. forecasts petroleum prices will decline by about \$10 per barrel between 2006 and 2016.

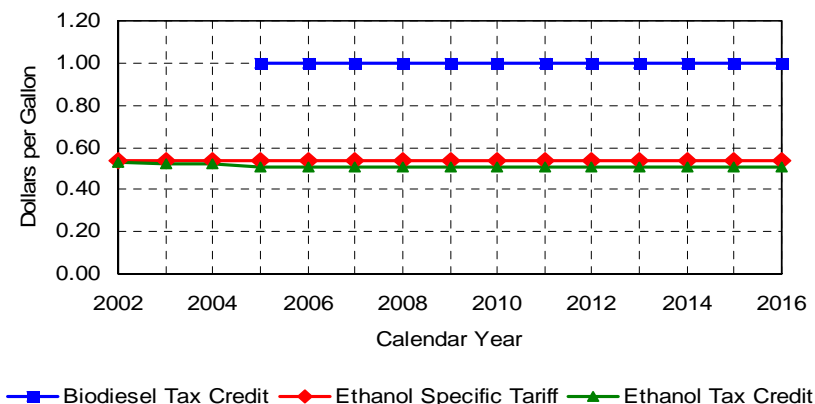
- The analysis uses 500 alternative paths for petroleum prices, approximately centered on the Global Insight forecast.

- The West Texas Intermediate price that corresponds with the NYMEX futures price typically runs about \$6 per barrel higher than the refiners' acquisition price.

Petroleum Refiners' Acquisition Price



Biofuel Tax and Tariff Provisions

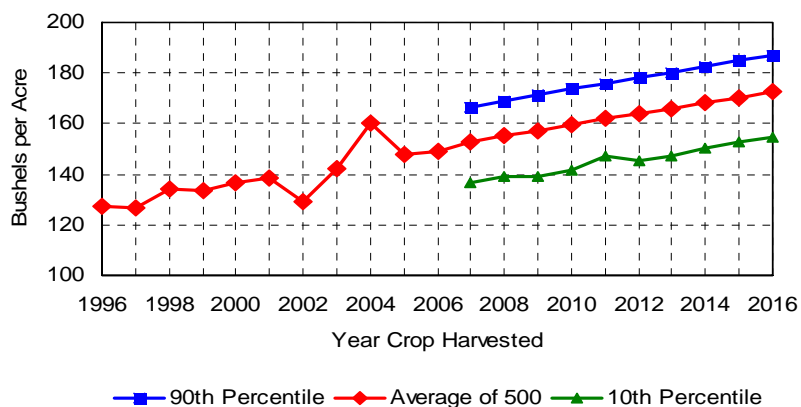


- The baseline assumes that biofuel tax and tariff provisions are extended when they would otherwise expire.

- The ethanol tariff and the biodiesel tax credit are due to expire at the end of 2008. The ethanol tax credit is scheduled to expire at the end of 2010.

- An alternative scenario, where the tax provisions expire as scheduled, is shown beginning on page 21.

Corn Yield per Harvested Acre



- Technology is assumed to evolve in line with past trends. Average crop yields, for example, increase at a pace consistent with trends of the last 20-25 years.

- As with petroleum prices, the analysis uses 500 alternative paths for crop yields and a variety of other factors that affect agricultural market supply and demand.

- The analysis does not assume large technological breakthroughs that would alter recent trends.

## U.S. Macroeconomic Assumptions

Calendar Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
(Percentage Change)											
Real GDP	3.3	2.3	3.2	3.4	3.2	2.8	2.4	2.5	2.7	2.8	2.9
Population Growth	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8
CPI, All Urban Consumers	3.2	1.8	2.1	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
PPI, All Commodities	4.7	2.6	1.8	0.4	0.3	0.4	0.1	0.4	0.6	0.7	0.7
Wages & Salaries	2.9	2.8	2.9	3.3	3.4	3.3	3.2	3.0	2.8	2.8	2.7
(Percent)											
Unemployment Rate	4.6	4.9	4.9	4.6	4.4	4.4	4.5	4.8	4.9	4.9	4.9
3-Month Treasury Bill Rate	4.7	4.6	4.4	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
AAA Bond Rate	5.6	5.3	5.7	6.4	6.5	6.5	6.5	6.5	6.5	6.5	6.5
(Dollars per Barrel)											
Petroleum Prices											
West Texas Intermediate	66.15	64.04	63.83	63.38	62.97	61.99	60.44	58.72	56.97	55.95	55.64
Refiners' Acquisition Cost	60.44	58.44	58.14	57.71	57.49	56.57	55.05	53.36	51.63	50.59	50.25
(Index, 2000=100)											
Inflation-Adj. Exch. Rate											
vs. Major Trading Partners	80.2	75.0	72.7	71.4	72.7	73.7	74.1	73.8	72.9	71.9	70.9
vs. Other Trading Partners	86.8	82.1	79.6	76.6	74.7	73.1	72.1	71.0	70.0	69.1	68.2
(Percentage Change)											
Foreign Real GDP Growth											
Major Trading Partners	2.7	2.2	2.4	2.5	2.4	2.3	2.2	2.1	2.1	2.0	2.0
Other Trading Partners	5.6	5.1	5.0	4.9	4.8	4.6	4.5	4.3	4.3	4.1	4.2

Source: Global Insight. Petroleum prices reflect an average of 500 alternatives approximately centered on Global Insight forecasts.

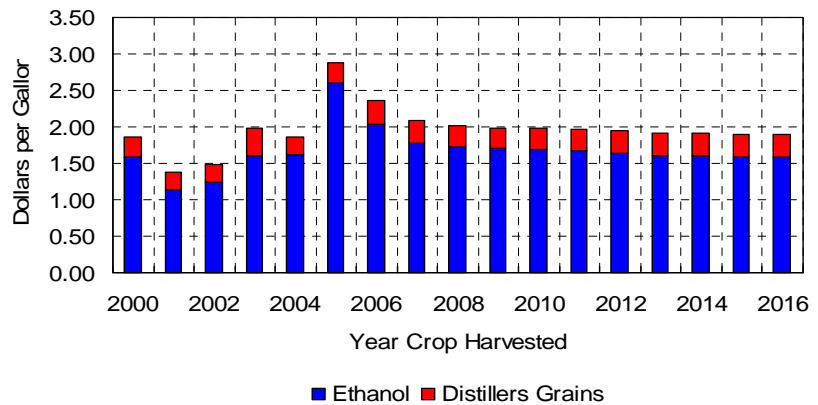
## Yield Assumptions

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
(Bushels per Acre)											
<b>Crop Yields</b>											
Corn	149.1	152.9	155.1	157.1	159.4	161.9	163.9	166.0	168.4	170.4	172.6
Soybeans	42.7	41.3	41.7	42.1	42.6	43.0	43.5	43.9	44.4	44.9	45.3
Wheat	38.7	42.1	42.4	42.7	43.0	43.3	43.6	43.9	44.3	44.6	44.9
Sorghum	56.2	63.9	64.1	64.4	64.5	64.7	65.1	65.2	65.4	65.7	65.9
(Gallons per Bushel of Corn)											
<b>Ethanol Yields</b>											
Dry Mill Ethanol	2.73	2.75	2.76	2.78	2.79	2.81	2.82	2.84	2.85	2.87	2.88
Wet Mill Ethanol	2.69	2.69	2.70	2.71	2.72	2.72	2.73	2.74	2.75	2.75	2.76
(Pounds per per Bushel of Corn)											
<b>Corn Coproduct Yields</b>											
Dry Mill Distillers Grain	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Wet Mill Corn Gluten Feed	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Wet Mill Corn Gluten Meal	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Wet Mill Corn Oil	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
(Pounds per Gallon of Biodiesel)											
<b>Biodiesel Yield</b>											
Soybean Oil (Crude)	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
(Pounds per Bushel of Soybeans)											
<b>Soybean Crushing Yields</b>											
Soybean Meal	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7
Soybean Oil	11.3	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4

# Ethanol Returns

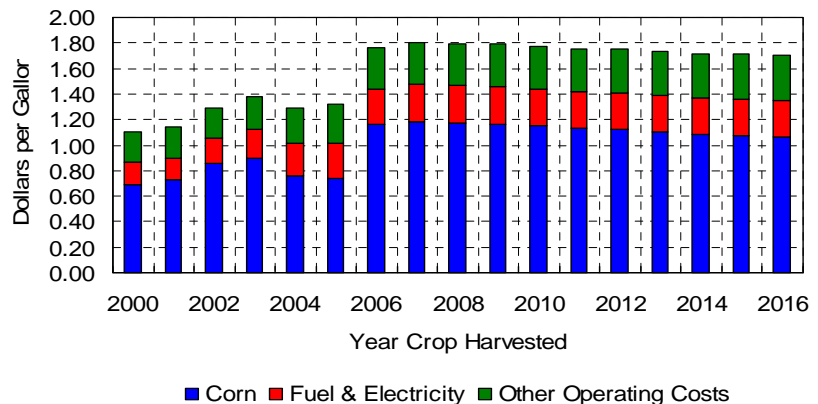
- The principal products of a dry mill plant are ethanol and distillers grains.
- Between 2000 and 2005, ethanol accounted for about 85% of the combined value of the two products at a typical plant.
- Projected ethanol prices decline because of increasing ethanol production and lower petroleum prices.

