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The Renewable Fuel Standard (RFS): An Overview

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Summary

The Renewable Fuel Standard (RFS) requires U.S. transportation fuel to contain a minimum volume of renewable fuel. The RFS—established by the Energy Policy Act of 2005 (P.L. 109-58; EPAct05) and expanded in 2007 by the Energy Independence and Security Act (P.L. 110-140; EISA)—began with 4 billion gallons of renewable fuel in 2006 and aims to ascend to 36 billion gallons in 2022. The Environmental Protection Agency (EPA) has statutory authority to determine the volume amounts after 2022.

The total renewable fuel statutory target consists of both conventional biofuel and advanced biofuel. Since 2014, the total renewable fuel statutory target has not been met, with the advanced biofuel portion falling below the statutory target by a large margin since 2015. Going forward, it is unlikely that the United States will meet the total renewable fuel target as outlined in statute.

EPA administers the RFS and is responsible for several tasks. For instance, within statutory criteria EPA evaluates which renewable fuels are eligible for the RFS program. Also, EPA establishes the amount of renewable fuel that will be required for the coming year based on fuel supply and other conditions although waiver authority in the statute allows the EPA Administrator to reduce the statutory volumes if necessary. Further, the statute requires that the EPA Administrator "reset" the RFS—whereby the fuel volumes required for future years are modified by the Administrator if certain conditions are met. EPA monitors compliance for the RFS using a system of tradable credits referred to as renewable identification numbers (RINs).

Congress has expressed ongoing interest in the RFS, particularly as the mandate relates to other legislative efforts (e.g., Reid Vapor Pressure requirements for ethanol-gasoline fuel blends containing greater than 10% ethanol, a national octane standard) and about oversight of the RIN market, among other things. Some assert it is time to amend or repeal the RFS, while others contend the best course of action is to maintain the status quo. For instance, some Members contend the RFS hurts consumers by creating an artificial market for ethanol. Others see ethanol as a part of a competitive energy strategy.

Congress may also express interest in how the EPA Administrator applies the RFS "reset" authority. EPA reports that in early 2019 it will issue a rulemaking that proposes to modify—or "reset"—the cellulosic biofuel, advanced biofuel, and total renewable fuel volume targets for the years 2020-2022.

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Introduction

Established by Congress as an amendment to the Clean Air Act, the Renewable Fuel Standard (RFS) mandates that U.S. transportation fuels contain a minimum volume of biofuel.[1] The mandated minimum volume increases annually and must be met using both conventional biofuel (e.g., corn starch ethanol) and advanced biofuel (e.g., cellulosic ethanol). For a renewable fuel to be applied toward the mandate, it must be used for certain purposes (i.e., transportation fuel, jet fuel, or heating oil) and meet certain environmental and biomass feedstock criteria.

A variety of factors, such as infrastructure, technology, and limited federal assistance, have led to challenges in meeting the total volume requirement established by Congress. These challenges have included a lack of cellulosic biofuel production and delays by the U.S. Environmental Protection Agency (EPA) in approving fuel pathways.[2] Further, it is not clear how changes in gasoline consumption in response to fluctuating crude oil and gasoline prices impact the biofuel or conventional fuel industries. It is also uncertain how the program will fare once EPA implements the "reset" provision of the statute, which allows the agency to modify the volumes required for future years (starting in 2016) if certain conditions are met.[3] In addition, some stakeholders have expressed concern about the transparency of the market wherein credits are traded to demonstrate compliance with the mandate.[4] Lastly, there is concern by some biofuel producers that the Trump Administration's issuance of multiple small refinery exemptions has adversely affected, or will adversely affect, biofuel demand.[5] Small refiners may petition the EPA Administrator for an exemption from the RFS mandate if they can prove disproportionate economic hardship.[6]

There are, however, two fuel categories that have consistently met their statutory targets: conventional biofuel and biomass-based diesel.[7] Also, since 2014, two advanced biofuel pathways—renewable compressed natural gas and renewable liquefied natural gas—have constituted the majority of the cellulosic biofuel volume target established by EPA.[8]

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[1] 42 U.S.C. §7545(o).

[2] For more discussion of fuel pathways, see the "Administering Agency" section of this report.

[3] EPA has initiated the process of "a rulemaking that will propose modifying the applicable volumes targets for cellulosic biofuel, advanced biofuel, and total renewable fuel for the years 2020-2022." See Environmental Protection Agency, *Renewable Fuel Standard Program Modification of Applicable Volumes, 2020 Standards, and Other Changes*, 2018, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201810&RIN=2060-AU28.

[4] U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Environment, *Background on Renewable Identification Numbers Under the Renewable Fuel Standard*, Hearing, 115th Cong., July 25, 2018; National Biodiesel Board, "NBB, Dozens of Biodiesel Companies Ask the President to Address RIN Values Without Undercutting the RFS and Rural America," press release, December 18, 2017.

[5] "Biofuel Makers Sue EPA over Small Refinery Waivers to Renewable Fuel Standard," *S&P Global Platts*, May 30, 2018; Senator Chuck Grassley, "Grassley, Thune, Blunt, Fischer, Ernst Joint Statement on EPA Attacks on RFS," press release, April 12, 2018, https://www.grassley.senate.gov/news/news-releases/grassley-thune-blunt-fischer-ernst-joint-statement-epa-attacks-rfs.

[6] For more information on small refinery exemptions, see 42 U.S.C. 7545(o)(9) or U.S. Environmental Protection Agency, *Renewable Fuel Standard Exemptions for Small Refineries*, https://www.epa.gov/renewable-fuel-standard-program/renewable-fuel-standard-exemptions-small-refineries.

