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The Renewable Fuel Standard (RFS): An Overview

Updated September 4, 2019

Congressional Research Service
https://crsreports.congress.gov
R43325

CRS REPORT
Prepared for Members and
Committees of Congress

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 relatively large margin since 2015. Going forward, it appears 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 related 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 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. Currently, there is interest in how the Trump Administration issues small refinery exemptions, the approval of fuel pathways (e.g., the renewable electricity pathway), how the EPA Administrator applies the RFS "reset" authority, and the program's environmental impact and performance, among other things. There is also interest in the 2020 standards which are to be finalized by the statutory deadline of November 30. On July 5, 2019, EPA released the proposed volume amounts for cellulosic biofuel, advanced biofuel, and total renewable fuel for 2020 and the proposed biomass-based diesel volume for 2021.

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.

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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.

The statute outlines volume requirements—listed in tables—for four biofuel categories: total renewable fuel, total advanced biofuel, cellulosic biofuel, and biomass-based diesel. The total renewable fuel statutory volume required for any given year equates to the sum of conventional biofuel (which is unspecified in statute) and advanced biofuel (which is specified in statute).[2] Both cellulosic biofuel and biomass-based diesel are subcategories of advanced biofuel (both of which are specified in statute). There is also a third advanced biofuel category—other advanced biofuels (which is unspecified in statute).[3]

The statutory volume requirements for both total renewable fuel and total advanced biofuel for the RFS have not been met since 2013. The Environmental Protection Agency (EPA) Administrator has the authority to waive the RFS requirements, in whole or in part, if certain conditions outlined in statute prevail.[4] EPA has used this waiver authority. For instance, the 2019 targets set by EPA for total renewable fuel and for total advanced biofuel were approximately 71% and 38% of the statutory targets, respectively. 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 EPA in approving fuel pathways.[5]

There are, however, two fuel categories that consistently have met their statutory targets: conventional biofuel and biomass-based diesel.[6] 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.[7]

Interplay exists between the RFS and a multitude of factors—some external to RFS policy and some internal. The impact of such interplay is not easily quantified or explained. For example, 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.[8] It is not clear how agricultural

[1] 42 U.S.C. §7545(o).

[2] Conventional biofuel equates to the difference between the total renewable fuel category and the advanced biofuel category.

[3] Other advanced biofuel is computed by subtracting both the cellulosic biofuel category and the biomass-based diesel category from the total advanced biofuel category.

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

[5] For an explanation and discussion of fuel pathways, see the "Administering Agency" section of this report.

[6] U.S. Environmental Protection Agency, *Public Data for the Renewable Fuel Standard Data*, July 22, 2019. Obligated parties have until March 31 to submit annual compliance reports for the prior year. See 40 C.F.R. 80.1451(a)(1).

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

[8] For more information, see CRS Report R45493, *The World Oil Market and U.S. Policy: Background and Select*

trade issues impact biofuel policies or the commodities used to produce biofuel.[9] 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 if certain conditions are met.[10]

Challenges to implementing the RFS have led to scrutiny of the program in Congress and to litigation about EPA's regulations.[11] 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.[12] They also have questioned whether to amend or repeal the RFS or whether to maintain the status quo.[13] This report provides a basic description of the RFS, including some of the widely discussed policy issues related to it.[14]

The Statute

The Renewable Fuel Standard (RFS) was established by the Energy Policy Act of 2005 (P.L. 109-58; EPAct05).[15] It was expanded in 2007 by the Energy Independence and Security Act (P.L. 110-140; EISA) (see the text box in this section for a discussion of the differences in the 2005 RFS and the 2007 RFS). 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

Issues for Congress, by Heather L. Greenley.

[9] For more information on agricultural trade issues, see CRS Report R45728, *Major Agricultural Trade Issues in the 116th Congress*, coordinated by Anita Regmi.

[10] The statute granted EPA the authority to "reset" the RFS given certain conditions starting in 2016. 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 to 2022." See Environmental Protection Agency, *Renewable Fuel Standard Program: Modification of Statutory Volume Targets*, RIN: 2060-AU28, 2019, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201904&RIN=2060-AU28.

[11] The 116th Congress has held one hearing to date that references RFS and ethanol. U.S. Congress, House Committee on Science, Space, and Technology, Subcommittee on Research and Technology, *Engineering Our Way to a Sustainable Bioeconomy*, 116th Cong., March 12, 2019. The 115th Congress held at least 12 hearings where the topics of biofuels and the 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.

[12] See, for example, Rep. Collin Peterson, "Peterson Dissatisfied with EPA's Proposed Rule on Biofuels Blending Requirements," press release, July 8, 2019; Sen. Ted Cruz, "Sen. Cruz: EPA's Proposal Is a Step Forward Towards Addressing Broken RINs System," press release, March 15, 2019.