Ethanol Dry Mill Receipts



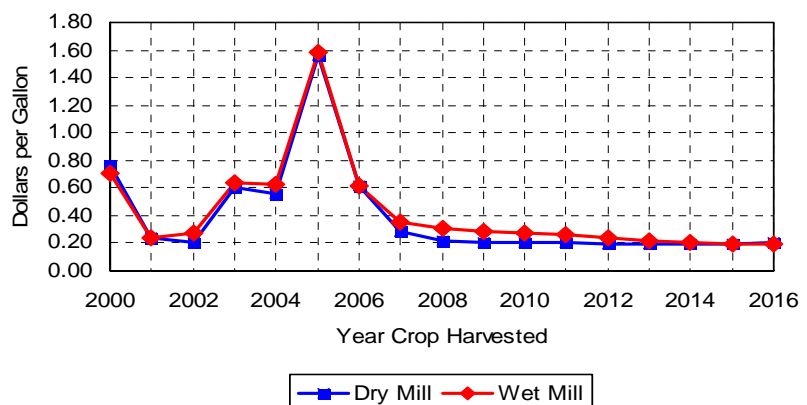
- Corn accounts for most of the operating costs of a dry mill ethanol plant. Higher corn prices explain the large increase in operating costs in 2006/07.
- Fuel, electricity, and other operating costs average about \$0.60 per gallon for a typical dry mill plant, but there is considerable variation across plants and time.
- Operating costs do not include the cost of capital and other fixed costs.

Ethanol Dry Mill Operating Costs



- Wet mill plants generate a wider range of coproducts including corn gluten feed, corn gluten meal and corn oil.
- Recent and projected net returns over operating costs show similar patterns for the two types of plants.
- Net operating returns have been marginally greater for wet mill plants in many years, but wet mill plants also cost more to build. Most new facilities are dry mill plants.

Dry and Wet Mill Returns over Operating Costs



## Dry Mill Ethanol Plant Net Returns over Operating Costs, 2007/08

	Corn Price (Dollars per Bushel)												
	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00
Ethanol Price	(Dollars per Gallon)												
1.25	0.07	0.01	-0.06	-0.12	-0.19	-0.25	-0.31	-0.38	-0.44	-0.51	-0.57	-0.64	-0.70
1.30	0.12	0.06	-0.01	-0.07	-0.14	-0.20	-0.26	-0.33	-0.39	-0.46	-0.52	-0.59	-0.65
1.35	0.17	0.11	0.04	-0.02	-0.09	-0.15	-0.21	-0.28	-0.34	-0.41	-0.47	-0.54	-0.60
1.40	0.22	0.16	0.09	0.03	-0.04	-0.10	-0.16	-0.23	-0.29	-0.36	-0.42	-0.49	-0.55
1.45	0.27	0.21	0.14	0.08	0.01	-0.05	-0.11	-0.18	-0.24	-0.31	-0.37	-0.44	-0.50
1.50	0.32	0.26	0.19	0.13	0.06	0.00	-0.06	-0.13	-0.19	-0.26	-0.32	-0.39	-0.45
1.55	0.37	0.31	0.24	0.18	0.11	0.05	-0.01	-0.08	-0.14	-0.21	-0.27	-0.34	-0.40
1.60	0.42	0.36	0.29	0.23	0.16	0.10	0.04	-0.03	-0.09	-0.16	-0.22	-0.29	-0.35
1.65	0.47	0.41	0.34	0.28	0.21	0.15	0.09	0.02	-0.04	-0.11	-0.17	-0.24	-0.30
1.70	0.52	0.46	0.39	0.33	0.26	0.20	0.14	0.07	0.01	-0.06	-0.12	-0.19	-0.25
1.75	0.57	0.51	0.44	0.38	0.31	0.25	0.19	0.12	0.06	-0.01	-0.07	-0.14	-0.20
1.80	0.62	0.56	0.49	0.43	0.36	0.30	0.24	0.17	0.11	0.04	-0.02	-0.09	-0.15
1.85	0.67	0.61	0.54	0.48	0.41	0.35	0.29	0.22	0.16	0.09	0.03	-0.04	-0.10
1.90	0.72	0.66	0.59	0.53	0.46	0.40	0.34	0.27	0.21	0.14	0.08	0.01	-0.05
1.95	0.77	0.71	0.64	0.58	0.51	0.45	0.39	0.32	0.26	0.19	0.13	0.06	0.00
2.00	0.82	0.76	0.69	0.63	0.56	0.50	0.44	0.37	0.31	0.24	0.18	0.11	0.05
2.05	0.87	0.81	0.74	0.68	0.61	0.55	0.49	0.42	0.36	0.29	0.23	0.16	0.10
2.10	0.92	0.86	0.79	0.73	0.66	0.60	0.54	0.47	0.41	0.34	0.28	0.21	0.15
2.15	0.97	0.91	0.84	0.78	0.71	0.65	0.59	0.52	0.46	0.39	0.33	0.26	0.20
2.20	1.02	0.96	0.89	0.83	0.76	0.70	0.64	0.57	0.51	0.44	0.38	0.31	0.25
2.25	1.07	1.01	0.94	0.88	0.81	0.75	0.69	0.62	0.56	0.49	0.43	0.36	0.30
2.30	1.12	1.06	0.99	0.93	0.86	0.80	0.74	0.67	0.61	0.54	0.48	0.41	0.35
2.35	1.17	1.11	1.04	0.98	0.91	0.85	0.79	0.72	0.66	0.59	0.53	0.46	0.40
2.40	1.22	1.16	1.09	1.03	0.96	0.90	0.84	0.77	0.71	0.64	0.58	0.51	0.45
2.45	1.27	1.21	1.14	1.08	1.01	0.95	0.89	0.82	0.76	0.69	0.63	0.56	0.50
2.50	1.32	1.26	1.19	1.13	1.06	1.00	0.94	0.87	0.81	0.74	0.68	0.61	0.55

Notes: The matrix shows net returns over variable operating costs for various combinations of ethanol and corn prices.

To calculate plant profits, capital and other fixed costs would also need to be subtracted from these figures.

In the red zone, negative numbers indicate the average plant is not able to cover operating costs.

In the yellow zone, net returns over operating costs are less than \$0.20 per gallon, which may be less than required to cover fixed costs.

The matrix assumes DDG prices change with corn prices. For example, a \$3.25/bu. corn price is associated with a \$98/ton DDG price.

Other operating costs (fuel, electricity, labor, etc.) are assumed to average \$0.62 per gallon.

The matrix assumes one bushel of corn yields 2.746 gallons of ethanol and 17 pounds of DDGs.

FAPRI average of 500 outcomes for 2007/08

December 2007 futures, Mar. 23, 2007

Corn price           \$3.23 per bushel  
Ethanol price       \$1.78 per gallon  
Dry mill net return   \$0.28 per gallon

Corn price           \$3.90 per bushel (\$4.10 minus \$0.20 assumed basis)  
Ethanol price       \$1.89 per gallon  
Dry mill net return   \$0.22 per gallon

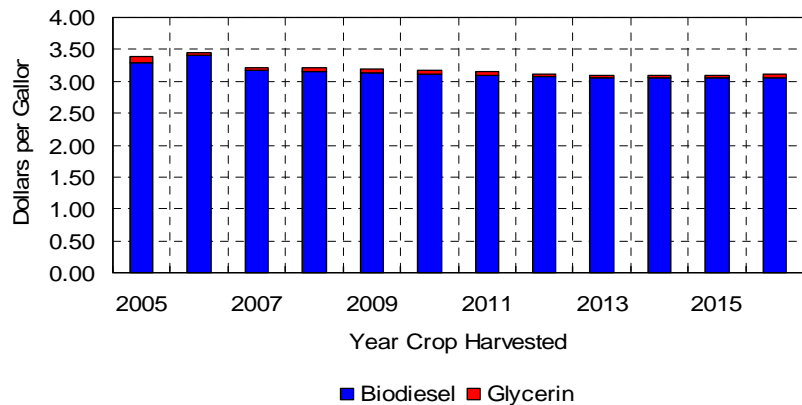
## Distribution of Dry Mill Ethanol Plant Net Returns over Operating Costs

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
Proportion of Stochastic Outcomes	(Percent)										
Negative Net Returns	0.0	0.0	0.0	1.4	2.0	1.4	1.2	2.6	3.0	1.8	1.2
\$0.00-\$0.20 per Gallon	0.0	30.6	54.4	60.6	60.4	60.8	62.0	62.4	62.0	62.2	61.4
Over \$0.20 per Gallon	100.0	69.4	45.6	38.0	37.6	37.8	36.8	35.0	35.0	36.0	37.4