[7] U.S. Environmental Protection Agency, *Public Data for the Renewable Fuel Standard Data*, December 10, 2018. Obligated parties have until March 31 to submit annual compliance reports for the prior year. §80.1451(a)(1) in the EPA RFS regulations.

[8] Ibid. EPA defines renewable compressed natural gas as biogas or biogas-derived pipeline quality gas that is compressed for use as transportation fuel and meets the definition of renewable fuel. EPA defines renewable liquefied natural gas as biogas or biogas-derived pipeline quality gas that goes through the process of liquefaction in which it is

Challenges in implementing the RFS have led to scrutiny of the program in Congress and to litigation about EPA's regulations.[9] Largely due to concerns about the implementation and feasibility of the RFS, some Members of Congress have expressed their perspectives on EPA's proposed and final rules as well as EPA's implementation of the program. They also have questioned whether to amend or repeal the RFS or whether to maintain the status quo.[10] This report provides a basic description of the RFS, including some of the widely discussed policy issues related to it.[11]

The Statute

The Renewable Fuel Standard (RFS) was established by the Energy Policy Act of 2005 (P.L. 109-58; EPAct05) and expanded in 2007 by the Energy Independence and Security Act (P.L. 110-140; EISA). The RFS mandate requires that transportation fuels sold or introduced into commerce in the United States contain an increasing volume of a predetermined suite of renewable fuels. The statute required 4.0 billion gallons of renewable fuel in 2006, ascending to 36.0 billion gallons required in 2022, with EPA determining the volume amounts after 2022 in future rulemakings. The statute centers on four renewable fuel categories—conventional biofuel, advanced biofuel, cellulosic biofuel, and biomass-based diesel—each with its own target volume.[12]

The total renewable fuel requirement under the RFS is met with the combination of fuels from two renewable fuel categories: conventional biofuel and advanced biofuel. The requirement for advanced biofuel, in general, can be met with the combination of three types of advanced biofuel: cellulosic biofuel, biomass-based diesel, and other advanced biofuels. To date, the total annual volumes required have been met mostly with conventional biofuel (e.g., corn starch ethanol). Beginning in 2015, the mandate capped the conventional biofuel volume amounts while increasing the requirement for advanced biofuels. For instance, the statutory RFS total advanced biofuel requirement increases over time from approximately 7% of the RFS in 2010 to 58% of the RFS in 2022.[13]

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cooled below its boiling point, and which meets the definition of renewable fuel. See 40 C.F.R. 80.1401.

[9] The 115th Congress held at least 12 hearings where the topics of biofuels and the Renewable Fuel Standard (RFS) were discussed. Since 2010, there have been numerous legal challenges regarding EPA's administration of the RFS. In some cases, courts have found against EPA's rules for various reasons; in others, courts have affirmed EPA's authority.

[10] Rep. Bob Goodlatte, "The Renewable Fuel Standard Hurts Consumers," press release, September 12, 2018, https://goodlatte.house.gov/news/documentsingle.aspx?DocumentID=1304; Sen. Cuck Grassley, "Ethanol Is a Critical Piece of America's Energy Strategy," *CNBC*, May 11, 2018, https://www.cnbc.com/2018/05/11/ethanol-is-critical-for-americas-energy-strategy-sen-grassley.html; Rep. Collin C. Peterson, "Peterson Sees Missed Opportunity in EPA's Final RFS Rule," press release, December 3, 2018; Sen. Tom Carper, "Carper Welcomes RFS Exemption Website, Urges Continued Improvements in Transparency," press release, September 20, 2018. Additionally, legislation has been proposed in the 115th Congress that would amend or repeal the RFS (e.g., H.R. 119, H.R. 776, H.R. 1314, and H.R. 1315).

[11] For additional discussion, see CRS Report R40155, *Renewable Fuel Standard (RFS): Overview and Issues*, by Kelsi Bracmort.

[12] The statute provides definitions for the four renewable fuels. *Conventional biofuel* is corn starch ethanol. *Advanced biofuel* is renewable fuel, other than corn starch ethanol, with lifecycle greenhouse gas emissions of at least 50% less than lifecycle greenhouse gas emissions from its gasoline or diesel counterpart. *Cellulosic biofuel* is renewable fuel derived from cellulose, hemicellulose, or lignin that is derived from renewable biomass, with lifecycle greenhouse gas emissions of at least 60% less than lifecycle greenhouse gas emissions from its gasoline or diesel counterpart. *Biomass-based diesel* is biodiesel or other renewable diesel with lifecycle greenhouse gas emissions of at least 50% less than lifecycle greenhouse gas emissions from its diesel counterpart.