[13] Legislation has been introduced the 116th Congress that would repeal or amend the RFS (see S. 2298, S. 1840, S. 1614, H.R. 3427, H.R. 3411, H.R. 3410, H.R. 3006, and H.R. 104). For a brief discussion about potential legislative reform for the RFS, see CRS In Focus IF10842, *The Renewable Fuel Standard: Is Legislative Reform Needed?*, by Kelsi Bracmort.

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

[15] More specifically, Section 1501 (Renewable Content of Gasoline) of EPAct05 amended Section 211 of the Clean Air Act (CAA) by adding a Renewable Fuel Program. 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 prescribed in EPAct05 for the years 2006 through 2012. 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.

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.[16] 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).[17]

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 implicitly 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 total renewable fuel requirement in 2010 to 58% of the total renewable fuel target in 2022.[18]

Differences Between the 2005 RFS and the 2007 RFS

There are at least five major changes in the RFS as expanded in 2007 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 RFS under EISA does not make the majority of woody biomass on federal lands available for use as a renewable feedstock. 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.

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

[17] 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.

[18] 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 2018.

Statutory Compliance

EPA regulates compliance with the RFS using a tradable credit system.[19] Obligated parties (generally, refiners and importers) submit credits—called renewable identification numbers (RINs)—to EPA for each gallon in their annual obligation.[20] (Thus, generally, each gallon of fuel produced to meet the obligation generates its own unique RIN.)[21] The 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.[22] The RVO is used by an obligated party to determine how many RINs they are to submit to EPA to be in compliance with the mandate.

In short, the RIN lifecycle can be described in three steps:

1. a RIN is attached to a gallon of qualifying renewable fuel once that fuel is produced,
2. the RIN is separated once the renewable fuel is blended with gasoline or diesel fuel, and
3. the separated RIN may be submitted for compliance, traded, or banked for future use.

RINs are valid for use to demonstrate compliance in the year they are generated and the following year.[23] At times, an obligated party may carry a deficit due to a variety of reasons. If an obligated party is in a deficit, they are unable to submit enough RINs to meet their RVO for that compliance period. 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.[24] 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.

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.[25] For example, a gallon of cellulosic biofuel may be used to

[19] 42 U.S.C. §7547(o)(5).

[20] 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. There are five different RIN types which are assigned based on a fuel's "D-code" depending upon the specific type of fuel. For more information, see CRS Testimony TE10026, *Background on Renewable Identification Numbers under the Renewable Fuel Standard*, by Brent D. Yacobucci.

[21] As will be discussed later in this section, some renewable fuels can generate more RINs per gallon of fuel.

[22] 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*, December 11, 2018.

[23] 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.

[24] 42 U.S.C. §7547(o)(5)(D).

[25] Although a gallon of a biofuel may be used to fulfill individual sub-requirements or the overall requirement, each

meet the cellulosic biofuel mandate, the advanced biofuel mandate, and the total renewable fuel mandate, possibly making it a more highly valued fuel.[26]

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.[27] 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.[28]

The 2020 Proposed Rule

EPA announced the 2020 proposed rule for the RFS on July 5, 2019, and published the proposed rule in the *Federal Register* on July 29, 2019.[29] The proposed rule calls for 20.04 billion gallons of total renewable fuel for 2020—an increase of 120 million gallons from the 19.92 billion gallons required in 2019 (see **Table 1**). The implied conventional biofuel volume requirement would remain at 15.00 billion gallons. The volume requirements proposed by EPA for 2020 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—following a pattern that started in 2014 with one exception, the 2018 requirement for cellulosic biofuel. EPA proposes to use the cellulosic waiver authority to reduce the statutory volumes.[30] EPA reports "the cellulosic waiver provision is best interpreted as requiring that the advanced biofuel and total renewable fuel volumes be reduced by equal amounts."[31] EPA proposes to reduce the statutory targets for both advanced biofuel and total renewable fuel by the same amount as the reduction for the cellulosic biofuel (i.e., 9.96 billion gallons). EPA reports it is making a proposed finding that the 2020 advanced biofuel statutory target of 15 billion gallons cannot be reached "primarily due to the expected continued shortfall in cellulosic biofuel; production of this fuel type has consistently

gallon counts once against the overall renewable fuel use obligation.

[26] 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*, July 22, 2019, https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rin-trades-and-price-information.

[27] 40 C.F.R. §80.1415.

[28] 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.

[29] U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2020 and Biomass-Based Diesel Volume for 2021, Response to the Remand of the 2016 Standards, and Other Changes; Proposed Rule" 84 *Federal Register*, July 29, 2019.

[30] 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.

[31] U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2020 and Biomass-Based Diesel Volume for 2021, Response to the Remand of the 2016 Standards, and Other Changes; Proposed Rule" 84 *Federal Register*, July 29, 2019.

fallen short of the statutory targets by 95 percent or more, …"[32] EPA proposes to keep the biomass-based diesel standard for 2021 the same as for 2020—at 2.43 billion gallons.