# Biodiesel Returns

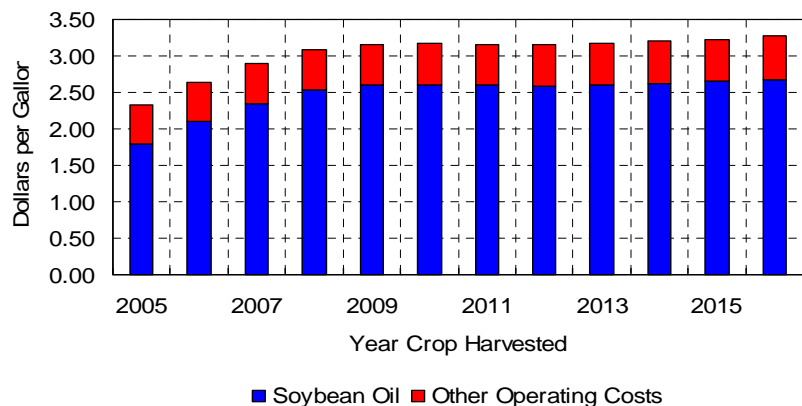
- The principal products of a typical biodiesel plant are biodiesel and glycerin.
- Because of market oversupply, glycerin prices have declined sharply. Biodiesel accounts for almost all of the revenue of a typical biodiesel plant.
- These calculations focus on a biodiesel facility and do not consider costs and returns for a facility that also crushes soybeans.

Biodiesel Plant Receipts



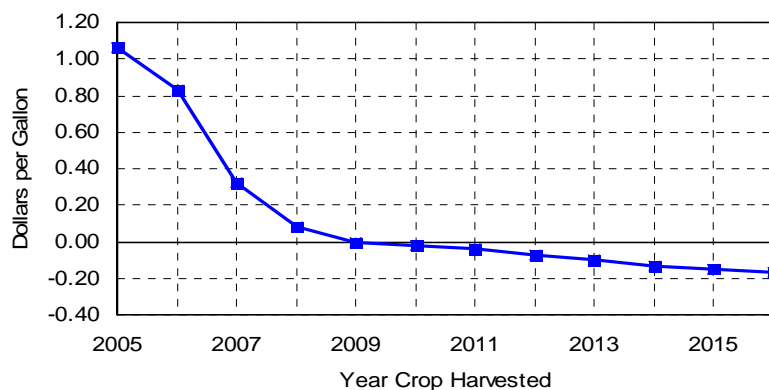
- Soybean oil accounts for a larger share of the operating costs of a biodiesel plant than corn's share of operating costs for an ethanol plant.
- Fuel, electricity, and other operating costs average about \$0.53 per gallon for a typical biodiesel plant, but there is considerable variation across plants and time.
- Operating costs do not include the cost of capital and other fixed costs.

Biodiesel Plant Operating Costs



- Biodiesel returns over operating costs were strongly positive for plants operating in 2005/06.
- The projected decline in net returns is primarily explained by increasing prices for soybean oil and other vegetable oils.
- If average net returns over operating costs actually prove to be negative, new investment is likely to slow and a significant portion of existing capacity may be idled.

Biodiesel Returns over Operating Costs



## Biodiesel Plant Net Returns over Operating Costs, 2007/08

	Soybean Oil Price (Dollars per Pound)												
	0.20	0.22	0.24	0.26	0.28	<b>0.30</b>	0.32	0.34	0.36	0.38	0.40	0.42	0.44
Biodiesel Price	(Dollars per Gallon)												
2.50	0.47	0.32	0.16	0.01	-0.15	-0.30	-0.45	-0.61	-0.76	-0.92	-1.07	-1.22	-1.38
2.55	0.52	0.37	0.21	0.06	-0.10	-0.25	-0.40	-0.56	-0.71	-0.87	-1.02	-1.17	-1.33
2.60	0.57	0.42	0.26	0.11	-0.05	-0.20	-0.35	-0.51	-0.66	-0.82	-0.97	-1.12	-1.28
2.65	0.62	0.47	0.31	0.16	0.00	-0.15	-0.30	-0.46	-0.61	-0.77	-0.92	-1.07	-1.23
2.70	0.67	0.52	0.36	0.21	0.05	-0.10	-0.25	-0.41	-0.56	-0.72	-0.87	-1.02	-1.18
2.75	0.72	0.57	0.41	0.26	0.10	-0.05	-0.20	-0.36	-0.51	-0.67	-0.82	-0.97	-1.13
2.80	0.77	0.62	0.46	0.31	0.15	0.00	-0.15	-0.31	-0.46	-0.62	-0.77	-0.92	-1.08
2.85	0.82	0.67	0.51	0.36	0.20	0.05	-0.10	-0.26	-0.41	-0.57	-0.72	-0.87	-1.03
2.90	0.87	0.72	0.56	0.41	0.25	0.10	-0.05	-0.21	-0.36	-0.52	-0.67	-0.82	-0.98
2.95	0.92	0.77	0.61	0.46	0.30	0.15	0.00	-0.16	-0.31	-0.47	-0.62	-0.77	-0.93
3.00	0.97	0.82	0.66	0.51	0.35	0.20	0.05	-0.11	-0.26	-0.42	-0.57	-0.72	-0.88
3.05	1.02	0.87	0.71	0.56	0.40	0.25	0.10	-0.06	-0.21	-0.37	-0.52	-0.67	-0.83
3.10	1.07	0.92	0.76	0.61	0.45	0.30	0.15	-0.01	-0.16	-0.32	-0.47	-0.62	-0.78
<b>3.15</b>	1.12	0.97	0.81	0.66	0.50	<b>0.35</b>	<b>0.20</b>	<b>0.04</b>	-0.11	-0.27	-0.42	-0.57	-0.73
3.20	1.17	1.02	0.86	0.71	0.55	0.40	0.25	0.09	-0.06	-0.22	-0.37	-0.52	-0.68
3.25	1.22	1.07	0.91	0.76	0.60	0.45	0.30	0.14	-0.01	-0.17	-0.32	-0.47	-0.63
3.30	1.27	1.12	0.96	0.81	0.65	0.50	0.35	0.19	0.04	-0.12	-0.27	-0.42	-0.58
3.35	1.32	1.17	1.01	0.86	0.70	0.55	0.40	0.24	0.09	-0.07	-0.22	-0.37	-0.53
3.40	1.37	1.22	1.06	0.91	0.75	0.60	0.45	0.29	0.14	-0.02	-0.17	-0.32	-0.48
3.45	1.42	1.27	1.11	0.96	0.80	0.65	0.50	0.34	0.19	0.03	-0.12	-0.27	-0.43
3.50	1.47	1.32	1.16	1.01	0.85	0.70	0.55	0.39	0.24	0.08	-0.07	-0.22	-0.38
3.55	1.52	1.37	1.21	1.06	0.90	0.75	0.60	0.44	0.29	0.13	-0.02	-0.17	-0.33
3.60	1.57	1.42	1.26	1.11	0.95	0.80	0.65	0.49	0.34	0.18	0.03	-0.12	-0.28
3.65	1.62	1.47	1.31	1.16	1.00	0.85	0.70	0.54	0.39	0.23	0.08	-0.07	-0.23
3.70	1.67	1.52	1.36	1.21	1.05	0.90	0.75	0.59	0.44	0.28	0.13	-0.02	-0.18
3.75	1.72	1.57	1.41	1.26	1.10	0.95	0.80	0.64	0.49	0.33	0.18	0.03	-0.13

Notes: The matrix shows net returns over variable operating costs for various combinations of biodiesel and soybean oil prices. To calculate plant profits, capital and other fixed costs would also need to be subtracted from these figures. In the red zone, negative numbers indicate the average plant is not able to cover operating costs. In the yellow zone, net returns over operating costs are less than \$0.20 per gallon, which may be less than required to cover fixed costs. The matrix assumes glycerin is valued at \$0.05 per gallon of biodiesel. Other operating costs (fuel, electricity, labor, etc.) are assumed to average \$0.54 per gallon. The matrix assumes 7.7 pounds of crude soybean oil are required to produce one gallon of biodiesel.

