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The Renewable Fuel Standard (RFS): In Brief

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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 fuel contain a minimum volume of biofuel.¹ The mandated minimum volume increases annually and must be met using both conventional biofuel (e.g., cornstarch ethanol) and advanced biofuel (e.g., cellulosic ethanol). For a biofuel to be applied toward the mandate, it must be used for certain purposes (transportation fuel, jet fuel, or heating oil) and meet certain environmental and biomass feedstock criteria.

A variety of factors (e.g., 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 and fluctuating crude oil and gasoline prices will impact the biofuel industry. It is also unclear how the program will fare if 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. Lastly, some stakeholders have expressed concern about RFS compliance—particularly about which party in the renewable fuel supply chain should be designated as the obligated party to demonstrate program compliance and about the transparency of the market whereby credits are traded to demonstrate compliance.

Although there are challenges, two fuel categories have met the 2016 statutory targets: conventional biofuel and biomass-based diesel. Also, two relatively new advanced biofuel pathways—renewable compressed natural gas and renewable liquefied natural gas—constitute the majority of the 2016 cellulosic biofuel volume target established by EPA.

Challenges in implementing the RFS have led to scrutiny of the program in Congress and to court rulings on EPA’s regulations.³ 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 and questioned whether to amend or repeal the RFS or whether the best course is to maintain the status quo.⁴

¹ 42 U.S.C. §7545(o).

² For more information on fuel pathways, see the “Administering Agency” section of this report.

³ The 115th Congress has held at least two hearings directly related to biofuels and indirectly related to the Renewable Fuel Standard (RFS): U.S. Congress, Senate Committee on Environment and Public Works, *Legislative Hearing on S. 517, the Consumer and Fuel Retailer Choice Act*, 115th Cong., June 14, 2017; and U.S. Congress, House Committee on Science, Space, and Technology, *Joint Subcommittee on Environment and Subcommittee on Energy Hearing—Examining Advancements in Biofuels: Balancing Federal Research and Market Innovation*, 115th Cong., July 25, 2017. The 114th Congress held multiple hearings in which the RFS or renewable fuels were the major focus or a recurring topic of discussion. Since 2010, there have been at least five legal challenges regarding the U.S. Environmental Protection Agency’s (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.

⁴ U.S. Congress, Senate Committee on Homeland Security and Governmental Affairs, Subcommittee on Regulatory Affairs and Federal Management, *Re-examining EPA’s Management of the Renewable Fuel Standard Program*, hearing, 114th Cong., 1st sess., June 18, 2015; U.S. Congress, House Committee on Science, Space, and Technology, Subcommittee on Environment, *The Renewable Fuel Standard: A Ten Year Review of Costs and Benefits*, hearing, 114th Cong., 1st sess., November 3, 2015; U.S. Congress, Senate Committee on Environment and Public Works, *Oversight of the Renewable Fuel Standard*, hearing, 114th Cong., 2nd sess., February 24, 2016; U.S. Congress, House Committee on Oversight and Government Reform, Subcommittee on the Interior, *Examining the Renewable Fuel Standard*, hearing, 114th Cong., 2nd sess., March 16, 2016; U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Energy and Power, *Renewable Fuel Standard-Implementation Issues*, hearing, 114th Cong., 2nd sess., June 22, 2016; U.S. Congress, House Committee on Science, Space, and Technology, Subcommittee on Energy, *The* (continued...)

This report provides a basic description of the RFS, including some of the widely discussed issues.⁵

The Statute

The RFS was established by the Energy Policy Act of 2005 (P.L. 109-58; EAct05) and expanded in 2007 by the Energy Independence and Security Act (P.L. 110-140; EISA). The RFS mandate requires that transportation fuel sold or introduced into commerce in the United States contain an increasing volume of a predetermined suite of renewable fuels. The statute requires 4.0 billion gallons of renewable fuel in 2006, ascending to 36.0 billion gallons 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 in the statute.

