The EPA's Renewable Fuel Standard Rulemaking for 2017 Was More Aggressive than Expected

Scott Irwin and **Darrel Good**

Department of Agricultural and Consumer Economics
University of Illinois

The U.S. Environmental Protection Agency (EPA) announced the final rulemaking for the Renewable Fuels Standard (RFS) for 2017 and the biomass-based diesel volume requirement for 2018 on November 23rd. In this article, we analyze the expected outcome of implementing the newly announced mandates. These standards surprised the market by upping the 2017 conventional ethanol mandate to the statutory maximum and increasing the mandate for total advanced biofuels more than expected. That is, the advanced biofuels mandate was reduced from the statutory mandate by much less than the maximum allowable reduction that is equal to the reduction in the cellulosic mandate. Figure 1 provides tangible evidence of the degree of market surprise in terms of RIN prices, the tradeable credits used to comply with the RFS. Both D4 biodiesel and D6 ethanol RINs prices have rallied more than 15 percent since release of the final 2017 rulemaking, with the D6 price crossing the psychologically important $1 mark. The focus of the present analysis, then, is on the magnitude of the "push" in production and consumption of biofuels implied by the requirements (mandates) of the RFS and the implications for production and consumption of biomass-based diesel. The analysis follows a similar format of our previous analysis of earlier EPA rulemakings, most recently in the *farmdoc daily* articles of May, 26, 2016 and June 2, 2016.

Background

The statute for the Renewable Fuels Standards (RFS) required the U.S. Environmental Protection Agency (EPA) to establish volume requirements for four categories of biofuels for each year from 2008 through 2022: cellulosic biofuel, biomass-based diesel, total advanced biofuel (which includes biomass-based diesel), and renewable fuel (referred to as conventional ethanol here). The difference between the total advanced mandate and the total of the cellulosic and biodiesel mandate is referred to as the undifferentiated advanced mandate and can be satisfied by a combination of qualified advanced biofuels. Conventional biofuels is generally assumed to be corn-based ethanol but this is actually not explicitly required by the RFS legislation. Instead, corn-based ethanol has been the cheapest alternative for this category that also meets the environmental requirements of the RFS. In addition, the conventional portion of the mandate can also be satisfied with discretionary blending of advanced biofuels, so one can refer to the conventional mandate as an implied mandate. We refer to this implied mandate as the conventional ethanol mandate in order to be consistent with the most common term for this particular RFS mandate. Cellulosic biofuels have been in very limited supply, so the EPA has written down the cellulosic mandate to very low levels relative to statutory levels each year. The total advanced biofuel

---

---

mandate has also been written down in conjunction with the write down in the cellulosic mandate. The biodiesel mandate was established as a minimum of one billion gallons per year from 2012 through 2022, with larger amounts subject to EPA approval.