### FAPRI average of 500 outcomes for 2007/08

Soybean oil price     \$0.307 per pound  
 Biodiesel price       \$3.17 per gallon  
 Plant net return       \$0.32 per gallon

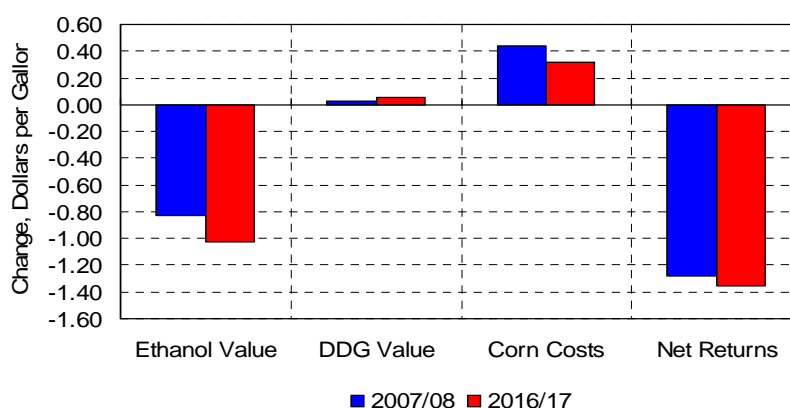
## Distribution of Biodiesel Plant Net Returns over Operating Costs

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
Proportion of Stochastic Outcomes	(Percent)										
Negative Net Returns	0.0	0.4	19.2	47.6	57.2	61.2	65.0	71.0	76.6	79.8	81.4
\$0.00-\$0.20 per Gallon	0.0	12.8	69.2	51.0	40.4	36.2	33.4	27.0	22.4	18.0	17.0
Over \$0.20 per Gallon	100.0	86.8	11.6	1.4	2.4	2.6	1.6	2.0	1.0	2.2	1.6

# Accounting for Low Biofuel Returns

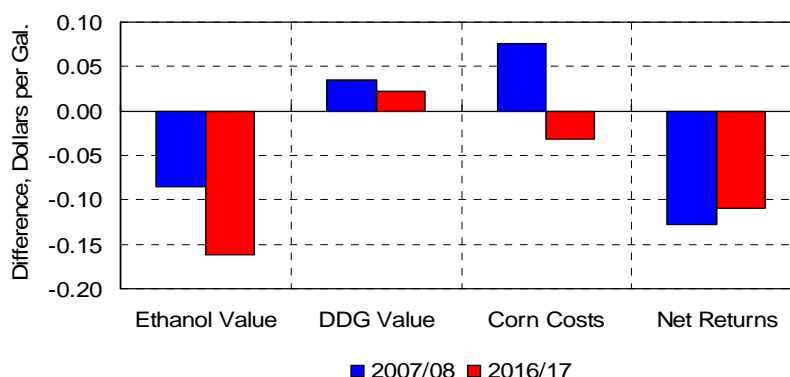
- Ethanol dry mill returns over operating costs decline dramatically from the record 2005/06 level of \$1.56 per gallon.
- Reductions in projected ethanol prices account for most of the decline in net returns.
- Higher corn costs account for about one-third of the decline in dry mill net returns between 2005/06 and 2007/08.

Ethanol Returns and Costs vs. 2005/06



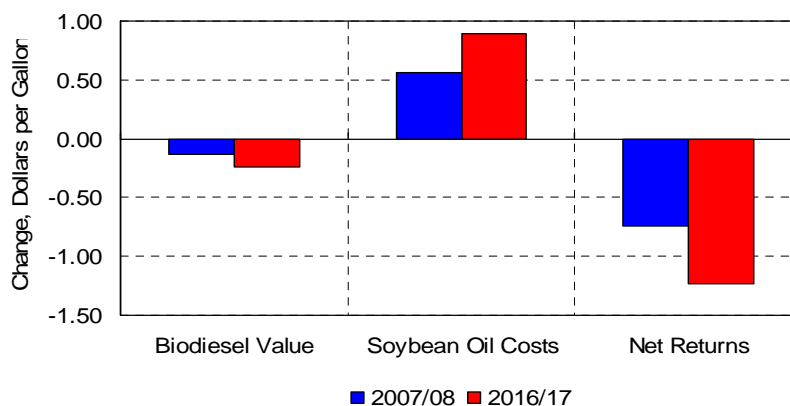
- For any given year, dry mill net returns differ across stochastic outcomes.
- Ethanol values are lower and corn costs are higher in the 2007/08 outcomes where net returns are less than \$0.20 per gallon than in the average of all 500 outcomes for 2007/08.
- In later years, corn prices tend to be below average in the outcomes where ethanol returns are below average. Low returns result in less ethanol production, which in turn reduces demand for corn.

Ethanol Returns and Costs: Low Returns vs. Avg.  
(Outcomes with Net Returns < \$0.20/Gallon vs. All Outcomes)



Biodiesel Returns and Costs vs. 2005/06

- Biodiesel net returns also decline sharply from record 2005/06 levels.
- In contrast to ethanol, most of the reduction in biodiesel returns can be explained by projected increases in feedstock (vegetable oil) prices, rather than by reductions in biodiesel prices.
- The increase in soybean oil costs is due to a number of factors, including acreage shifts away from soybeans and strong demand in Europe for vegetable oil to feed Europe's growing biodiesel industry.



## Dry Mill Ethanol Plant Returns and Operating Costs

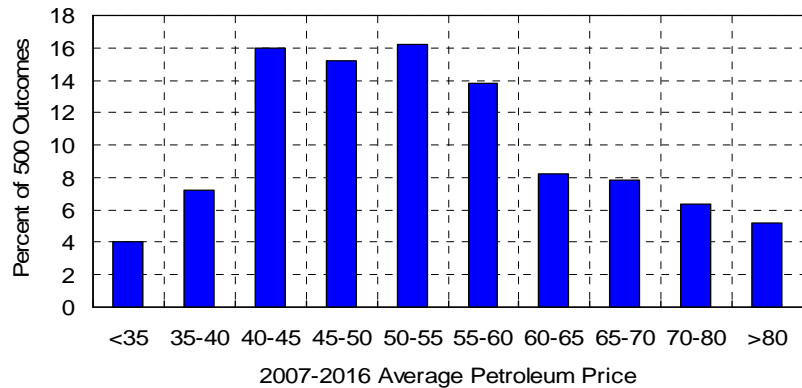
Crop Year	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
<b>Average Results</b>	(Dollars per Gallon)											
Value of Ethanol	2.61	2.03	1.78	1.73	1.70	1.69	1.67	1.64	1.61	1.60	1.58	1.58
Value of Distillers Grains	0.27	0.33	0.30	0.28	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.32
Total Receipts	2.88	2.37	2.08	2.02	1.98	1.97	1.96	1.94	1.92	1.90	1.90	1.90
Cost of Corn	0.74	1.16	1.18	1.17	1.16	1.15	1.13	1.12	1.10	1.08	1.07	1.06
Other Operating Costs	0.58	0.60	0.62	0.63	0.62	0.62	0.62	0.62	0.63	0.63	0.64	0.64
Total Operating Costs	1.32	1.76	1.80	1.80	1.79	1.77	1.75	1.74	1.73	1.72	1.71	1.70
Net Operating Return	1.56	0.61	0.28	0.22	0.20	0.20	0.21	0.19	0.19	0.19	0.19	0.20
<b>Change from 2005/06</b>												
Value of Ethanol		-0.57	-0.83	-0.88	-0.91	-0.92	-0.94	-0.97	-0.99	-1.01	-1.03	-1.03
Value of Distillers Grains		0.06	0.03	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05
Total Receipts		-0.51	-0.80	-0.86	-0.90	-0.90	-0.92	-0.94	-0.96	-0.98	-0.98	-0.98
Cost of Corn		0.42	0.44	0.43	0.43	0.41	0.40	0.38	0.37	0.35	0.33	0.32
Other Operating Costs		0.02	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06
Total Operating Costs		0.44	0.48	0.48	0.47	0.45	0.44	0.42	0.41	0.40	0.39	0.38
Net Operating Return		-0.95	-1.28	-1.34	-1.36	-1.36	-1.35	-1.37	-1.37	-1.37	-1.37	-1.36
<b>Outcomes with Net Returns Less than \$0.20 per Gallon</b>												
Value of Ethanol			1.69	1.63	1.60	1.57	1.53	1.50	1.48	1.45	1.43	1.42
Value of Distillers Grains			0.34	0.30	0.30	0.31	0.31	0.32	0.32	0.33	0.33	0.34
Total Receipts			2.03	1.93	1.90	1.87	1.84	1.82	1.80	1.78	1.77	1.76
Cost of Corn			1.25	1.18	1.16	1.15	1.12	1.10	1.08	1.05	1.04	1.02
Other Operating Costs			0.62	0.63	0.62	0.62	0.62	0.63	0.63	0.64	0.64	0.64
Total Operating Costs			1.88	1.81	1.79	1.77	1.75	1.72	1.71	1.69	1.68	1.67
Net Operating Return			0.15	0.12	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.09
			(Percent)									
Share of 500 Outcomes		0.0	30.6	54.4	62.0	62.4	62.2	63.2	65.0	65.0	64.0	62.6
<b>Difference between Low-Return Outcomes and Average</b>	(Dollars per Gallon)											
Value of Ethanol			-0.08	-0.10	-0.11	-0.12	-0.14	-0.14	-0.13	-0.14	-0.15	-0.16
Value of Distillers Grains			0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Total Receipts			-0.05	-0.08	-0.09	-0.10	-0.12	-0.12	-0.12	-0.13	-0.13	-0.14
Cost of Corn			0.08	0.01	0.00	0.00	-0.01	-0.02	-0.03	-0.03	-0.03	-0.03
Other Operating Costs			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Operating Costs			0.08	0.01	0.00	0.00	-0.01	-0.02	-0.02	-0.03	-0.03	-0.03
Net Operating Return			-0.13	-0.10	-0.09	-0.10	-0.11	-0.10	-0.09	-0.10	-0.10	-0.11