[13] Calculations include the annual mandate required by statute in 2007 and do not take into account EPA's revision of

A key part of the statutory definition of each fuel category is whether the fuel achieves certain greenhouse gas (GHG) reductions relative to gasoline and diesel fuel. Each fuel is assigned a lifecycle GHG emission threshold (in proportion to baseline lifecycle GHG emissions for gasoline and diesel).[14] For example, a fuel must achieve at least a 50% GHG reduction to be considered an *advanced biofuel*, at least a 60% reduction to be considered a *cellulosic biofuel*, and at least a 50% reduction to be considered *biomass-based diesel*. Similarly, biofuel from new facilities—those built after enactment of the 2007 law—must achieve at least a 20% GHG reduction to qualify as a conventional renewable fuel.[15]

Statutory Compliance

EPA regulates compliance with the RFS using a tradable credit system.[16] Obligated parties (generally, refiners) submit credits—called renewable identification numbers (RINs)—to EPA that equal the number of gallons in their annual obligation.[17] This annual obligation, referred to as the renewable volume obligation (RVO), is the obligated party's total gasoline and diesel sales multiplied by the annual renewable fuel percentage standards announced by EPA.[18] RINs are valid for use in the year they are generated and the following year.[19] Obligated parties may carry a deficit from one year to the next, but in the year following the deficit, the obligated party must meet compliance for that year's renewable fuel volume requirement and purchase or generate enough credits to satisfy the deficit from the previous year.[20] RINs may be used by the party that generates them or they may be traded with other parties. The EPA Moderated Transaction System (EMTS) is used to register RIN transactions.

the biofuel mandates for 2010 through 2018.

[14] For more discussion, see CRS Report R40460, *Calculation of Lifecycle Greenhouse Gas Emissions for the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci and Kelsi Bracmort.

[15] New facilities are facilities that commence construction after December 19, 2007. 42 U.S.C. §7545 (o)(2)(A)(i).

[16] 42 U.S.C. §7547(o)(5).

[17] EPA defines an obligated party as any refiner that produces gasoline or diesel fuel within the 48 contiguous states or Hawaii, or any importer of gasoline or diesel fuel into the 48 contiguous states or Hawaii during a compliance period. A renewable identification number (RIN) is a unique 38-character number that is issued (in accordance with EPA guidelines) by the biofuel producer or importer at the point of biofuel production or the port of importation. Each qualifying gallon of renewable fuel has its own unique RIN. For more information, see CRS Testimony TE10026, *Background on Renewable Identification Numbers under the Renewable Fuel Standard*, by Brent D. Yacobucci.

[18] For 2019, the overall renewable fuel percentage standard is 10.97%, the advanced biofuel percentage standard is 2.71%, the biomass-based diesel percentage standard is 1.73%, and the cellulosic biofuel percentage standard is 0.230%. EPA, "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020; Final Rule," 83 *Federal Register* 63704, December 11, 2018.

[19] 40 C.F.R. §80.1427(6)(i) in the EPA RFS regulations. Obligated parties may use RINS generated in the previous year to meet up to 20% of their current year exporter renewable volume obligation. EPA, "RFS Renewable Identification Number (RIN) Quality Assurance Program; Final Rule," 79 *Federal Register*, July 18, 2014.

[20] 42 U.S.C. §7547(o)(5)(D).

Differences Between the 2005 RFS and the 2007 RFS

The RFS was established in 2005 by the Energy Policy Act. Specifically, Section 1501 (Renewable Content of Gasoline) of EPAct05 amended Section 211 of the Clean Air Act (CAA) by adding a Renewable Fuel Program. CAA Section 211(o) requires any gasoline and diesel fuel and fuel additives produced and commercially distributed for use in highway motor vehicles to be registered with EPA. Section 1501 directed the EPA Administrator to ensure that gasoline sold or introduced into commerce in the United States contained a minimum volume of renewable fuel. This "original" 2005 RFS required 4.0 billion gallons of renewable fuel for 2006, ascending to 7.5 billion gallons by 2012. The amount of renewable fuel was described in EPAct05 for the years 2006 through 2011. Beginning in 2013, the annual volume of renewable fuel was to be determined by the EPA Administrator and the Secretaries of Agriculture and Energy. Additionally, the RFS established in EPAct05 would have required that at least 250 million gallons of the renewable fuel be derived from cellulosic biomass starting in 2013.

The RFS was expanded in 2007 by the Energy Independence and Security Act. There are at least five major changes in the RFS as expanded by EISA:

- larger annual volumes,
- the establishment of separate requirements for different classes of biofuels (e.g., cellulosic, advanced),
- the addition of greenhouse gas accounting requirements,
- a different renewable biomass definition (as explained below), and
- an expansion of EPA's waiver authority to lower RFS volumes.

The renewable biomass definition for the 2007 RFS does not allow for biomass removed from federal lands, and excludes crops from forested lands. Further, the 2007 RFS waiver authority directs the EPA Administrator to set the annual standard for cellulosic biofuels under the RFS for the following year by November 30 of each year, and to lower the cellulosic biofuel standard if projected U.S. production is less than the volume in the statute. The 2007 RFS waiver authority also allows the EPA Administrator to reduce the renewable fuel and advanced biofuel requirements of the standard, if the cellulosic biofuel requirement is lowered.

Different biofuels are not treated equally within the RFS. The categories are nested within each other, such that some fuels qualify for multiple categories (e.g., cellulosic ethanol), while others (mainly corn starch ethanol) may only be used to meet the overall RFS but not the advanced category or its nested subcategories.[21] For example, a gallon of cellulosic biofuel may be used to meet the cellulosic biofuel mandate, the advanced biofuel mandate, and the total renewable fuel mandate, possibly making it a more highly valued fuel.[22]

In addition, some biofuels generate more RINs per volume than others because of the difference in the fuel's energy content. This difference is accounted for by a metric referred to as the equivalence value (EV) of the biofuel.[23] The EV of a renewable fuel represents the number of gallons that can be claimed for compliance purposes for every physical gallon of renewable fuel used, and it is generally the ratio of the energy content of a gallon of the fuel to a gallon of ethanol. For example, because biodiesel has an EV of 1.5 when being used as an advanced biofuel, 1,000 physical gallons of biodiesel would equal 1,500 RIN gallons of advanced biofuels.[24]

[21] Although a gallon of a biofuel may be used to fulfill individual sub-requirements or the overall requirement, each gallon counts once against the overall renewable fuel use obligation.