Figure 1. Daily D4 Biodiesel and D6 Ethanol RINs Prices, 2016 Vintage, 11/2/2015 - 11/30/2016
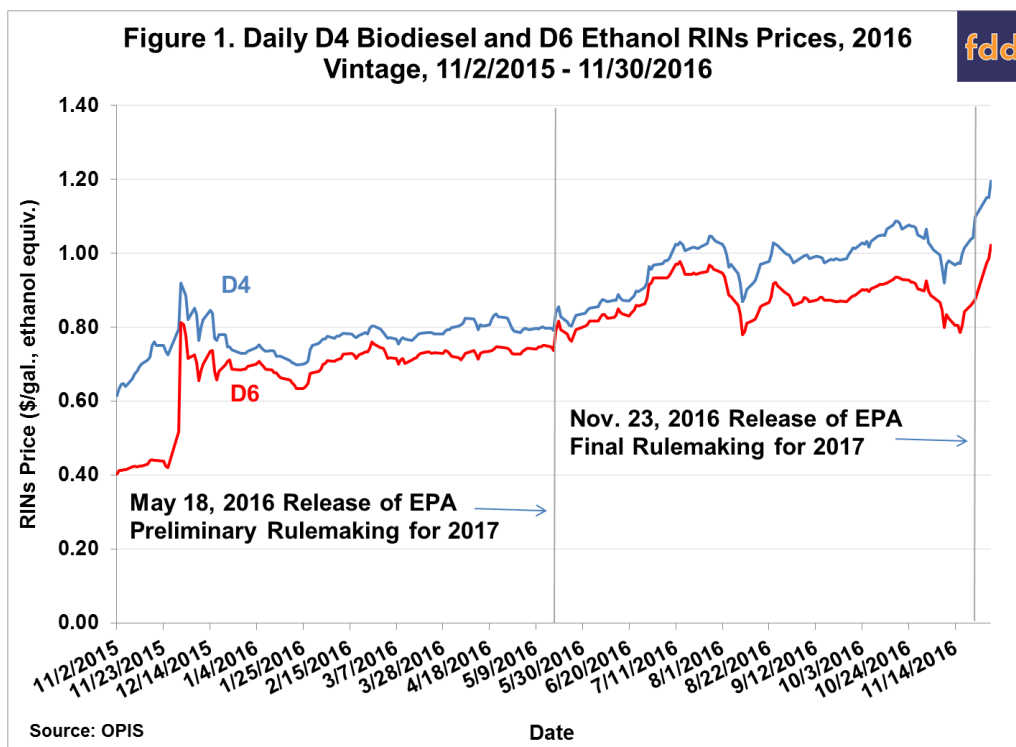
Source: OPIS

Table 1 summarizes the statutory RFS volume requirements for the 2014 through 2018 calendar years, as well as the mandates contained in final EPA rulemaking for those years. For 2017, the renewable fuel volume requirement is established at 19.28 billion gallons, compared to the 2016 standard of 18.11 billion gallons and the statutory requirement of 24 billion gallons. The biomass-based diesel mandate is increased by 100 million gallons for 2018. The cellulosic biofuels and total advanced biofuels requirements are larger than the requirements for 2016, but well below the statutory requirements. The conventional ethanol requirement for 2017 is 15.0 billion gallons, 500 million gallons larger than the 2016 requirement and equal to the statutory requirement.

Table 1. RFS Volume Requirements for the U.S., 2014-2018

Category	RFS Statutory					EPA 2014-2016 Final Rulemaking				EPA Final 2017 Rulemaking	
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2017	2018
Cellulosic Biofuel	1.75	3.00	4.25	5.50	7.00	0.033	0.123	0.230	NA	0.311	NA
Biomass-Based Diesel	>1	>1	>1	>1	>1	1.63	1.73	1.90	2.00	2.00	2.10
Advanced Biofuel	3.75	5.50	7.25	9.00	11.00	2.67	2.88	3.61	NA	4.28	NA
Total	18.15	20.50	22.25	24.00	26.00	16.28	16.93	18.11	NA	19.28	NA
Implied Conventional	14.40	15.00	15.00	15.00	15.00	13.61	14.05	14.50	NA	15.00	NA

Note: These volumes are stated in billion gallons of ethanol equivalents, except for biomass-based diesel which is stated in billion gallons of "wet" physical volume terms. NA stands for not applicable.