# Petroleum and Biofuel Prices

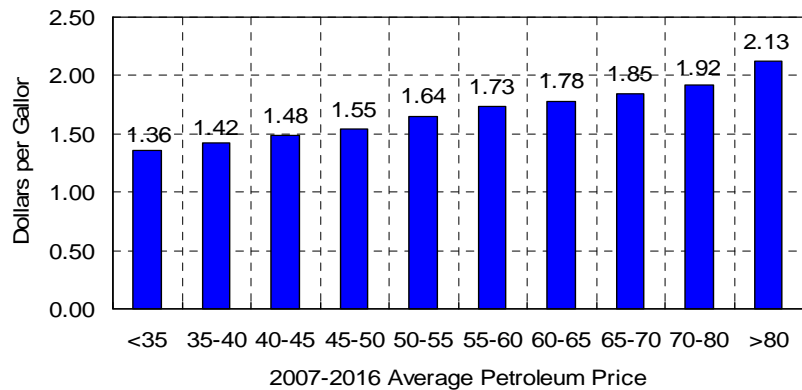
Distribution of 2007-2016 Avg. Petroleum Prices

- The projections look at 500 alternative paths for petroleum prices. Across the 500 outcomes for 2007-2016, the average refiners' acquisition price for petroleum is \$54 per barrel.
- In 4% of the 500 outcomes, the 10-year average price is less than \$35 per barrel. In 5% it is more than \$80.
- In any given year, the range of petroleum prices is even greater than for these 10-year averages.



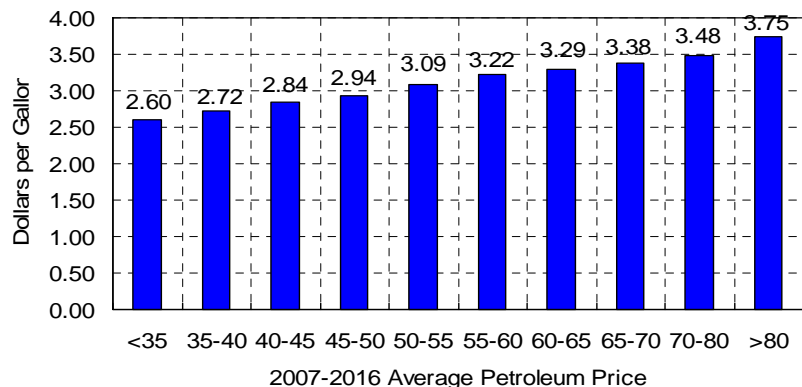
Ethanol Price, FOB Omaha, 2007-2016 Avg.

- All else equal, higher petroleum prices are associated with higher ethanol prices.
- The 10-year average ethanol price, FOB Omaha, across all 500 outcomes is \$1.66 per gallon.
- Ethanol prices depend on more than petroleum prices. For example, increases in ethanol supplies may cause ethanol prices to decline relative to gasoline and petroleum prices.



Biodiesel Price, Plant, 2007-2016 Avg.

- As with ethanol, higher petroleum prices are associated with higher biodiesel prices.
- The 10-year average biodiesel price at the plant across all 500 outcomes is \$3.10 per gallon.
- For both ethanol and biodiesel, these results assume extension of the federal tax credits that support producer biofuel prices and returns.



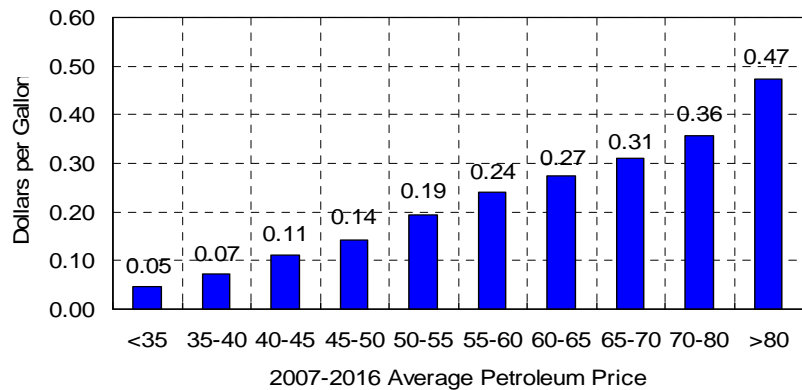
# Petroleum Prices and Market Effects

- Higher petroleum prices are associated with higher ethanol prices and greater net returns over operating costs for ethanol plants.

- A \$0.01 per gallon difference in average ethanol prices corresponds to a smaller absolute difference in average net returns.

- This occurs because production costs for fuel and feedstocks also tend to increase when petroleum prices increase.

Ethanol Net Operating Returns, 2007-2016 Avg.



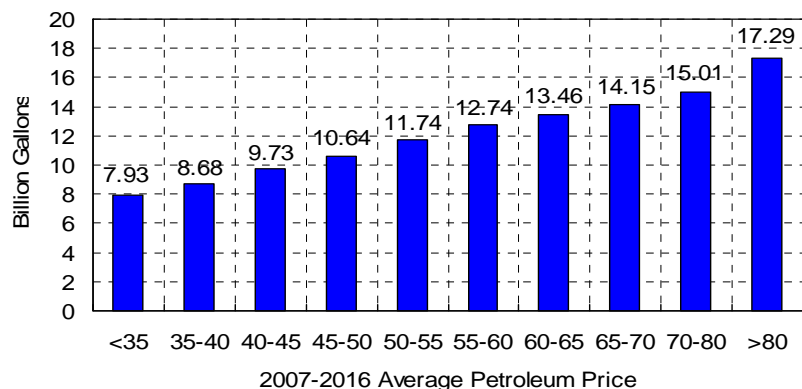
- Higher petroleum prices and ethanol plant net returns are associated with greater levels of ethanol production.

- The 10-year average annual level of ethanol production is 11.8 billion gallons.

- Ethanol production is more than twice as great when average petroleum prices are over \$80 per barrel as when they are under \$35 per barrel.

- The difference is even greater near the end of the 10-year projection, when capacity has time to adjust.

Ethanol Production, 2007-2016 Avg.

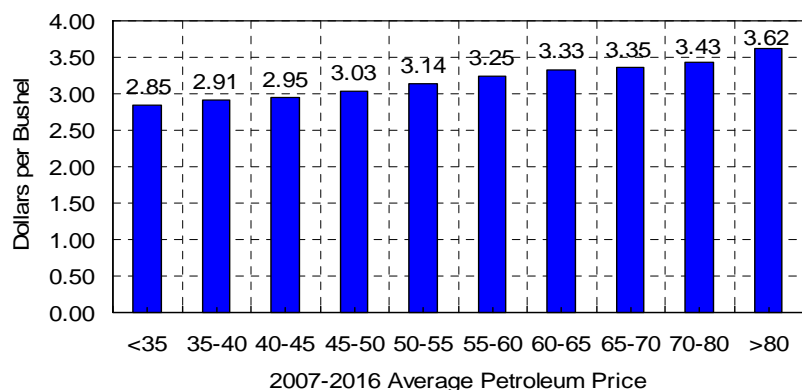


- Higher petroleum prices result in more ethanol use of corn and higher corn production costs, both of which contribute to higher corn prices.

- The average projected corn price across 500 outcomes for 2007-2016 is \$3.15 per bushel.

- Weather, export demand and other factors also affect corn prices.

Corn Prices, 2007-2016 Avg.



# Appendix: Excerpts from U.S. Briefing Book

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The following tables are excerpts from the *FAPRI U.S. Baseline Briefing Book*, FAPRI-UMC report #02-07 ([www.fapri.missouri.edu/outreach/publications/2007/FAPRI UMC Report 02 07.pdf](http://www.fapri.missouri.edu/outreach/publications/2007/FAPRI_UMC_Report_02_07.pdf)). The briefing book provides additional tables, graphs and explanations of the results.

The baseline was prepared in January and February 2007 based on information available in mid-January 2007. Many results of the baseline have significant implications for biofuel producer returns.

- The increase in ethanol production results in higher prices for corn and more corn production.
- Corn area expands at the expense of soybeans and other crops, which in turn contributes to higher prices for those grains and oilseeds.
- Underlying export demand for corn, soybean oil, and other commodities remains strong, in part because of biofuel expansion in Europe and other countries. After an initial decline because of rising prices, U.S. corn and soybean oil exports increase in spite of prices that remain high by historical standards.
- Higher feed costs slow the rate of growth in production of beef, pork, poultry, and dairy products.
- Distillers grain prices are pulled higher by high grain prices and lower by large supplies of distillers grains and low protein meal prices. Distiller grain prices dip initially, but then recover relative to corn.
- Soybean meal prices are pulled higher by reduced soybean production, but lower by competition from distillers grains and by increased crush to supply soybean oil. The last two effects dominate the first, and soybean meal prices remain weak throughout the baseline.
- Soybean oil prices are pulled higher by reduced soybean production, the impact of weak soybean meal prices on soybean crush, and the demand for vegetable oil to supply biodiesel plants in the United States and Europe.

