

THE RFS2: Then and Now

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On December 19, 2007, the Energy Independence and Security Act was signed into law, greatly expanding the scope and impact of the Renewable Fuel Standard (RFS). At the signing ceremony, President George W. Bush remarked that the expanded program (broadly known as the “RFS2”) was a “...major step toward reducing our dependence on oil, confronting global climate change, expanding production of renewable fuels and giving future generations a nation that is stronger, cleaner and more secure.”

A decade after the RFS2 was adopted, tremendous progress has been made toward achieving the objectives of this landmark policy. Renewable fuel production and consumption have grown dramatically. America’s dependence on petroleum—particularly imports—is down significantly. Greenhouse gas emissions and harmful tailpipe pollution from the transportation sector have fallen. The value of agricultural products and farm income have been buoyed. And communities across the country have benefited from the job creation, increased tax revenue, and heightened household income that stem from the construction and operation of a biorefinery.

Meanwhile, the doomsday outcomes threatened by opponents of the RFS2 simply have not materialized. U.S. cropland continues to shrink as forestland and grassland expand, Amazon deforestation rates continue to decline, and U.S. and global food price inflation rates are lower than before the RFS was adopted.

This brief analysis draws on data from a government agencies, universities, and other public sources to examine how the world has changed (and how many things have stayed the same) since adoption of the RFS2 in 2007. These key indicators show that by any objective measure, the RFS2 has been a tremendous success.



Evolution of an Industry

The RFS2 stimulated investment in the biofuels industry, supporting dramatic growth in the production of ethanol and other renewable fuels. In turn, the expansion of the ethanol industry has created more jobs, more economic activity, and increased animal feed production.

Meanwhile, the RFS2 spurred new technology, greater efficiency, and increased investment in the agriculture sector. The 2017 corn crop was 12% larger than the 2007 crop, yet corn acres were down 3% and total cropland was down 6%. And, 2017 corn prices are 24% lower than in 2007.

ETHANOL PRODUCTION	2007	2017	% Change
Operational Ethanol Plants	110	211	+92% ▲
Ethanol Production (<i>billion gallons</i>)	6.5	15.8	+143% ▲
Co-product Animal Feed (<i>million metric tons</i>)	18.4	41.4	+125% ▲
Gross Value of Industry Output (<i>billion \$</i>)	\$17.8	\$31.0	+74% ▲
Ethanol Industry Jobs (<i>Direct, Indirect, Induced</i>)	238,541	339,176	+42% ▲
Advanced & Cellulosic Biofuel Production (<i>billion gallons</i>)	0.49	2.79	+469% ▲

AGRICULTURAL PRODUCTION AND VALUE	2007	2017	% Change
Corn Production (<i>billion bushels</i>)	13.0	14.6	+12% ▲
Average Corn Yield (<i>bushels per acre</i>)	150.7	175.4	+16% ▲
Corn Acres Planted (<i>million acres</i>)	93.5	90.4	-3% ▼
Total Cropland (<i>million acres</i>)	402	376	-6% ▼
Season-Average Corn Price (<i>\$/bushel</i>)	\$4.20	\$3.20	-24% ▼
Corn Surplus (<i>billion bushels</i>)	1.62	2.49	+54% ▲
Gross Value of U.S. Crops (<i>billion \$</i>)	\$150.1	\$189.9	+27% ▲
Gross Value of U.S. Livestock (<i>billion \$</i>)	\$138.5	\$175.3	+27% ▲
Net Farm Income (<i>billion \$</i>)	\$70.0	\$63.2	-10% ▼

Changing the Fuel Market

The nation's motor fuel market has been transformed since the RFS2 was adopted in 2007. Today, ethanol makes up more than 10% of the gasoline pool, petroleum imports are down, pump prices are lower than they were a decade ago, and higher-level blends like E15 and flex fuels like E85 are expanding.

U.S. GASOLINE MARKET	2007	2017	% Change
Gasoline Blendstock (<i>billion gallons</i>)	135.5	128.6	-5% ▼
Ethanol (<i>billion gallons</i>)	6.9	14.4	+109% ▲
Total Finished Gasoline (<i>billion gallons</i>)	142.4	143.0	+0.04% ▲
Ethanol Blend Rate	4.84%	10.07%	--

E15 AND FLEX FUEL MARKET	2007	2017	% Change
Retail Stations Selling E85/Flex Fuels	1,208	4,077	+238% ▲
States Offering E85/Flex Fuels	24	45	+88% ▲
Flex Fuel Vehicles on the Road (<i>million</i>)	6.7	24.5	+266% ▲
Retail Stations Selling E15	0	1,215	--
States Offering E15	0	29	--
Share of Vehicle Fleet Legally Approved to Use E15	0%	91%	--