[22] The value of any biofuel within the RFS depends on the RIN price at a given time. As different categories of RINs are used to meet the various standards, there is often a price difference between RINs (e.g., advanced biofuel RINs are generally more expensive than conventional biofuel RINs). However, there is no public market for RINs, so real-time price data are difficult to obtain. EPA does provide historical weekly RIN price data. Environmental Protection Agency, *RIN Trades and Price Information*, December 10, 2018, https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rin-trades-and-price-information.

[23] 40 C.F.R. §80.1415.

[24] All EVs are in relation to the energy content of ethanol. The EV for ethanol is 1.0. One gallon of biodiesel contains

The 2019 Final Rule

EPA released the final rule for the RFS for 2019 on November 30, 2018.[25] The rule calls for 19.92 billion gallons of total renewable fuel for 2019—a 1% increase from the 19.29 billion gallons required in 2018 (see **Table 1**). The conventional biofuel volume requirement remains at 15.00 billion gallons. The volume requirements set by EPA for 2019 for total renewable fuel, advanced biofuel, and cellulosic biofuel are all less than the volumes called for in statute but greater than the previous year's volumes—an annual occurrence that started in 2014. EPA used the cellulosic waiver authority to reduce the statutory volumes.[26] EPA reduced the statutory targets for both advanced biofuel and total renewable by the same amount as the reduction for the cellulosic biofuel (i.e., 8.08 billion gallons). EPA reports that the advanced biofuel statutory target of 13.0 billion gallons "cannot be reached in 2019 … primarily due to the expected continued shortfall in cellulosic biofuel."[27] EPA estimates there are 2.59 billion carryover RINs available.[28] In its response to comments regarding the rule, EPA mentions a forthcoming reset rulemaking.[29]

EPA set the biomass-based diesel 2020 volume requirement at 2.43 billion gallons. Biomass-based diesel is the predominant biofuel used to satisfy the advanced biofuel portion of the mandate. Previously, it has been used to backfill the overall advanced biofuel requirement if another advanced biofuel fell short (e.g., cellulosic biofuel). EPA reports "the advanced biofuel volume requirement is driving the production and use of biodiesel and renewable diesel volumes over and above volumes required through the separate BBD [biomass-based diesel] standard" and that the 2020 volume requirement "provides sufficient incentive to producers of 'other' advanced biofuels."[30] EPA acknowledges that it took into consideration the unavailability of the biodiesel tax credit for 2019, the tariffs on imports of biodiesel from Argentina and Indonesia, the tariffs on soybeans exported to China, and more in its assessment of the biodiesel requirement for 2020.

roughly 1.5 times the energy of one gallon of ethanol, and thus has an EV of 1.5.

[25] EPA, "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020; Final Rule," 83 *Federal Register* 63704, December 11, 2018.

[26] For more information on waiver authority for the RFS, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

[27] Ibid.

[28] Ibid. Within limits, carryover RINs may be used to comply with the next year's mandate. EPA proposes to preserve the RINs to provide obligated parties with compliance flexibility.

[29] A "reset" requires that the EPA Administrator modify the applicable volumes of the RFS in future years starting in 2016 if certain conditions are met. U.S. Environmental Protection Agency, *Renewable Fuel Standard Program—Standards for 2019 and Biomass-Based Diesel Volume for 2020: Response to Comments*, EPA-420-R-18-019, December 2018. For more information on the RFS reset, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

[30] Ibid.

Table 1. Renewable Fuel Standard Statute, EPA Final and Proposed Volumes

(billions of gallons)

Year	Statute, Final, or Proposed	Total Renewable Fuel	Portion from Advanced Biofuels: Total Advanced Biofuels	Portion from Advanced Biofuels: *Cellulosic Biofuel*	Portion from Advanced Biofuels: *Biomass-Based Diesel*	Cap on Conventional Biofuel	Due Date and Actual Date of Final Rule
2010	**S**	12.95	0.95	*0.1000*	*0.65*	12.00	Nov. 2009
	F	12.95	0.95	*0.0065*	*1.15*	12.00	Feb. 2010
2011	**S**	13.95	1.35	*0.2500*	*0.80*	12.60	Nov. 2010
	F	13.95	1.35	*0.0060*[a]	*0.80*	12.60	Nov. 2010
2012	**S**	15.20	2.00	*0.5000*	*1.00*	13.20	Nov. 2011
	F	15.20	2.00	*0.0105*[b]	*1.00*	13.20	Dec. 2011
2013	**S**	16.55	2.75	*1.0000*	*≥1.00*	13.80	Nov. 2012
	F	16.55	2.75	*0.0008*	*1.28*	13.80	Aug. 2013
2014	**S**	18.15	3.75	*1.7500*	*≥1.00*	14.40	Nov. 2013
	F	16.28	2.67	*0.0330*	*1.63*	13.61	Nov. 2015
2015	**S**	20.50	5.50	*3.0000*	*≥1.00*	15.00	Nov. 2014
	F	16.93[c]	2.88	*0.1230*	*1.73*	14.05	Nov. 2015
2016	**S**	22.25	7.25	*4.2500*	*≥1.00*	15.00	Nov. 2015
	F	18.11[c]	3.61	*0.2300*	*1.90*	14.50	Nov. 2015
2017	**S**	24.00	9.00	*5.5000*	*≥1.00*	15.00	Nov. 2016
	F	19.28	4.28	*0.3110*	*2.00*	15.00	Nov. 2016
2018	**S**	26.00	11.00	7.0000	*≥1.00*	15.00	Nov. 2017
	F	19.29	4.29	0.2880	*2.10*	15.00	Nov. 2017
2019	**S**	28.00	13.00	8.5000	*≥1.00*	15.00	Nov. 2018
	F	19.92	4.92	0.4180	2.10	15.00	Nov 2018
2020	**S**	30.00	15.00	10.5000	*≥1.0*	15.00	Nov. 2019
	P	TBD	TBD	TBD	2.43[d]	TBD	TBD
2021	**S**	33.00	18.00	13.5000	*≥1.00*	15.00	Nov. 2020
	P	TBD	TBD	TBD	TBD	TBD	TBD
2022	**S**	36.00	21.00	16.0000	*≥1.00*	15.00	Nov. 2021
	P	TBD	TBD	TBD	TBD	TBD	TBD
2023 and beyond	**S**	To Be Determined by the EPA Administrator[e]					