## U.S. Corn Supply and Utilization

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
<b>Area</b> (Million Acres)											
Base Area	87.6	87.6	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7
Planted Area	78.3	86.7	89.7	89.8	90.0	90.1	90.1	90.0	89.8	89.6	89.4
Harvested Area	70.6	79.4	82.4	82.5	82.8	82.9	82.9	82.8	82.7	82.5	82.4
<b>Yield</b> (Bushels per Acre)											
Actual	149.1	152.9	155.1	157.1	159.4	161.9	163.9	166.0	168.4	170.4	172.6
Program, Direct	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3
Program, CCP	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3
<b>Supply</b> (Million Bushels)											
Beginning Stocks	1,967	760	837	1,004	1,024	1,049	1,093	1,131	1,168	1,233	1,262
Production	10,535	12,148	12,792	12,972	13,207	13,427	13,600	13,754	13,936	14,054	14,227
Imports	10	10	10	10	10	10	10	10	10	10	10
<b>Domestic Use</b>											
Feed, Residual	5,941	5,687	5,650	5,626	5,676	5,729	5,775	5,816	5,858	5,902	5,952
Fuel Alcohol	2,183	3,160	3,845	4,139	4,188	4,180	4,165	4,142	4,129	4,126	4,128
HFCS	521	523	525	528	531	534	537	540	542	545	547
Seed	22	23	23	23	23	23	23	23	23	23	23
Food, Other	835	842	849	855	862	869	876	883	889	896	902
<b>Exports</b>											
	2,249	1,846	1,743	1,790	1,912	2,060	2,197	2,323	2,440	2,543	2,635
<b>Total Use</b>											
	11,752	12,081	12,635	12,962	13,192	13,394	13,572	13,727	13,881	14,036	14,187
<b>Ending Stocks</b>											
CCC Inventory	0	0	0	0	0	0	0	0	0	0	0
Under Loan	48	60	64	65	69	74	80	85	95	98	103
Other Stocks	712	777	940	959	980	1,018	1,051	1,083	1,138	1,164	1,208
<b>Prices and Returns</b> (Dollars)											
Farm Price/bu.	3.17	3.23	3.22	3.23	3.21	3.18	3.16	3.13	3.09	3.06	3.04
Loan Rate/bu.	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
Average LDP Rate/bu.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Target Price/bu.	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
CCP Rate/bu.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Direct Payment/bu.	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Gross Market Revenue/a.	472.15	490.68	497.43	504.42	509.34	512.16	514.90	516.53	516.91	518.48	522.09
LDP Revenue/a.	0.04	0.01	0.02	0.00	0.03	0.08	0.13	0.08	0.26	0.27	0.26
Variable Expenses/a.	212.14	220.84	228.19	231.22	233.78	236.63	238.77	242.04	245.77	250.06	254.34
Mkt + LDP Net Returns/a.	260.05	269.85	269.25	273.20	275.60	275.61	276.26	274.57	271.40	268.69	268.01
CCP Revenue/Base a.	0.00	0.01	0.05	0.00	0.06	0.13	0.23	0.18	0.49	0.47	0.45
Direct Payment/Base a.	24.35	24.35	24.35	24.35	24.35	24.35	24.35	24.35	24.35	24.35	24.35

## U.S. Ethanol and Coproduct Supply and Utilization

Calendar or Crop Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<b>Ethanol</b>											
	(Million Gallons, Calendar Year)										
Production	4,856	7,057	9,560	11,178	11,849	12,021	12,106	12,226	12,398	12,604	12,848
From Corn	4,692	6,845	9,294	10,873	11,518	11,661	11,692	11,702	11,707	11,740	11,797
From Other Feedstocks	165	211	262	292	304	305	305	305	304	304	304
Cellulosic	0	0	3	13	27	54	109	220	387	560	746
Net Imports (Ethyl Alcohol)	679	238	290	292	299	305	311	317	326	333	338
Disappearance	5,370	7,234	9,692	11,369	12,102	12,312	12,410	12,534	12,712	12,924	13,171
Ending Stocks	399	460	618	718	764	777	785	794	806	819	834
Renewable Fuel Mandate	4,000	4,700	5,400	6,100	6,800	7,400	7,500	7,588	7,675	7,761	7,847
Production Capacity, Jan. 1	4,336	5,386	8,867	11,868	13,670	14,302	14,568	14,813	15,125	15,430	15,698
<b>Fuel Prices</b>											
	(Dollars per Barrel, Calendar Year)										
Petroleum, Ref. Acquisition	60.44	58.44	58.14	57.71	57.49	56.57	55.05	53.36	51.63	50.59	50.25
Petroleum, W. TX Interm.	66.15	64.04	63.83	63.38	62.97	61.99	60.44	58.72	56.97	55.95	55.64
	(Dollars per Gallon, Calendar Year)										
Unl. Gasoline, FOB Omaha	1.94	1.95	1.96	1.95	1.94	1.91	1.88	1.83	1.80	1.77	1.76
Unl. Gasoline, Retail	2.59	2.58	2.59	2.58	2.57	2.55	2.52	2.48	2.45	2.42	2.42
Ethanol, FOB Omaha	2.58	1.95	1.76	1.72	1.70	1.68	1.66	1.63	1.61	1.59	1.58
Ethanol, Tax Credit	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Ethanol, Implied Retail	2.72	2.06	1.88	1.84	1.82	1.81	1.79	1.77	1.75	1.73	1.72
Ethanol/Gas Retail Ratio	105.0%	80.1%	72.7%	71.4%	70.9%	71.0%	71.1%	71.2%	71.4%	71.4%	71.4%
<b>Distillers, Brewers Grains</b>											
	(Thousand Tons, Sep.-Aug. Year)										
Production (Dry Equivalent)	16,025	23,700	29,060	31,596	32,127	32,198	32,197	32,153	32,177	32,286	32,416
Domestic Use	14,677	22,213	27,430	29,856	30,276	30,227	30,101	29,943	29,847	29,844	29,874
Net Exports	1,348	1,487	1,630	1,741	1,850	1,971	2,096	2,210	2,330	2,442	2,541
	(Dollars per Ton, Sep.-Aug. Year)										
Price, Lawrenceburg, IN	107.54	97.35	92.09	91.86	94.05	96.26	98.84	101.28	103.22	105.83	108.94
<b>Corn Gluten Feed</b>											
	(Thousand Tons, Sep.-Aug. Year)										
Production	9,079	9,533	9,883	9,894	9,860	9,805	9,762	9,709	9,656	9,614	9,567
Domestic Use	6,293	6,719	7,056	7,078	7,062	7,025	7,001	6,965	6,928	6,906	6,879
Net Exports	2,787	2,814	2,826	2,816	2,798	2,781	2,761	2,743	2,727	2,709	2,687
	(Dollars per Ton, Sep.-Aug. Year)										
Price, 21%, IL Points	79.70	79.04	77.45	77.07	76.96	76.63	76.78	76.48	75.78	75.44	75.49
<b>Corn Gluten Meal</b>											
	(Thousand Tons, Sep.-Aug. Year)										
Production	2,389	2,509	2,601	2,604	2,595	2,580	2,569	2,555	2,541	2,530	2,518
Domestic Use	1,389	1,503	1,587	1,583	1,568	1,548	1,532	1,513	1,493	1,477	1,459
Net Exports	1,000	1,005	1,014	1,020	1,026	1,032	1,036	1,042	1,048	1,053	1,058
	(Dollars per Ton, Sep.-Aug. Year)										
Price, 60%, IL Points	273.81	281.97	277.60	271.60	267.34	264.33	263.58	259.68	253.73	248.01	243.93
<b>Corn Oil</b>											
	(Million Pounds, Oct.-Sep. Year)										
Production	2,494	2,619	2,715	2,718	2,709	2,694	2,682	2,667	2,653	2,641	2,628
Domestic Use	1,775	1,901	2,001	2,001	1,986	1,966	1,951	1,933	1,917	1,903	1,889
Net Exports	731	724	719	719	723	727	731	734	737	739	741
Ending Stocks	124	118	113	111	111	112	112	111	110	108	106
	(Cents per Pound, Oct.-Sep. Year)										
Chicago Price	28.93	32.26	34.97	35.82	35.84	35.60	35.59	35.65	35.92	36.14	36.57