The total renewable fuel requirement for the RFS is met with the combination of fuels from two renewable fuel categories: conventional biofuel and advanced biofuel. Further, 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., cornstarch ethanol). Beginning in 2015, the mandate caps the conventional biofuel volume amounts while increasing the requirement of advanced biofuels. For instance, the RFS advanced biofuel requirement increases over time from less than 1% of the RFS in 2010 to 58% of the RFS in 2022.⁶

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.⁷ Each fuel is assigned a lifecycle GHG emission threshold (in proportion to baseline lifecycle GHG emissions for gasoline and diesel).⁸ 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*,

(...continued)

EPA Renewable Fuel Standard Mandate, hearing, 114th Cong., 2nd sess., July 23, 2016. U.S. Congress, Senate Committee on Homeland Security and Governmental Affairs, Subcommittee on Regulatory Affairs and Federal Management, *Examining Two GAO Reports Regarding the Renewable Fuel Standard*, hearing, 114th Cong., 2nd sess., December 1, 2016. House Committee on Energy and Commerce, “Committee Leaders Comment on 2017 Final RFS Standard,” press release, November 23, 2016; Rep. Bob Goodlatte, “Goodlatte: Federal Ethanol Mandate is a Flop,” press release, March 2, 2017. Sen. Chuck Grassley, “Grassley: EPA’s RFS Proposal a Mixed Bag,” press release, July 5, 2017. 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).

⁵ This report presents information that can be found in more detail in CRS Report R40155, *Renewable Fuel Standard (RFS): Overview and Issues*, by Kelsi Bracmort.

⁶ Calculations include the annual mandate required by statute in 2007 and do not take into account EPA’s revision of the biofuel mandates for 2010 through 2017.

⁷ The statute provides definitions for the four renewable fuels. *Conventional biofuel* is cornstarch ethanol. *Advanced biofuel* is renewable fuel, other than cornstarch 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.

⁸ For more information, see CRS Report R40460, *Calculation of Lifecycle Greenhouse Gas Emissions for the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci and Kelsi Bracmort.

and at least a 50% reduction to be considered *biomass-based diesel*. Similarly, biofuel from new facilities must achieve at least a 20% GHG reduction to qualify as a conventional renewable fuel.

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.

Statutory Compliance

The EPA regulates compliance with the RFS using a tradable credit system.⁹ Obligated parties¹⁰ submit credits—called renewable identification numbers (RINs)¹¹—to EPA that equal the number of gallons in their annual obligation.¹² 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.¹³ RINs are valid for use in the year they are generated and the following year.¹⁴ Further, 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.¹⁵ 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.

⁹ 42 U.S.C. §7547(o)(5).

¹⁰ EPA reports that an obligated party is 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.

¹¹ A renewable identification numbers (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.

¹² For more information, see CRS Report R42824, *Analysis of Renewable Identification Numbers (RINs) in the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci.

¹³ For 2017, the overall renewable fuel percentage standard is 10.70%, the advanced biofuel percentage standard is 2.38%, the biomass-based diesel percentage standard is 1.67%, and the cellulosic biofuel percentage standard is 0.173%. EPA, “Renewable Fuel Standard Program: Standards for 2017 and Biomass-Based Diesel Volume for 2018; Final Rule,” 81 *Federal Register*, December 12, 2016.

¹⁴ §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.

¹⁵ 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 EPAAct05 amended Section 211 of the Clean Air Act (CAA) by adding a Renewable Fuel Program. CAA Section 211 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 EPAAct05 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 EPAAct05 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, meaning that some biofuels can be used to meet the annual standard for multiple RFS categories.¹⁶ The categories are nested within each other, such that some fuels qualify for multiple categories (e.g., cellulosic ethanol), while others (mainly cornstarch ethanol) may only be used to meet the overall RFS but not the advanced category or its nested subcategories. 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, possibly making it a more highly valued fuel.¹⁷

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.¹⁸ 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,¹⁹ 1,000 physical gallons of biodiesel would equal 1,500 RIN gallons of advanced biofuels.

¹⁶ 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.

¹⁷ 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 RINs). However, there is no public market for RINs, so price data is difficult to obtain.

¹⁸ 40 C.F.R. §80.1415.

¹⁹ All EVs are in relation to the energy content of ethanol. The EV for ethanol is 1.0. One gallon of biodiesel contains roughly 1.5 times the energy of one gallon of ethanol, and thus has an EV of 1.5.