Source: Energy Independence and Security Act of 2007 (EISA; P.L. 110-140); contact the author for U.S. Environmental Protection Agency (EPA) final and proposed rule citations.

Notes: S = Statute, F = Final, P = Proposed, TBD = To Be Determined. All volumes are ethanol equivalent, except for biomass-based diesel, which is actual. The 2010 biomass-based diesel requirement of 1.15 billion gallons equals the 0.5 billion gallon requirement for 2009 plus the 0.65 billion gallon requirement for 2010. Cap

on Conventional Biofuel = Total Renewable Fuel – Total Advanced Biofuel. The total advanced biofuel requirement equals the sum of cellulosic biofuel and biomass-based diesel (both of which have annual volume targets provided in statute and are identified in Table 1 in italics) plus other advanced biofuel (which does not have an annual volume target provided in statute).

a. EPA rescinded the 2011 cellulosic biofuel standard.

b. RFS Final Rule 2012, *Federal Register*, January 9, 2012. Subsequently vacated under American Petroleum Institute v. EPA, D.C. Cir., No. 12-1139, 1/25/13.

c. The D.C. Circuit Court vacated EPA's 2016 total renewable fuel volume requirement and remanded the 2015 final rule to EPA for reconsideration. Americans for Clean Energy v. EPA, No. 16-1005, 2017 U.S. App. LEXIS 13692, at *4-5 (D.C. Cir. July 28, 2017).

d. The 2020 final volume requirement for biomass-based diesel is 2.43 billion gallons.

e. The EPA Administrator is to consult with the Secretaries of Energy and Agriculture and take into account an analysis of certain factors to determine the volume amounts. 42 U.S.C. §7547(o)(2)(B)(ii).

RFS Implementation Issues

Implementation of the RFS has been complex, and compliance with some of its parts has been challenging, according to some stakeholders. This section briefly explains some of the general concerns and challenges with implementing the RFS.

Administering Agency

EPA administers the RFS.[31] This responsibility includes evaluating renewable fuel pathways eligible for the RFS.[32] In addition, EPA is required to evaluate the ability of the biofuel industry to produce enough fuel to meet the annual volume standard, release an annual volume standard based on its research findings,[33] and ensure that annual compliance by obligated parties is met. All of the above must be completed annually, taking into consideration comments from other government agencies, the public, and, recently, court decisions. These responsibilities could be viewed as an addition to EPA's regulatory workload and have required EPA to develop new capabilities to carry them out.

For several years following the 2010 issuance of the amended RFS final rule,[34] EPA has had difficulty projecting certain volume requirements (e.g., cellulosic biofuels) which have led EPA to use its waiver authority to set annual volume requirements for cellulosic biofuel, total advanced biofuel, and total renewable fuel different from what was stated in the statute.[35] Legal challenges

[31] Although the RFS is administered by EPA, programs under other federal departments may indirectly assist biofuel production that may be used to meet the mandate. For example, the U.S. Department of Agriculture provides resources and support for biofuel feedstock development and supply (e.g., Biomass Crop Assistance Program) as well as biofuel infrastructure development (e.g., Rural Energy for America Program, Biorefinery Assistance Program, Biofuel Infrastructure Partnership, etc.).

[32] A fuel pathway consists of three components: a biomass feedstock, a biofuel production process, and a fuel type (e.g., ethanol made from corn starch using a dry mill production process). The fuel pathway is assigned to a renewable fuel category (known by its D code provided in Table 1 of 40 C.F.R. §80.1426 in the RFS regulations) which signifies which RIN the biofuel is eligible for to be in compliance with the RFS. EPA maintains a list of approved fuel pathway and fuel pathway petitions on its website (https://www.epa.gov/renewable-fuel-standard-program/approved-pathways-renewable-fuel).

[33] Frequently, EPA has approved annual standards for some biofuels different from what was originally scheduled in statute.

[34] EPA, "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule," 75 *Federal Register*, March 26, 2010.