## U.S. Corn Processing

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
<b>Corn Food, Industrial Use</b>											
	(Million Bushels)										
Fuel Alcohol	2,183	3,160	3,845	4,139	4,188	4,180	4,165	4,142	4,129	4,126	4,128
HFCS	521	523	525	528	531	534	537	540	542	545	547
Glucose and Dextrose	235	238	239	240	241	242	243	244	245	246	246
Starch	275	277	280	282	285	287	290	292	295	298	300
Beverage Alcohol	135	136	137	138	140	141	142	144	145	146	147
Cereals and Other	189	191	193	195	197	199	201	202	204	206	208
Total	3,539	4,525	5,219	5,522	5,581	5,582	5,577	5,565	5,560	5,568	5,577
<b>Corn Dry Milling</b>											
Corn Dry Milled for Ethanol	1,757	2,661	3,293	3,591	3,655	3,664	3,664	3,659	3,662	3,675	3,691
(Share of Total Ethanol)	80.5%	84.2%	85.6%	86.8%	87.3%	87.6%	88.0%	88.3%	88.7%	89.1%	89.4%
Yields per Bushel of Corn											
	(Units per Bushel)										
Ethanol (Gallons)	2.73	2.75	2.76	2.78	2.79	2.81	2.82	2.84	2.85	2.87	2.88
Distillers Grains (Pounds)	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
Costs and Returns											
	(Dollars per Gallon)										
Ethanol Value	2.03	1.78	1.73	1.70	1.69	1.67	1.64	1.61	1.60	1.58	1.58
Distillers Grains Value	0.33	0.30	0.28	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.32
Corn Cost	-1.16	-1.18	-1.17	-1.16	-1.15	-1.13	-1.12	-1.10	-1.08	-1.07	-1.06
Fuel and Electricity Cost	-0.28	-0.30	-0.30	-0.30	-0.29	-0.29	-0.29	-0.29	-0.29	-0.29	-0.29
Other Operating Costs	-0.32	-0.32	-0.32	-0.33	-0.33	-0.33	-0.34	-0.34	-0.34	-0.35	-0.35
Net Operating Return	0.61	0.28	0.22	0.20	0.20	0.21	0.19	0.19	0.19	0.19	0.20
<b>Corn Wet Milling</b>											
	(Million Bushels)										
Corn Wet Milled for Ethanol	426	498	553	548	533	516	501	483	467	452	437
(Share of Total Ethanol)	19.5%	15.8%	14.4%	13.2%	12.7%	12.4%	12.0%	11.7%	11.3%	10.9%	10.6%
Other Corn Wet Milling	1,167	1,174	1,181	1,188	1,196	1,204	1,212	1,220	1,227	1,235	1,241
Total Corn Wet Milling	1,593	1,672	1,734	1,736	1,730	1,720	1,713	1,703	1,694	1,687	1,678
Yields per Bushel of Corn											
	(Units per Bushel)										
Ethanol (Gallons)	2.69	2.69	2.70	2.71	2.72	2.72	2.73	2.74	2.75	2.75	2.76
Gluten Feed (Pounds)	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40	11.40
Gluten Meal (Pounds)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Corn Oil (Pounds)	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57
Costs and Returns											
	(Dollars per Gallon)										
Ethanol Value	2.03	1.78	1.73	1.70	1.69	1.67	1.64	1.61	1.60	1.58	1.58
Gluten Feed Value	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Gluten Meal Value	0.15	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13
Corn Oil Value	0.17	0.19	0.20	0.21	0.21	0.20	0.20	0.20	0.20	0.21	0.21
Corn Cost	-1.18	-1.20	-1.19	-1.19	-1.18	-1.17	-1.16	-1.14	-1.12	-1.11	-1.10
Fuel and Electricity Cost	-0.22	-0.23	-0.24	-0.23	-0.23	-0.22	-0.22	-0.22	-0.22	-0.23	-0.23
Other Operating Costs	-0.50	-0.51	-0.51	-0.52	-0.52	-0.53	-0.53	-0.54	-0.54	-0.55	-0.55
Net Operating Return	0.62	0.35	0.31	0.28	0.27	0.26	0.24	0.22	0.20	0.19	0.19

## U.S. Soybean Supply and Utilization

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
<b>Area</b> (Million Acres)											
Base Area	52.9	52.9	52.9	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0
Planted Area	75.5	70.5	69.2	70.5	70.5	70.3	70.1	70.2	70.0	70.0	69.8
Harvested Area	74.6	69.4	68.1	69.4	69.4	69.2	69.0	69.1	69.0	69.0	68.8
<b>Yield</b> (Bushels per Acre)											
Actual	42.7	41.3	41.7	42.1	42.6	43.0	43.5	43.9	44.4	44.9	45.3
Program, Direct	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8
Program, CCP	34.1	34.1	34.1	34.1	34.1	34.1	34.1	34.1	34.1	34.1	34.1
<b>Supply</b> (Million Bushels)											
Beginning Stocks	449	574	463	392	396	402	408	411	420	425	433
Production	3,188	2,870	2,838	2,924	2,954	2,981	3,000	3,036	3,063	3,096	3,117
Imports	4	4	4	4	4	4	4	4	4	4	4
<b>Domestic Use</b>	1,947	1,896	1,886	1,926	1,957	1,990	2,026	2,067	2,112	2,156	2,200
Crush	1,781	1,739	1,727	1,762	1,791	1,821	1,855	1,893	1,935	1,976	2,017
Seed, Residual	166	157	159	163	166	169	171	174	177	180	183
<b>Exports</b>	1,120	1,089	1,027	999	994	988	975	963	950	934	912
<b>Total Use</b>	3,068	2,985	2,913	2,924	2,951	2,978	3,002	3,031	3,062	3,091	3,112
<b>Ending Stocks</b>	574	463	392	396	402	408	411	420	425	433	443
CCC Inventory	0	0	0	0	0	0	0	0	0	0	0
Under Loan	61	54	47	49	51	52	52	57	57	60	61
Other Stocks	513	409	345	346	351	356	358	363	368	373	382
<b>Prices and Returns</b> (Dollars)											
Farm Price/bu.	6.10	6.73	7.05	7.03	6.92	6.81	6.79	6.70	6.59	6.48	6.43
IL Processor Price/bu.	6.39	7.00	7.32	7.29	7.19	7.08	7.06	6.97	6.87	6.76	6.71
Loan Rate/bu.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Average LDP Rate/bu.	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.06
Target Price/bu.	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80
CCP Rate/bu.	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.05	0.04
Direct Payment/bu.	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Gross Market Revenue/a.	260.74	276.54	292.17	294.32	292.60	291.47	293.39	291.85	290.90	289.03	289.39
LDP Revenue/a.	0.62	0.51	0.85	0.69	1.39	1.57	1.73	2.37	2.88	3.02	2.94
Variable Expenses/a.	99.17	107.27	109.72	111.50	113.13	114.89	116.45	118.32	120.41	122.73	125.05
Mkt + LDP Net Returns/a.	162.19	169.78	183.30	183.51	180.87	178.15	178.67	175.91	173.36	169.33	167.28
CCP Revenue/Base a.	0.00	0.37	0.34	0.36	0.59	0.74	0.85	1.07	1.20	1.36	1.30
Direct Payment/Base a.	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52
Soybean/Corn Price Ratio	1.93	2.09	2.19	2.18	2.15	2.14	2.15	2.14	2.14	2.12	2.11
Meal Price, 48% Protein/ton	180.16	188.26	185.51	180.45	176.72	173.97	173.15	169.65	164.45	159.48	155.86
Oil Price/cwt.	27.21	30.67	33.49	34.34	34.33	34.08	34.05	34.09	34.34	34.54	34.95
Crushing Margin/bu.	0.99	0.98	0.93	0.93	0.94	0.95	0.95	0.97	0.97	0.98	1.00

## U.S. Soybean Oil Supply and Utilization

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
(Million Pounds)											
<b>Supply</b>	23,235	22,530	21,896	22,023	22,308	22,647	23,044	23,478	23,947	24,406	24,855
Beginning Stocks	3,019	2,656	2,158	1,880	1,838	1,829	1,842	1,842	1,835	1,825	1,807
Production	20,181	19,839	19,703	20,107	20,435	20,782	21,166	21,600	22,077	22,546	23,013
Imports	35	35	35	35	35	35	35	35	35	35	35
<b>Domestic Use</b>	19,142	19,785	19,662	19,754	19,860	19,985	20,029	20,076	20,095	20,107	20,068
Biodiesel	2,552	3,454	3,525	3,528	3,441	3,356	3,194	3,037	2,862	2,722	2,530
Food and Other	16,589	16,331	16,137	16,226	16,419	16,629	16,834	17,039	17,233	17,385	17,538
<b>Exports</b>	1,438	587	353	431	619	819	1,173	1,567	2,027	2,492	2,998
<b>Total Use</b>	20,579	20,373	20,016	20,185	20,479	20,804	21,202	21,643	22,122	22,599	23,066
<b>Ending Stocks</b>	2,656	2,158	1,880	1,838	1,829	1,842	1,842	1,835	1,825	1,807	1,789
(Cents per Pound)											
<b>Price</b>											
Decatur, IL	27.21	30.67	33.49	34.34	34.33	34.08	34.05	34.09	34.34	34.54	34.95