The 2018 Proposed Rule

EPA released the proposed rule for the RFS for 2018 on July 5, 2017.²⁰ The rule calls for 19.24 billion gallons of total renewable fuel for 2018—an approximate decrease of 0.2% from the 19.28 billion gallons required in 2017 (see **Table 1**). The rule proposes to

- establish volume requirements and annual percentage standards for total renewable fuel, advanced biofuel, cellulosic biofuel, and biomass-based diesel for 2018 and
- establish the applicable volume of biomass-based diesel for 2019.

In general, the 2018 proposed rule is similar to the 2017 final rule. For instance, EPA proposes to use solely the cellulosic waiver authority to reduce the applicable volume requirements. EPA reports the reductions are necessary due to a significant shortfall in cellulosic biofuel production. Also, EPA estimates there are 2.03 billion carryover RINs available.²¹ EPA is not proposing to set the 2018 renewable fuel volume requirements “at levels that would envision a drawdown in the bank of carryover RINs.”²²

There is one primary distinction between the 2018 proposed rule and the 2017 final rule: EPA proposes to keep the biomass-based diesel 2019 volume requirement at the same volume required for 2018. 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 that the proposed biomass-based diesel volume could allow room for more non-biomass-based diesel advanced biofuels to participate in the RFS. Further, EPA reports that a higher volume requirement is not necessary to provide support for the biomass-based diesel industry.

Additionally, in the proposed rule, EPA reports it will “begin technical analysis to inform a future reset rulemaking action.”²³ Lastly, EPA seeks public comment on potential changes to the credit trading structure used to show program compliance and on what steps it could take to ensure domestic energy independence and security given the increasing volumes of biofuel imports being used to meet the mandate.

The 2017 Final Rule

EPA announced the final rule for the RFS for 2017 on November 23, 2016.²⁴ The issuance of this final rule keeps the RFS on its statutory schedule.²⁵ The final rule calls for 19.28 billion gallons of

²⁰ EPA, “Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019,” 82 *Federal Register*, July 21, 2017.

²¹ 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.

²² EPA, “Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019,” 82 *Federal Register*, July 21, 2017.

²³ The modification-of-applicable-volumes section within the statute, referred to by some as the “reset” section, requires that the EPA Administrator modify the applicable volumes of the RFS in future years starting in 2016 if certain conditions are met. For more information, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

²⁴ EPA, “Renewable Fuel Standard Program: Standards for 2017 and Biomass-Based Diesel Volume for 2018; Final Rule,” 81 *Federal Register*, December 12, 2016.

²⁵ The Clean Air Act requires EPA to issue the annual RFS standards for the upcoming year by November 30th partly so (continued...)

total renewable fuel for 2017—an approximately 6.5% increase over the 18.11 billion gallons required in 2016 (see **Table 1**).

The 2017 final rule follows the precedent set in the previous final rule; it lowers the total renewable fuel volume required (19.28 billion gallons) to an amount below the statutory requirement (24 billion gallons). The reduction comes solely from the advanced biofuel category, which was lowered to 4.28 billion gallons from the statutory requirement of 9.0 billion gallons. The final rule maintains the conventional biofuel requirement at 15.0 billion gallons. EPA used the cellulosic biofuel waiver authority to reduce the cellulosic biofuel and advanced biofuel volume requirements.

EPA generally relied on the same approach to determine the volume requirements in its 2017 final rule as it used for the prior year.²⁶ EPA again mentions real world constraints—including slow development of the cellulosic biofuel industry, limited supply of other advanced biofuels to offset the cellulosic biofuel shortfall, and marketplace constraints to supply consumers with certain biofuels—as being partially responsible for the reduced volume requirements. Included in its explanation for reducing the total renewable fuel requirement, partly due to inadequate domestic supply, EPA provided some data on the fuel type amounts (e.g., E15, E85, biodiesel) that could be available in 2017. EPA also noted in its final rule that an estimated 1.54 billion carryover RINs are available to meet the proposed requirements. A potential issue not discussed in the final rule is how, and under what time frame, EPA plans to address the “reset” section of the waiver authority that has been triggered for the cellulosic biofuel and total advanced biofuel requirements with this and the previous final rules.²⁷

Considerations

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 issues and challenges with implementing the RFS.