Calculation of Conventional Gaps

We start the analysis of the EPA final rulemaking with a computation of the "push" above the E10 blend wall in the production and consumption of conventional ethanol for each year from 2014 through 2017. The magnitude of the push is calculated as the gap (difference) between the EPA mandate as implemented and the actual or expected consumption of conventional ethanol. Those calculations are presented in Table 2. To understand the calculations, it is necessary to recognize that the mandate is not enforced as a strictly volumetric mandate, but instead is enforced as a fractional mandate. The EPA establishes the blend, or fractional, rate based on the volumetric mandate and a projection of petroleum-based gasoline and diesel consumption. Obligated parties, then, meet their obligations by blending at that established rate regardless of whether total gasoline and diesel consumption is more or less than the EPA projection. As a result, the magnitude of the final volumetric mandate is dependent on the actual magnitude of gasoline and diesel consumption. In the first section of Table 2, we show the estimates used by EPA in final rulemakings for 2014-2017 for establishing the fractional rate. Using 2017 as an example, total gasoline and diesel consumption (including biofuels) is projected at 196.76 billion gallons (line 3). That projection is reduced by the projection of biofuels included in the total, resulting in a projection of petroleum-based gasoline and diesel consumption of 180.13 billion gallons (line 12). To reach the mandate of 15 billion gallons of conventional ethanol, then, the fractional rate is set at 8.33 percent [15/180.13]. The EPA estimates that only 14.35 billion gallons of ethanol will actually be used in 2017 (line 5) and that conventional ethanol use will reach only 14.11 billion gallons (line 9). That leaves a conventional mandate gap of 890 million gallons (line 11). That gap can be filled by a combination of: i) discretionary blending of advanced biofuels (most likely biomass-based diesel), ii) use of existing stocks of biofuels credits in the form of outstanding Renewable Identification Numbers (RINs), and iii) expansion of conventional ethanol use in higher blends such as E15 and E85.

Table 2. Conventional Mandate Gap under EPA Final RFS Rulemaking for 2014-2016 and 2017

Item	EPA Final Rulemakings				Alternative Scenario			
	2014	**2015**	**2016**	**2017**	**2014**	**2015**	**2016**	**2017**
(1) Total Gasoline Use	136.480	139.380	139.960	143.610	136.480	140.438	143.949	146.108
(2) Total Diesel Use	55.670	54.050	55.260	53.150	55.670	53.506	51.725	53.150
(3) Total Gasoline and Diesel Use	192.150	193.430	195.220	196.760	192.150	193.944	195.674	199.258
(4) E10 Blend Wall [(1) X 0.10]	13.648	13.938	13.996	14.361	13.648	14.044	14.395	14.611
(5) Total Ethanol Use [(7)+(8)+(9)]	13.420	13.810	13.850	14.350	13.420	13.900	14.300	14.550
(6) Total Ethanol Inclusion Rate [(5)/(1)]	9.83%	9.91%	9.90%	9.99%	9.83%	9.90%	9.93%	9.96%
(7) Cellulosic Ethanol Use	0.001	0.002	0.004	0.013	0.001	0.002	0.004	0.013
(8) Other Advanced Ethanol Use	0.090	0.115	0.068	0.227	0.090	0.115	0.068	0.127
(9) Conventional Ethanol Use	13.329	13.693	13.778	14.110	13.329	13.783	14.228	14.410
(10) Conventional Ethanol Mandate	13.604	14.051	14.507	15.000	13.604	14.090	14.497	15.191
(11) Conventional Mandate Gap [(10)-(9) if >0]	0.275	0.358	0.729	0.890	0.275	0.307	0.269	0.781
(12) Petroleum Gasoline and Diesel Use	177.140	177.860	179.320	180.13	177.140	178.354	179.194	182.428
(13) Fractional Ethanol Mandate [(10)/(12)]	7.68%	7.90%	8.09%	8.33%	7.68%	7.90%	8.09%	8.33%

Notes: All values stated in terms of billion gallons except (6) and (13), which are in percentage terms. Total petroleum gasoline and diesel use (12) is net of renewable fuel use (ethanol and biomass-bsaed diesel) and the small refinery exemption, and therefore, does not equal total gasoline and diesel use (3). The small refinery exemption is set to zero for 2015-2017.