[35] For more discussion, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and*

have been brought against the EPA regarding some of these annual fuel volume projections. For instance, the American Petroleum Institute objected to EPA's 2012 cellulosic biofuel production projection, among other things, and challenged it in court. The federal court vacated the 2012 cellulosic biofuel standard and provided principles for EPA to apply to future annual projections.[36] Likewise, Americans for Clean Energy and other petitioners challenged various aspects of the final rule that set the volume requirements and projections for 2014-2016 and 2017 for biomass-based diesel, including EPA's interpretation of "inadequate domestic supply" in exercising its general waiver authority to reduce the total volume requirements. The D.C. Circuit Court vacated EPA's 2016 total renewable fuel volume requirement and remanded the 2015 final rule to EPA for reconsideration consistent with the court's decision.[37]

In some instances the timing of EPA's RFS regulatory actions, such as the annual announcement of the renewable fuel volume requirements, has not met statutory deadlines. The most recent final rules, including the 2019 final rule, adhere to the statutory schedule.[38] However, some of the earlier final rules did not meet the statutory deadline.[39] A lack of timely rulemaking combined with inaccurate volume projections could affect private investment, according to some advanced biofuel producers.[40] Regardless, they lead to uncertainty in compliance for obligated parties. The amount of time it takes the agency to approve new fuel pathways and register new facilities has been raised in public comments to proposed RFS rules.[41] Slow approval could stifle investment and production of new fuels. Further, prolonged processing time for some program enhancement rules—such as the Proposed Renewables Enhancement and Growth Support Rule (REGS rule)—may impede the growth of the program.[42]

Lastly, the final rule for 2014 through 2016 triggered the "reset" provision of the RFS for the advanced biofuel and cellulosic biofuel categories.[43] The 2019 final rule triggered the "reset" provision for total renewable fuel.[44] Thus, three of the four renewable fuel categories identified in statute are subject to being "reset" by the EPA Administrator. The reset provision gives the EPA Administrator authority to adjust the applicable volumes of the RFS for future years starting in 2016 if certain conditions are met.[45] How EPA implements this provision will affect renewable fuel production and compliance with the overall program. EPA reports that it will issue a

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Modification of Volumes, by Kelsi Bracmort.

[36] American Petroleum Institute v. EPA, 706 F.3d 474 (D.C. Cir. 2013). More discussion of this legal challenge is in CRS Report R41106, *The Renewable Fuel Standard (RFS): Cellulosic Biofuels*, by Kelsi Bracmort.

[37] Americans for Clean Energy v. EPA, No. 16-1005, 2017 U.S. App. LEXIS 13692, at *4-5 (D.C. Cir. July 28, 2017).

[38] Under the Clean Air Act, each year's standards are required to be announced by November 30 of the previous year.

[39] EPA's late announcement of the annual requirements may be due to the depth of the analysis (e.g., difficulty in obtaining reliable and timely information from the industry) or to other factors.

[40] Written statement by Nebraska Governor Pete Ricketts, Chairman, Governors' Biofuels Coalition, *U.S. Environment Protection Agency, Public Hearing, Proposed Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019*, Washington, DC, August 1, 2017.

[41] EPA, *Renewable Fuel Standard Program—Standards for 2018 and Biomass-Based Volume for 2019: Response to Comments*, EPA-420-R-17-007, December 2017.

[42] EPA issued the proposed REGS rule in November 2016. The REGS rule would modify RFS program regulations to increase production of cellulosic and other advanced biofuels, among other things. It is not clear when the final rule will be issued.

[43] 42 U.S.C. §7545(o)(7)(F).

[44] EPA, "Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020; Final Rule," 83 *Federal Register* 63704, December 11, 2018.

[45] For more discussion of the reset provision, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

rulemaking in early 2019 that proposes to reset the cellulosic biofuel, advanced biofuel, and total renewable fuel volume targets for the years 2020-2022.[46]

Qualifying Biofuels

As noted above, there are a number of nested categories within the RFS; a fuel may qualify as a biofuel for one or more portions of the mandate.[47] Difficulty by some advanced biofuel producers in understanding which advanced biofuels qualify for the RFS can lead to challenges in determining how compliance is being met.[48]

Not all fuels from a renewable source are eligible under the RFS. The RFS operates as a biofuel standard, with priority assigned to liquid transportation fuels from biomass feedstocks.[49] Other renewable sources (e.g., wind) do not qualify. Before a fuel can generate RFS RINs, however, that fuel pathway must be approved by EPA; according to advanced biofuel producers that process can take a considerable amount of time for some fuels.[50]

Lastly, some may view the RFS as a biofuel production mandate. The statutory language does not mandate the production of biofuels; rather, it mandates the use of biofuel. However, it could be argued that it is difficult to use a fuel that is not being produced and that the RFS therefore indirectly creates a demand for certain biofuels and thus stimulates their production.

Cellulosic Biofuel Production

By statute, cellulosic biofuel is targeted to comprise approximately 44% of the total renewable fuel mandate in 2022. However, the annual cellulosic biofuel production volume established by Congress is not being met. Actual cellulosic biofuel production volumes (e.g., cellulosic ethanol) are below the expectations set when the law was passed. For instance, in 2019, the statute requires 8.5 billion gallons of cellulosic biofuel. EPA set the 2019 target volume at 418 million gallons for 2019. This shortfall is due to several factors, including lack of private investment, technology setbacks, and uneven support from the federal government.[51] These factors, coupled

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[46] Environmental Protection Agency, *Renewable Fuel Standard Program Modification of Applicable Volumes, 2020 Standards, and Other Changes*, 2018, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201810&RIN=2060-AU28.

[47] Approved RFS fuels and feedstocks are provided by EPA at http://www.epa.gov/otaq/fuels/renewablefuels/new-pathways/approved-pathways.htm.

[48] For example, there were questions by some about the eligibility of algae-based biofuels for the RFS. For more information, see CRS Report R42122, *Algae's Potential as a Transportation Biofuel*, by Kelsi Bracmort.