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that obligated parties can plan for mandate compliance. In several past instances, EPA was late in issuing the annual standards. For more information on EPA’s delayed issuance of the annual standards, see the “Administering Agency” section of this report.

²⁶ This prior-year final rule—for 2014, 2015, and 2016—is commonly referred to as the three-year rule. This three-year rule was unique in many ways. For instance, for the first time since the RFS’s inception, EPA reduced the total renewable fuel volume required below what was scheduled in statute, including the volume implicitly allowed for conventional biofuel, and reduced the total advanced biofuel requirement below what was in statute for all three years. In the three-year rule, EPA used two waiver authorities—the general waiver authority and the cellulosic biofuel waiver authority—to reduce the required amounts. EPA, “Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017; Final Rule,” 80 *Federal Register* 239, December 14, 2015.

²⁷ CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort. In November 2015 and again in November 2016, EPA reported that it intends to address the “reset” requirements with a separate rulemaking. EPA, Renewable Fuel Standards for 2014, 2015 and 2016, and the Biomass-Based Volume for 2017: Response to Comments, EPA-420-R-15-024, November 2015; EPA, Renewable Fuel Standard Program - Standards for 2017 and Biomass-Based Volume for 2018: Response to Comments, November 2016.

Table I. Renewable Fuel Standard Statute, EPA Final and Proposed Volume Amounts
(in billions of gallons)

		Total Renewable Fuel	Portion from Advanced Biofuels			Cap on Conventional Biofuel	Date of Final Rule
			Total Advanced Biofuels	Cellulosic	Biomass-Based Diesel		
2010	S	12.95	0.95	0.1	0.65	12	Nov. 2009
	F	12.95	0.95	0.0065	1.15	12	Feb. 2010
2011	S	13.95	1.35	0.25	0.8	12.6	Nov. 2010
	F	13.95	1.35	0.006 ^a	0.8	12.6	Nov. 2010
2012	S	15.2	2	0.5	1	13.2	Nov. 2011
	F	15.2	2	0.0105 ^b	1	13.2	Dec. 2011
2013	S	16.55	2.75	1	≥1.0	13.8	Nov. 2012
	F	16.55	2.75	0.0008	1.28	13.8	Aug. 2013
2014	S	18.15	3.75	1.75	≥1.0	14.4	Nov. 2013
	F	16.28	2.67	0.033	1.63	13.61	Nov. 2015
2015	S	20.5	5.5	3	≥1.0	15	Nov. 2014
	F	16.93	2.88	0.123	1.73	14.05	Nov. 2015
2016	S	22.25	7.25	4.25	≥1.0	15	Nov. 2015
	F	18.11	3.61	0.23	1.9	14.5	Nov. 2015
2017	S	24	9	5.5	≥1.0	15	Nov. 2016
	F	19.28	4.28	0.311	2	15	Nov. 2016
2018	S	26	11	7	≥1.0	15	Nov. 2017
	P	19.24	4.24	0.238	2.1 ^c	15	TBD
2019	S	28	13	8.5	≥1.0	15	Nov. 2018
	P	TBD	TBD	TBD	2.1	TBD	TBD
2020	S	30	15	10.5	≥1.0	15	Nov. 2019
	P	TBD	TBD	TBD	TBD	TBD	TBD
2021	S	33	18	13.5	≥1.0	15	Nov. 2020
	P	TBD	TBD	TBD	TBD	TBD	TBD
2022	S	36	21	16	≥1.0	15	Nov. 2021
	P	TBD	TBD	TBD	TBD	TBD	TBD
2023 and beyond	S	TBD by the EPA Administrator ^d					

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) 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 2018 final volume requirement for biomass-based diesel is 2.1 billion gallons.
- d. 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).

Administering Agency

EPA administers the RFS.²⁸ This includes evaluating renewable fuel pathways eligible for the RFS.²⁹ 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,³⁰ 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 a significant 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,³¹ EPA had difficulty with projecting certain volume requirements (e.g., cellulosic biofuels). One of the concerns some have raised is the accuracy of EPA's projections. Based on these projections, EPA has used its waiver authority to set annual volume requirements for cellulosic biofuel, total advanced biofuel, and total renewable fuel different from what was identified in the statute.³² Legal challenges 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.³³

²⁸ 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.).