In the second section of Table 2, we calculate the conventional mandate gap with alternative scenarios for 2015, 2016, and 2017. The difference between these scenarios and that of the EPA is primarily in our higher projections of total gasoline consumption. Based on estimates provided by the U.S. Energy

Information Administration (EIA) in its November 2016 Short Term Energy Outlook (STEO) we estimate that gasoline consumption increased by 2.9 percent year-over year in 2015 and is proceeding at a rate of increase of 2.5 percent in 2016. We project a conservative 1.5 percent increase for 2017 based on the assumption of continued low crude oil prices. Our calculations based on EIA estimates also suggest that ethanol consumption exceeded the EPA estimate in 2015 and will exceed the EPA projection for 2016. We also project larger consumption in 2017, even with a slightly lower inclusion rate (Line 6). With gasoline consumption under the alternative scenario exceeding the EPA estimate for 2017 and with a fixed fractional rate of 8.33 percent, the volumetric mandate is 191 million gallons larger than the EPA's mandate. Our projection of consumption of other advanced ethanol use (almost entirely imports from Brazil) is 100 million gallons less than the EPA projection. On net, then, our estimate of the conventional mandate gap for 2017 is 109 million gallons less than under the EPA scenario. In addition the gap is 51 million gallons smaller for 2015 and 460 million gallons smaller for 2016. The reason for the drop in 2016 is that our higher estimate of gasoline consumption implies a much higher consumption of ethanol.

The EPA characterized the newly announced 2017 standards in this statement: "The final standards are expected to continue driving the market to overcome constraints in renewable fuel distribution infrastructure, which in turn is expected to lead to substantial growth over time in the production and use of renewable fuels." That is, the EPA asserted that the rulemaking constitutes a "push" in biofuels consumption beyond the so called E10 blend wall and for continued expansion in advanced biofuels consumption. Regardless of the assumptions used, our analysis indicates that the EPA was true to their intention of pushing the conventional ethanol mandate beyond the blend wall.

Calculation of Advanced and Total RFS Gaps

The advanced biofuels gaps for our alternative scenarios are calculated in Table 3 and are presented along with the conventional mandate gaps in order to estimate the total RFS gaps resulting from implementing the EPA mandates. The advanced gap for each year is calculated as the total advanced biofuels mandate as implemented minus the sum of the cellulosic and biomass-based diesel mandates minus the expected consumption of undifferentiated ethanol (Brazilian and domestic) and non-ethanol biofuels. The calculated advanced gap is zero for both 2014 and 2015, 428 million gallons in 2016 and 804 million gallons in 2017. Like the conventional gaps, these gaps would have to be met with some combination of additional production and consumption of advanced biofuels and the use of the existing stock of biofuels credits in the form of outstanding Renewable Identification Numbers (RINs). Assuming that the gaps are filled entirely by biomass-based biodiesel, we calculate total biomass-based diesel production and consumption requirements for each year. The total includes the biomass-based diesel mandate plus the total RFS gap divided by 1.5. The RFS gap is divided by 1.5 since the gap in Table 3 is calculated as ethanol equivalents. Implied total biomass-based diesel consumption (line 12), then, is calculated in terms of wet gallons. The implied increase in potential biomass-based diesel is truly eye-popping, jumping from about 2.0 billion gallons in 2015 to 3.1 billion gallons in 2017.

The magnitude of the implied use of biomass-based biodiesel likely explains the 6 percent increase in soybean oil prices since November 22nd (*farmdoc daily*, November 28, 2016). Based on estimates in the EIA Monthly Biodiesel Production Report, about 7.4 pounds of feedstock are required for each gallon of biodiesel production and soybean oil accounts for 54 percent of those feedstocks. At that rate, an increase in biomass-based diesel production of 719 million gallons in 2017 would require an additional 2.87 billion pounds of soybean oil. To put that in perspective, 2.87 billion pounds represents 14 percent of the USDA's projection of domestic soybean oil consumption during the 2016-17 marketing year that already includes a projection of 5.95 billion pounds used for biodiesel production. The increase would be larger if soybean oil garnered a larger share of the biodiesel feedstock market and smaller if a portion of the gap were filled from the stock of RINs. The willingness for the industry to use RINs stocks, however, may depend on expectations of future EPA rulemakings and the outcome of pending court cases about previous waivers of the conventional ethanol mandate.