[49] In July 2014, EPA approved new cellulosic and advanced biofuel pathways to include the production of compressed natural gas, liquefied natural gas, and electricity from biogas from landfills, municipal waste-water treatment facility digesters, agricultural digesters, and separated municipal solid waste digesters. Another category of a compliant fuel for the RFS is home heating oil—fuel oils which are produced from qualifying renewable biomass and used to generate heat to warm buildings or other facilities where people live, work, recreate, or conduct other activities. See EPA, "Regulation of Fuels and Fuel Additives: RFS Pathways II, and Technical Amendments to the RFS Standards and E15 Misfueling Mitigation Requirements; Final Rule," 79 *Federal Register* 138, July 18, 2014. EPA, "Regulation of Fuels and Fuel Additives: Modifications to Renewable Fuel Standard Program,"78 *Federal Register*, October 22, 2013.

[50] Biotechnology Innovation Organization, "2018 RFS Volumes Set Back Growth in Cellulosic Biofuels," press release, November 30, 2017, https://www.bio.org/press-release/2018-rfs-volumes-set-back-growth-cellulosic-biofuels; "BIO Encourages EPA to Speed Approvals of New Biofuel Pathways," *Business Wire*, March 31, 2014, https://www.businesswire.com/news/home/20140331006205/en/BIO-Encourages-EPA-Speed-Approvals-New-Biofuel.

[51] For more discussion, see CRS Report R41106, *The Renewable Fuel Standard (RFS): Cellulosic Biofuels*, by Kelsi Bracmort.

with the fact that annual volumes in the statute were established when market conditions for raising investment capital for new biofuel technologies were more favorable, may suggest unrealistic targets for some advanced biofuels for the near future. These production limitations have raised questions about whether the statutory cellulosic biofuel volumes are attainable.

Blend Wall

The "blend wall"—the upper limit to the total amount of ethanol that can be blended into U.S. gasoline and still maintain automobile performance and comply with the Clean Air Act—has been viewed by many to be in direct conflict with the biofuel volumes mandated in the RFS.[52] Thus far, the largest volume being met under the RFS is for the nonadvanced (conventional) biofuel segment of the mandate, met mainly with corn starch ethanol blended into gasoline. Due to a variety of factors, ethanol content in gasoline is generally limited to 10% (E10). With a relatively fixed supply of gasoline, the amount of ethanol that can be supplied this way is also limited. If the ethanol content of gasoline for the majority of vehicles remains at 10%, and given current fuel consumption rates, the conventional biofuel portion of the RFS is requiring slightly more ethanol than can technically be blended into gasoline.[53]

While the blend wall remains a concern, it may not be as significant an impediment to immediate fuel consumption as previously considered by some. Indeed, EPA reports "the E10 blendwall is not the barrier that some stakeholders believe it to be."[54] Had the RFS mandates—for both conventional biofuel *and* advanced biofuel—come to fruition in the form of mostly ethanol, or had fuel consumption decreased further, the blend wall potentially could have led to more discussion about the volume mandates. However, primarily due to the lack of cellulosic biofuel production, more time has been granted to address the blend wall and the scheduled levels of biofuels in the RFS.

Some possible approaches could alleviate blend wall concerns in the near term. One option suggested by some is to blend higher levels of ethanol into conventional gasoline.[55] In 2010 EPA granted a Clean Air Act waiver that allows gasoline to contain up to 15% ethanol for use in model year 2001 and newer light-duty motor vehicles.[56] However, limited demand, infrastructure and automobile warranty concerns, and the lack of a waiver to sell E15 during the summer months, have precluded widespread offering and purchase of E15, gasoline blended with 10.5% to 15% ethanol.[57] Widespread use of E15 could potentially postpone the blend wall for a few years.

Another option to address the blend wall would be an aggressive push for the use of ethanol in flexible-fuel vehicles capable of using E85, a gasoline-ethanol blend containing 51% to 83%

[52] For more discussion, see CRS Report R40445, *Intermediate-Level Blends of Ethanol in Gasoline, and the Ethanol "Blend Wall,"* by Kelsi Bracmort.

[53] The U.S. Energy Information Administration (EIA) reports that approximately 142.6 billion gallons of motor gasoline was consumed in the United States in 2017 and approximately 14.4 billion gallons of fuel ethanol was blended into motor gasoline in 2017. This equates to ethanol constituting approximately 10.1% of motor gasoline in the United States in 2017. EIA, *Short-Term Energy Outlook*, Table 4a, January 2018.

[54] EPA, "Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019; Proposed Rule," 82 *Federal Register*, July 21, 2017.

[55] Farmdoc Daily, *Expanding the Ethanol Blend Wall—A Role for E85?*, January 31, 2013.

[56] Currently, E15 cannot be sold during summer months due to Reid Vapor Pressure requirements. S. 517 and H.R. 1311 would give ethanol-gasoline fuel blends such as E15 a waiver from these requirements. For more discussion, see CRS Insight IN10979, *Year-Round Sale of E15*, by Kelsi Bracmort.

[57] There are both government and industry infrastructure initiatives aimed at increasing the availability of E15 and other higher ethanol-gasoline blends (e.g., USDA Biofuel Infrastructure Partnership and the Prime the Pump fund).

ethanol.[58] However, there are infrastructure constraints with the use of E85. For example, the number of E85 fueling stations is limited.[59] To help address these infrastructure issues, the U.S. Department of Agriculture (USDA) announced $100 million in matching grants in 2015 under its Biofuel Infrastructure Partnership.[60] The grants may be used for blender pumps, dedicated E15 or E85 pumps, and new storage tanks and related equipment associated with new facilities or additional capacity.