## U.S. Soybean Meal Supply and Utilization

Crop Year	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17
(Thousand Tons)											
<b>Supply</b>	42,934	41,885	41,598	42,446	43,134	43,861	44,665	45,573	46,570	47,553	48,532
Beginning Stocks	314	290	288	291	294	297	299	299	302	305	309
Production	42,454	41,430	41,145	41,989	42,674	43,398	44,200	45,108	46,103	47,082	48,057
Imports	166	166	166	166	166	166	166	166	166	166	166
<b>Domestic Use</b>	33,929	33,736	33,829	34,353	35,008	35,734	36,354	37,031	37,684	38,442	39,183
<b>Exports</b>	8,716	7,861	7,478	7,799	7,829	7,828	8,012	8,240	8,581	8,803	9,037
<b>Total Use</b>	42,645	41,598	41,307	42,152	42,837	43,562	44,365	45,271	46,265	47,244	48,220
<b>Ending Stocks</b>	290	288	291	294	297	299	299	302	305	309	312
(Dollars per Ton)											
<b>Price</b>											
Decatur, IL, 48% Protein	180.16	188.26	185.51	180.45	176.72	173.97	173.15	169.65	164.45	159.48	155.86



## U.S. Biodiesel Sector

Calendar or Crop Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<b>Biodiesel Production</b>											
	(Million Gallons, Oct.-Sep. Year)										
From Soybean Oil	331	449	458	458	447	436	415	394	372	353	329
From Canola Oil	30	62	69	74	80	86	86	85	82	81	79
From Other Fats and Oils	24	29	30	32	34	37	39	41	43	45	47
Total Biodiesel Production	386	539	557	563	561	559	540	521	497	479	455
<b>Fuel Prices</b>											
	(Dollars per Gallon, Calendar Year)										
Biodiesel, Plant	3.37	3.35	3.17	3.15	3.14	3.12	3.09	3.07	3.05	3.05	3.05
#2 Diesel, Refiner Sales	2.02	1.95	1.98	1.96	1.95	1.93	1.89	1.85	1.82	1.79	1.78
#2 Diesel, Retail	2.71	2.62	2.64	2.63	2.63	2.60	2.57	2.53	2.50	2.48	2.47
Tax Credit, Virgin Veg. Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tax Credit, Other Feedstock	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Biodiesel, Implied Retail	3.06	3.01	2.83	2.82	2.81	2.79	2.77	2.75	2.74	2.73	2.74
Biodiesel/Diesel Retail Ratio	112.9%	115.1%	107.1%	107.2%	107.0%	107.4%	107.7%	108.6%	109.4%	110.2%	110.9%
<b>Costs and Returns</b>											
	(Dollars per Gallon, Oct.-Sep. Year)										
Biodiesel Value	3.40	3.17	3.16	3.14	3.12	3.10	3.07	3.05	3.05	3.05	3.06
Glycerin Value	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Soybean Oil Cost	-2.10	-2.36	-2.58	-2.64	-2.64	-2.62	-2.62	-2.62	-2.64	-2.66	-2.69
Other Operating Costs	-0.53	-0.54	-0.54	-0.55	-0.56	-0.56	-0.57	-0.57	-0.58	-0.58	-0.59
Net Operating Return	0.83	0.32	0.08	0.00	-0.02	-0.04	-0.07	-0.10	-0.13	-0.15	-0.17

## Biofuel Tax and Tariff Extensions: 2011-2016 Averages

	Tax Provisions Extended Indefinitely	Tax Provisions Expire as Scheduled	Absolute Difference	Percentage Difference
<b>Tax and Tariff Provisions</b>				
	(Dollars per Gallon)			
Ethanol Tax Credit	0.51	0.00	-0.51	-100.0%
Biodiesel Tax Credit (Virgin Veg. Oil)	1.00	0.00	-1.00	-100.0%
Ethanol Specific Tariff	0.54	0.00	-0.54	-100.0%
<b>Biofuel Sector Results</b>				
	(Billion Gallons)			
Ethanol Production	12.37	8.61	-3.75	-30.4%
Ethanol Net Imports	0.32	0.48	0.16	49.4%
Ethanol Domestic Disappearance	12.68	9.11	-3.57	-28.1%
Biodiesel Production	0.51	0.23	-0.27	-53.9%
	(Dollars per Gallon)			
Ethanol Price, FOB Omaha Plant	1.63	1.34	-0.29	-17.8%
Ethanol Implied Retail Price	1.76	1.98	0.22	12.5%
Dry Mill Returns Over Operating Costs	0.19	0.04	-0.15	-79.7%
Biodiesel Plant Price	3.07	2.12	-0.95	-31.0%
<b>Corn Sector Supply and Use</b>				
	(Billion Bushels)			
Corn Production	13.83	13.31	-0.52	-3.7%
Corn Ethanol Use	4.14	2.82	-1.33	-32.1%
Corn Feed Use	5.84	6.24	0.40	6.8%
Corn Exports	2.37	2.77	0.40	16.9%
<b>Soybean Sector Supply and Use</b>				
	(Billion Bushels)			
Soybean Production	3.05	3.10	0.05	1.6%
Soybean Crush	1.92	1.92	0.01	0.3%
Soybean Exports	0.95	0.99	0.03	3.4%
	(Billion Pounds)			
Soyoil Biodiesel Use	2.95	1.33	-1.62	-55.0%
Soyoil Other Domestic Use	17.11	17.73	0.62	3.6%
Soyoil Exports	1.85	2.91	1.07	57.9%
<b>Crop Planted Acreage</b>				
	(Million Acres)			
Corn	89.84	86.46	-3.38	-3.8%
Soybeans	70.08	71.18	1.10	1.6%
Wheat	57.46	58.00	0.54	0.9%
9 Other Crops Plus Hay	96.42	96.40	-0.03	0.0%
Conservation Reserve Area	31.95	32.60	0.65	2.0%
12 Crops + Hay + CRP	345.76	344.64	-1.11	-0.3%
<b>Crop Sector Prices</b>				
	(Dollars per Bushel)			
Corn Farm Price	3.11	2.81	-0.30	-9.6%
Soybean Farm Price	6.63	6.14	-0.49	-7.4%
Wheat Farm Price	4.19	4.03	-0.16	-3.9%
Sorghum Farm Price	3.01	2.81	-0.20	-6.6%
	(Cents per Pound)			
Upland Cotton Farm Price	58.10	57.85	-0.26	-0.4%
Soyoil Market Price, Decatur, IL	34.34	26.89	-7.45	-21.7%
	(Dollars per Ton)			
Soymeal Price, 48% Protein	166.09	179.85	13.75	8.3%
DDG Price, Indiana	102.39	113.35	10.96	10.7%

## Biofuel Tax and Tariff Extensions: 2011-2016 Averages, cont.

	Tax Provisions Extended Indefinitely	Tax Provisions Expire as Scheduled	Absolute Difference	Percentage Difference
<b>Tax and Tariff Provisions</b>	(Dollars per Gallon)			
Ethanol Tax Credit	0.51	0.00	-0.51	-100.0%
Biodiesel Tax Credit (Virgin Veg. Oil)	1.00	0.00	-1.00	-100.0%
Ethanol Specific Tariff	0.54	0.00	-0.54	-100.0%
<b>Meat and Milk Production</b>	(Billion Pounds)			
Beef Production	28.39	28.44	0.05	0.2%
Pork Production	22.56	22.65	0.09	0.4%
Broiler Production	39.73	39.87	0.14	0.3%
Milk Production	199.66	199.93	0.27	0.1%
<b>Livestock and Dairy Prices</b>	(Dollars per Cwt.)			
Steers, Nebraska Direct	84.61	84.13	-0.48	-0.6%
Feeder Steers, Oklahoma City	100.55	101.11	0.55	0.5%
Barrows & Gilts, 51-52% Lean	49.75	48.97	-0.78	-1.6%
Broilers, 12 City Wholesale	70.82	70.08	-0.74	-1.0%
All Milk	14.47	14.41	-0.06	-0.4%
<b>Government Outlays</b>	(Billion Dollars)			
Marketing Loans (Crop Years)	0.59	0.93	0.34	56.9%
Countercyclical Payments (Crop Years)	0.90	1.13	0.23	25.2%
Net CCC Outlays (Fiscal Years)	11.17	11.74	0.57	5.1%
Ethanol Tax Credit	6.47	0.00	-6.47	-100.0%
<b>Farm Income</b>	(Billion Dollars)			
Crop Receipts	154.06	147.34	-6.72	-4.4%
Livestock Receipts	134.16	133.54	-0.61	-0.5%
Government Payments	11.06	11.63	0.57	5.1%
Rent to Non-Operator Landlords	14.13	12.44	-1.69	-12.0%
Other Production Expenses	270.78	268.54	-2.24	-0.8%
Total Production Expenses	284.92	280.98	-3.93	-1.4%
Other Net Farm Income	46.64	46.38	-0.27	-0.6%
Net Farm Income	61.00	57.91	-3.09	-5.1%
<b>Value of Farm Real Estate</b>	(Dollars per Acre)			
	2,746	2,670	-75.23	-2.7%
<b>Consumer Food Price Index</b>	(Index)			
	228.6	228.4	-0.2	-0.1%