U.S. PETROLEUM IMPORTS	2007	2017	% Change
Crude Oil Imports (<i>billion barrels</i>)	3.66	2.91	-20% ▼
Crude Oil Imports as % of U.S. Demand	66%	48%	--
Crude Oil Imports from OPEC (<i>billion barrels</i>)	1.97	1.17	-41% ▼
OPEC Share of U.S. Crude Oil Imports	54%	40%	--
Gasoline Imports (<i>billion gallons</i>)	6.33	0.53	-92% ▼
U.S. Petroleum (Crude Oil & Products) Net Import Dependence	58%	21%	--

FUEL PRICES	2007	2017	% Change
Brent Crude Oil (<i>per barrel</i>)	\$72.44	\$53.01	-27% ▼
Retail Gasoline, Regular (<i>per gallon</i>)	\$2.80	\$2.40	-14% ▼
Retail Diesel (<i>per gallon</i>)	\$2.89	\$2.65	-8% ▼
Wholesale Rack Gasoline, Regular (<i>per gallon</i>)	\$2.23	\$1.81	-19% ▼
Wholesale Rack Ethanol (<i>per gallon</i>)	\$2.24	\$1.49	-33% ▼

The RFS2 and Food Markets

A decade after the RFS2 was adopted, real-world evidence and data show the “food vs. fuel” argument was nothing but a colossal myth propagated by renewable fuel opponents. In reality, food prices have advanced more slowly in the past 10 years (since the RFS2 was adopted) than they did in the preceding 20 years. Moreover, production of meat, milk, and eggs has grown faster than the population. Globally, the past decade has seen a decrease in undernourishment rates and increases in grain supplies and surpluses that have outpaced population growth.

U.S. RETAIL FOOD PRICES	2007	2017	20-Yr Avg.
Overall Food Price Inflation (<i>change from previous year</i>)	+4.0%	+1.0% ▼	+2.5%
Grocery Prices (<i>change from previous year</i>)	+4.2%	+0.3% ▼	+2.2%
Restaurant Prices (<i>change from previous year</i>)	+3.6%	+2.5% ▼	+2.7%
Red Meat, Poultry, Fish Prices (<i>change from previous year</i>)	+3.8%	0.0% ▼	+2.8%
Cereals & Bakery Item Prices (<i>change from previous year</i>)	+4.4%	0.0% ▼	+2.3%
Dairy Prices (<i>change from previous year</i>)	+7.5%	+0.3% ▼	+2.2%

U.S. MEAT, MILK, AND EGG PRODUCTION	2007	2017	% Change
Milk Production (<i>billion pounds</i>)	185.7	215.8	+16.2% ▲
Red Meat & Poultry Production (<i>billion pounds</i>)	91.0	100.1	+10.0% ▲
Egg Production (<i>billion eggs</i>)	90.6	105.3	+16.2% ▲
Red Meat & Poultry per Capita Availability (<i>pounds</i>)	202.3	217.8	+7.7% ▲

GLOBAL SITUATION	2007	2017	% Change
Global Population Undernourished (<i>million</i>)	890	789	-11% ▼
Percent of Global Population Undernourished	13.5%	10.7%	--
World Grain Supply (Coarse Grains, Wheat, Rice) (<i>billion metric tons</i>)	2.46	3.23	+31% ▲
World Grain Supply per Capita (<i>pounds per person</i>)	809	943	+17% ▲
World Grain Ending Stocks (<i>billion metric tons</i>)	0.35	0.66	+85% ▲

POPULATION	2007	2017	% Change
United States (<i>million people</i>)	301.2	325.5	+8% ▲
World (<i>million people</i>)	6,706.4	7,550.3	+12% ▲

The RFS2 and the Environment

Increased ethanol use under the RFS2 has helped improve the nation's air quality and reduce greenhouse gas emissions, even though Americans are driving more miles today than ever before. In addition, the data show that cropland has continued to shrink since the RFS2 was adopted, while forestland and grassland have expanded. At the same time, fertilizer use efficiency has increased and GHG emissions from agriculture are down considerably.