Other Factors

The RFS is not a stand-alone policy. It interacts with many factors that are not easily controlled. For example, cellulosic biofuel production, at a minimum, requires conversion technology, which itself requires technical expertise and time to ramp up to commercial scale. The large quantity of biomass feedstocks needed to produce such biofuels requires factors such as appropriate weather conditions and an expectation of stable markets for feedstock commodities. Further, some types of biofuel production thus far have been sensitive to the availability of tax incentives in order to be economically feasible (e.g., biodiesel).[61] Unexpected occurrences (e.g., drought, failed technology, tax incentive expiration) could potentially impact an entire industry, especially for some advanced biofuels in nascent industries compared to conventional transportation fuels.

Congressional Issues

The RFS was established in 2005 at a time when Congress foresaw the need to diversify the country's energy portfolio, strengthen the economy of rural communities that could contribute to biofuel production, bolster U.S. standing in an emerging segment of the energy technology market, and protect the environment, among other objectives. The RFS was then subsequently expanded in 2007. Over the past decade some components of the RFS have progressed steadily toward meeting statutory requirements and other components have not.

The RFS is a program with ambitious objectives. Policy questions surrounding future consideration of the RFS might include

- What should be the purposes of the RFS?
- Is the RFS properly designed to achieve those purposes?
- What happens when, and if, the RFS achieves its purposes?

At the outset, some would argue that the first question may seem straightforward; the RFS exists to introduce more biofuels into the transportation fuel market to achieve a number of transportation fuel supply and environmental objectives. However, the statute does not list any

[58] The Energy Information Administration (EIA) estimated there would be approximately 19.6 million flexible-fuel vehicles (FFVs) in use in 2016 designed to use any mix of gasoline and/or E85. However, most of these FFVs are not using E85. U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Energy and Power, *Statement of Howard Gruenspecht Deputy Administrator Energy Information Administration U.S. Department of Energy*, 114th Cong., 2nd sess., June 22, 2016.

[59] The U.S. Department of Energy reports there were 3,309 E85 fueling stations in early December 2018. U.S. Department of Energy, *Ethanol Fueling Station Locations*, December 14, 2018, https://afdc.energy.gov/fuels/ethanol_locations.html#/find/nearest?fuel=E85.

[60] For more discussion, see CRS In Focus IF10377, *USDA Initiative Is Funding New Ethanol Infrastructure*, by Mark A. McMinimy.

[61] For more discussion, see CRS Report R41282, *Agriculture-Based Biofuels: Overview and Emerging Issues*, by Mark A. McMinimy.

specific purposes or objectives. Some stakeholders argue that the RFS exists primarily to find another market for biomass feedstocks or to promote the economy of rural America (e.g., the construction of biofuel facilities that create jobs). To the extent the RFS was designed to reduce U.S. dependence on foreign oil, and to the extent that hydraulic fracturing and the growth of unconventional oil and gas production have contributed to achieving that objective, some stakeholders have questioned whether the RFS is still needed for energy security purposes.[62] Likewise, the environmental impact of the RFS could be challenged, as the advanced biofuel component of the RFS—set to yield greater greenhouse gas emission reduction benefits—has missed the statutory targets by a large margin.[63]

In examining whether the RFS is well designed to realize its general purpose, some have inquired about the challenges in achieving the ambitious RFS targets, given concerns about the slow development of some advanced biofuel supplies. Additionally, past delays in announcing final annual standards by EPA have led to uncertainty for biofuel producers, feedstock growers, and refiners. Whether the RFS should be eliminated, amended to address the current challenges in the program, or maintained in its current form is an ongoing question for Congress. A related question is whether the current provisions for EPA to waive various portions of the RFS mandates and to reset the RFS are sufficient to address the current supply challenges or whether the use of these waivers runs counter to the goals of the program. Some Members of Congress have proposed alternatives to the RFS, such as transitioning to an octane standard.[64]

Other Members of Congress have expressed interest in modifying or eliminating the conventional biofuel (e.g., corn starch ethanol) portion of the mandate. Some contend that the conventional biofuel segment of the biofuels industry is well established, so it should not require a use mandate. In addition, it has been argued that a demand for conventional biofuels exists regardless of congressional involvement. Others counter that the RFS is needed to help lower GHG emissions and to assure that the biofuels industry continues to have access to a fuel distribution infrastructure that is largely controlled by petroleum interests.

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[62] For more discussion, see CRS Report R44854, *21st Century U.S. Energy Sources: A Primer*, coordinated by Michael Ratner.

[63] U.S. Government Accountability Office, *Renewable Fuel Standard: Program Unlikely to Meet Production or Greenhouse Gas Reduction Targets*, GAO-17-264T, December 1, 2016; U.S. Government Accountability Office, *Renewable Fuel Standard: Low Expected Production Volumes Make It Unlikely That Advanced Biofuels Can Meet Increasing Targets*, GAO-17-108, November 28, 2016.

[64] Rep. John Shimkus, "Shimkus, Flores Release Draft 21st Century Transportation Fuels Act," press release, November 21, 2018, https://shimkus.house.gov/media-center/press-releases/shimkus-flores-release-draft-21st-century-transportation-fuels-act; U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Environment, *Discussion Draft: The 21st Century Transportation Fuels Act*, 115th Cong., December 11, 2018.

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