²⁹ A fuel pathway consists of three components: a biomass feedstock, a biofuel production process, and a fuel type (e.g., ethanol made from cornstarch 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 §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.

³⁰ Frequently, EPA has approved annual standards for some biofuels different from what was originally scheduled in statute.

³¹ EPA, "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule," 75 *Federal Register*, March 26, 2010.

³² For more information, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

³³ *American Petroleum Institute v. EPA*, 706 F.3d 474 (D.C. Cir. 2013). More information about this legal challenge is provided in CRS Report R41106, *The Renewable Fuel Standard (RFS): Cellulosic Biofuels*, by Kelsi Bracmort.

Another pressing issue for EPA is the timing of the annual announcement of the renewable fuel volume requirements.³⁴ The latest final rule, issued in late November 2016, maintains the statutory schedule. The previous final rule, issued in late 2015, covered three years—2014, which had completely passed; 2015, which was almost done; and 2016.³⁵ A lack of timely rulemaking combined with its inaccurate volume projections could affect private investment, according to some stakeholders. An additional concern is the amount of time it takes the agency to approve new fuel pathways.³⁶

Lastly, the final rule for 2014 through 2016 triggered the “reset” provision of the RFS for the advanced biofuel and cellulosic biofuel categories.³⁷ 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.³⁸ How EPA implements this provision will affect renewable fuel production and use.³⁹

Qualifying Biofuels

Some have had difficulty understanding which biofuel is eligible for each part of the mandate.⁴⁰ There are a number of nested categories within the RFS, and a fuel may qualify as a biofuel for one or more portions of the mandate.⁴¹ Difficulty in understanding which advanced biofuels qualify for the RFS can lead to challenges in determining how compliance is being met.

Not all fuels from a renewable source are eligible biofuels under the RFS. The RFS operates as a biofuel standard, with priority assigned to liquid transportation fuels from biomass feedstocks.⁴² Other renewable sources (e.g., wind) do not qualify. Notably, imported biofuels that meet the biomass feedstock qualifications and GHG reduction thresholds are eligible to meet the RFS volume requirements (e.g., Brazilian sugarcane ethanol). Before a fuel can generate RFS RINs however, that fuel pathway must be approved by EPA, a process that can take a considerable amount of time, according to some stakeholders.

³⁴ Under the Clean Air Act, each year’s standards are required to be announced by November 30 of the previous year.

³⁵ 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.

³⁶ EPA, “Renewable Fuel Standard Program - Standards for 2017 and Biomass-Based Volume for 2018: Response to Comments,” November 2016.

³⁷ 42 U.S.C. §7545(o)(7)(F).

³⁸ For more information on the reset provision, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

³⁹ EPA reports in the 2018 proposed rule that it will “begin technical analysis to inform a future reset rulemaking action.” EPA, “Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019,” 82 *Federal Register*, July 21, 2017.

⁴⁰ 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.

⁴¹ Approved RFS fuels and feedstocks are provided by EPA at <http://www.epa.gov/otaq/fuels/renewablefuels/new-pathways/approved-pathways.htm>.

⁴² 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. 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.

Cellulosic Biofuel Production

By statute, cellulosic biofuel is the fuel category assigned 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, and actual cellulosic biofuel production volumes (e.g., cellulosic ethanol) are below expectations. For instance, in 2016, the statute required 4.25 billion gallons of cellulosic biofuel. Actual production was approximately 193 million gallons (roughly 4.5% of the statutory requirement), of which 98% was renewable compressed or liquefied natural gas.⁴³ This is due to several factors, including lack of private investment, technology setbacks, and uneven support from the federal government.⁴⁴ These factors, coupled 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 indicate unrealistic targets for some advanced biofuels for the near future. This has 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.⁴⁵ Thus far, the largest volume being met under the RFS is for the non-advanced (conventional) biofuel segment of the mandate, and this has been met mainly with cornstarch 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 abuts the line of just slightly requiring more ethanol than can technically be blended into gasoline.⁴⁶

Technically, the blend wall remains a concern, but it may not be as obvious 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.”⁴⁷ 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 a more serious 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 recent developments could alleviate blend wall concerns in the near term. One option suggested by stakeholders could be to blend higher levels of ethanol into conventional gasoline.