GHG EMISSIONS AND CRITERIA POLLUTANTS	2007	2017	% Change
GHG Emissions from Transportation (<i>million metric tons CO2e</i>)	1,980	1,849	-7% ▼
U.S. Vehicle Miles Traveled (<i>billion miles</i>)	3,003	3,223	+7% ▲
GHG Emissions per Mile Traveled (<i>pounds CO2e per mile</i>)	1.45	1.26	-13% ▼
GHG Emissions Avoided from using Ethanol (<i>million tons CO2e</i>)	12.7	49.6	+291% ▲
Carbon Monoxide Concentration (<i>parts per million</i>)	1.93	1.35	-30% ▼
Ozone Concentration (<i>parts per million</i>)	0.080	0.069	-14% ▼
Coarse Particulate Matter Concentration (<i>micrograms per m3</i>)	62.98	51.31	-19% ▼
Fine Particular Matter Concentration (<i>micrograms per m3</i>)	11.90	7.77	-35% ▼

AGRICULTURE IMPACTS AND LAND USE	2007	2017	% Change
U.S. Cropland Area (<i>million acres</i>)	402	376	-7% ▼
U.S. Forested Area (<i>thousand square miles</i>)	1,183	1,197	+1% ▲
U.S. Grassland Area (<i>thousand square miles</i>)	1,296	1,359	+5% ▲
Deforestation Rate in the Amazon (<i>square miles</i>)	4,498	2,558	-43% ▼
GHG Emissions from Agricultural Soil Management, Urea Fertilization, and Liming (<i>million metric tons CO2e</i>)	278.7	260.1	-7% ▼
Nitrogen Fertilizer Use per Corn Bushel (<i>pounds per bushel</i>)	0.88	0.81	-8% ▼
Phosphate Fertilizer User per Corn Bushel (<i>pounds per bushel</i>)	0.32	0.28	-13% ▼
Potash Fertilizer User per Corn Bushel (<i>pounds per bushel</i>)	0.35	0.30	-15% ▼

Data Sources

1. Operational Ethanol Plants: Renewable Fuels Association (**RFA**)
2. Ethanol Production: **RFA** and Energy Information Administration (**EIA**)
3. Co-product Animal Feed: **RFA** and U.S. Department of Agriculture (**USDA**)
4. Gross Value of Ethanol Industry Output: **RFA** based on **USDA** market values
5. Ethanol Industry Jobs: **ABF Economics**, **LECG Economics** (2016 is latest available)
6. Advanced and Cellulosic Biofuel Production: Environmental Protection Agency (**EPA**)
7. Corn Production: **USDA** (2007/08 and 2017/18)
8. Average Corn Yield: **USDA**
9. Corn Acres Planted: **USDA**
10. Total Cropland: **EPA**
11. Corn Price: **USDA**
12. Corn Surplus: **USDA**
13. Gross Value of Crops and Livestock: **USDA**
14. Net Farm Income: **USDA**
15. Corn Surplus: **USDA**
16. Value of Agriculture Products: **USDA**
17. U.S. Gasoline and Ethanol Consumption: **EIA** (2017 projected base don YTD data)
18. Stations and States Selling E85/Flex Fuel: **E85Prices.com** and DOE Alternative Fuels Data Center (**AFDC**)
19. FFVs on the Road: **AFDC** and **EPA**
20. Stations and States Selling E15: **RFA** and **E85prices.com**
21. Percent of Vehicle Fleet Legally Approved for E15: **RFA** based on **EPA** data
22. Petroleum Imports: **EIA**
23. U.S. Petroleum Net Import Dependence with and without Ethanol: **RFA** based on **EIA** data
24. Petroleum Product Prices: **EIA**
25. Wholesale Ethanol and Gasoline Prices (Omaha Rack): **Nebraska Energy Office**
26. Annual Average Food Price Inflation Rates: **USDA** and Department of Labor (**DOL**)
27. U.S. Milk, Red Meat and Poultry, Egg Production: **USDA**
28. World Hunger Statistics: UN Food & Agriculture Organization (**FAO**) (2014-2016 is latest available)
29. World Grain Supplies and Ending Stocks: **USDA**
30. U.S. Population: U.S. Census Bureau
31. World Population: United Nations
32. GHG Emissions from U.S. Transportation: **EIA**
33. Vehicle Miles Traveled: Federal Highway Administration (**FHWA**)
34. GHG Emissions Avoided: **RFA** based on Dept. of Energy (**DOE**) GREET Model
35. Concentration Levels of Key Air Pollutants: **EPA** (2016 is latest available)
36. Total U.S. Cropland: **EPA**
37. U.S. Forested Area and Grassland Area: **EPA** (2016 is latest available)
38. Deforestation in the Amazon: **Brazil INPE**
39. GHG Emissions from Agricultural Soil Management, Urea, Liming: **EPA** (2016 is latest available)
40. Fertilizer Use Data: **RFA** based on **USDA** data (2016 is latest available)