Table 3. Conventional, Advanced, and Total RFS Gaps under EPA Final Rulemakings for 2014-2017

Item	2014	2015	2016	2017
(1) Conventional Ethanol Mandate	13.604	14.090	14.497	15.191
(2) Conventional Ethanol Use	13.329	13.783	14.228	14.410
(3) Conventional Mandate Gap [(1)-(2)]	0.275	0.307	0.269	0.781
(4) Advanced Mandate	2.675	2.889	3.602	4.335
(5) Cellulosic Mandate	0.034	0.123	0.229	0.315
(6) Biomass-Based Diesel Mandate	1.665	1.772	1.899	2.026
(7) Undifferentiated Brazilian Ethanol	0.064	0.089	0.041	0.100
(8) Undifferentiated Domestic Ethanol	0.026	0.026	0.027	0.027
(9) Undifferentiated Non-Ethanol	0.053	0.033	0.027	0.050
(10) Advanced Mandate Gap [(4)-(5)-(6)*1.5-(7)-(8)-(9) if >0]	0.000	0.000	0.428	0.804
(11) Total RFS Gap [(3)+(10)]	0.276	0.307	0.697	1.586
(12) Implied Total Biomass-Based Diesel [(6)+(11)/1.5]	1.849	1.976	2.364	3.083

Notes: These volumes are all stated in billion gallons of ethanol equivalents, except for (6) biomass-based diesel and (12) implied total biodiesel, which are stated in billion gallons of "wet" physical volume terms

Implications

We analyzed the magnitude of the "push" in production and consumption of biofuels implied by the 2017 requirements (mandates) of the RFS published last week by the EPA. We found that regardless of the assumptions used, the EPA was true to their intention of pushing the conventional ethanol mandate beyond the blend wall. Two important additional questions arise from our "gap" analysis of the RFS mandates. First, given our projection that domestic consumption of conventional ethanol could reach 14.41 billion gallons in 2017, when will domestic consumption reach the statutory mandate of 15 billion gallons and completely eliminate the conventional mandate gap? The answer has important implications for the value of conventional ethanol (D6) RINs. The second is a policy issue. The advanced biofuels mandates for each year from 2014 to 2017 represent a push in production and consumption in that the write down in the total advanced mandate was less than the write down in the cellulosic mandate. That difference is 469 million gallons in 2017, much larger than in the previous two years. An important policy issue, then, is whether the magnitude of the push will continue to increase under a new Administration. The answer has important implications for the demand for biodiesel feedstocks and the value of biomass-based biodiesel (D4) RINs. We will examine these questions in an upcoming article.

References

Environmental Protection Agency. "Renewable Fuel Standard Program: Standards for 2017 and Biomass-Based Diesel Volume for 2018." Prepublication version signed by EPA Administrator, Gina McCarthy on November 23, 2016, and accessed November 30, 2016. https://www.epa.gov/sites/production/files/2016-11/documents/rfs-2017-annual-rule-frm-2016-11-23.pdf [Please refer to the official version in a forthcoming FR publication, which will appear on the Government Printing Office's FDSys website (www.gpo.gov/fdsys/search/home.action) and on Regulations.gov (www.regulations.gov) in Docket No. EPA-HQ-OAR-2016-0004.]

Good, D. "Weekly Outlook: EPA Renewable Fuel Standard Rallies Soybean Oil Prices." *farmdoc daily* (6):223, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, November 28, 2016.
Irwin, S., and D. Good. "RFS Standards Beyond 2017--Biodiesel or Bust?" *farmdoc daily* (6):104, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, June 2, 2016.

Irwin, S., and D. Good. "The EPA's Proposed 2017 RFS Standards: Is a Push Still a Push?" *farmdoc daily* (6):100, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, May 26, 2016.

U.S. Energy Information Administration. *Petroleum & Other Liquids: Monthly Biodiesel Production Report.* Accessed November 30, 2016. http://www.eia.gov/biofuels/biodiesel/production/

U.S. Energy Information Administration. *Short-Term Energy Outlook.* Released November 8, 2016, and accessed November 30, 2016. http://www.eia.gov/outlooks/steo/