⁴³ EPA, *2016 Renewable Fuel Standard Data*.

⁴⁴ For more information, see CRS Report R41106, *The Renewable Fuel Standard (RFS): Cellulosic Biofuels*, by Kelsi Bracmort.

⁴⁵ For more information, see CRS Report R40445, *Intermediate-Level Blends of Ethanol in Gasoline, and the Ethanol “Blend Wall”*, by Kelsi Bracmort.

⁴⁶ The U.S. Energy Information Administration (EIA) reports that approximately 143.0 billion gallons of motor gasoline was consumed in the United States in 2016 and approximately 14.4 billion gallons of fuel ethanol was blended into motor gasoline in 2016. This equates to ethanol constituting approximately 10.07% of motor gasoline in the United States in 2016. EIA, *Short-Term Energy Outlook*, Table 4a, July 2017.

⁴⁷ EPA, “Renewable Fuel Standard Program: Standards for 2018 and Biomass-Based Diesel Volume for 2019,” 82 *Federal Register*, July 21, 2017.

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.⁴⁸ However, infrastructure and automobile warranty concerns have precluded widespread offering and purchase of E15, gasoline blended with 10.5% to 15% ethanol.⁴⁹ 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% ethanol.⁵⁰ There are infrastructure concerns with the use of E85. For example, the number of E85 fueling stations is limited.⁵¹ To help address these infrastructure issues, USDA announced \$100 million in matching grants in 2015 under its Biofuel Infrastructure Partnership.⁵² 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).⁵³ Unexpected occurrences (e.g., drought, failed technology, tax incentive expiration) could potentially impact an entire industry, especially for some advanced biofuels that are nascent industries compared to conventional transportation fuels.

Congressional Issues

The RFS was established at a time when Congress foresaw the need to diversify the country's energy portfolio, strengthen the economy of rural communities by encouraging certain agricultural commodities that contribute to biofuel production, bolster U.S. standing in an emerging segment of the energy technology market, and protect the environment, among other objectives. As the 10-year anniversary for the expansion of the RFS approaches, there are

⁴⁸ 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 information, see CRS Insight IN10703, *Reid Vapor Pressure Requirements for Ethanol*, by Kelsi Bracmort.

⁴⁹ 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).

⁵⁰ EIA estimated there would be approximately 19.6 million flexible-fuel vehicles (FFVs) in use in 2016 that would be 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.

⁵¹ The U.S. Department of Energy reports there were 2,964 E85 fueling stations in early December 2016. U.S. Department of Energy, *Ethanol Fueling Station Locations*, December 5, 2016.

⁵² For more information, see CRS In Focus IF10377, *USDA Initiative Is Funding New Ethanol Infrastructure*, by Mark A. McMinimy.

⁵³ For more information, see CRS Report R41282, *Agriculture-Based Biofuels: Overview and Emerging Issues*, by Mark A. McMinimy.

indications of which components of the RFS have progressed steadily toward meeting congressional intentions and which components have not.

The RFS is a policy with an ambitious agenda. 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, upon deeper study, it could be argued that the RFS exists 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). Moreover, 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, is the RFS still needed for energy security purposes?⁵⁴ 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 not met the statutory targets by a large margin.⁵⁵

In examining whether the RFS is well designed to realize its purposes, some have inquired about the challenges in achieving the ambitious RFS targets, given concerns about the slow development of some advanced biofuels. Additionally, past delays in announcing final annual standards by EPA have led to significant 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, as the agency did for 2017, 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.

The third question relates to some congressional interest in the elimination of the conventional biofuel (e.g., cornstarch ethanol) portion of the mandate. If a segment of the biofuels industry has consistently reached the annual mandate set by Congress, is the mandate still necessary? 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.

⁵⁴ For more information, see CRS Report R44854, *21st Century U.S. Energy Sources: A Primer*, coordinated by Michael Ratner.

⁵⁵ 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.

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