EPA addresses other implementation duties in the 2020 proposed rule. For instance, EPA reports that it will address its obligation to reset the statutory volumes in a separate rulemaking.[33] Also, EPA addresses a court decision that remanded the 2016 final rule back to EPA.[34] EPA proposes to keep the 2016 volume requirement as is "[i]n light of the retroactive nature of an increase in the volume requirement for total renewable fuel of 500 million gallons and the additional burden that such an increase would place on obligated parties, …."[35] Lastly, EPA seeks public comment on several proposed regulatory changes, including diesel RVO calculations, pathway petition conditions, and clarifying the definition of a renewable fuel exporter, among other things.

[32] U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2020 and Biomass-Based Diesel Volume for 2021, Response to the Remand of the 2016 Standards, and Other Changes; Proposed Rule" 84 *Federal Register*, July 29, 2019.

[33] Ibid. 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. 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.

[34] In its final rule for the 2016 RFS volume requirements, EPA used both the general waiver authority and the cellulosic biofuel waiver authority to reduce the statutory renewable fuel requirements. The rule was challenged by several petitioners. The D.C. circuit court vacated the 2016 total renewable fuel requirement and remanded the rule to EPA. U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017; Final Rule," 80 *Federal Register*, December 14, 2015. Americans for Clean Energy v. EPA, No. 16-1005, 2017 U.S. App. LEXIS 13692, at *4-5 (D.C. Cir. July 28, 2017).

[35] U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2020 and Biomass-Based Diesel Volume for 2021, Response to the Remand of the 2016 Standards, and Other Changes; Proposed Rule" 84 *Federal Register*, July 29, 2019.

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	20.04	5.04	0.5400	2.43[d]	15.00	TBD
2021	**S**	33.00	18.00	13.5000	*≥1.00*	15.00	Nov. 2020
	P	TBD	TBD	TBD	2.43	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); Final and proposed rules are available at U.S. Environmental Protection Agency, *Regulations and Volume Standards for Renewable Fuel Standards*, September 4, 2019, https://www.epa.gov/renewable-fuel-standard-program/regulations-and-volume-standards-renewable-fuel-standards.

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. §7545(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.[36] This responsibility includes evaluating renewable fuel pathways eligible for the RFS.[37] 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,[38] 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 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.

In the years following the 2010 issuance of the amended RFS final rule,[39] EPA has also used its waiver authority to set annual volume requirements for cellulosic biofuel, total advanced biofuel,

[36] 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.).

[37] 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).

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

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

and total renewable fuel different from what was stated in the statute.[40] Legal challenges have been brought against the EPA regarding some of these annual fuel volume requirements and the projections on which they were based. For instance, the American Petroleum Institute objected to EPA's 2012 cellulosic biofuel production projection methodology, 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.[41] 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 held that EPA's interpretation of "inadequate domestic supply" was not reasonable and that EPA had improperly exercised its waiver authority as a result. It 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.[42]

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.[43] However, some of the earlier final rules did not meet the statutory deadline.[44] A lack of timely rulemaking combined with inaccurate volume projections could affect private investment, according to some advanced biofuel producers.[45] Additionally, 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.[46] 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.[47]

Lastly, the final rule for 2014 through 2016 triggered the "reset" provision of the RFS for the advanced biofuel and cellulosic biofuel categories.[48] The 2019 final rule triggered the "reset"

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

[41] 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.

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

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

[44] 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.

[45] 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.

[46] EPA, *Renewable Fuel Standard Program—Standards for 2019 and Biomass-Based Volume for 2020: Response to Comments*, EPA-420-R-18-019, November 2018.

[47] 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. EPA has on two occasions issued a request for additional comment for certain portions of the REGS rule. EPA requested comment on the confidential business information provisions of the proposed REGS rule in April 2019. Also, EPA requested comment on multiple provisions of the proposed REGS rule in the 2020 RFS proposed rule released in July 2019. U.S. Environmental Protection Agency, *Renewables Enhancement and Growth Support Rule: Request for further comment*, Docket ID No. EPA-HQ-OAR-2016-0041, pre-publication copy, April 11, 2019; U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2020 and Biomass-Based Diesel Volume for 2021, Response to the Remand of the 2016 Standards, and Other Changes; Proposed Rule," 84 *Federal Register*, July 29, 2019.

[48] 42 U.S.C. §7545(o)(7)(F).

provision for total renewable fuel.[49] Thus, three of the four renewable fuel categories with explicit volume amounts 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.[50] How EPA implements this provision will affect renewable fuel production and compliance with the overall program. EPA reports it will address its obligation to reset the statutory volumes in a separate rulemaking.[51]

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.[52] 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.[53]

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.[54] 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.[55] EPA reports it has approved over 115 pathway petitions since 2010.[56] EPA reports there are 22 pending pathway petitions.[57]

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

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

[50] 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.

[51] U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2020 and Biomass-Based Diesel Volume for 2021, Response to the Remand of the 2016 Standards, and Other Changes; Proposed Rule," 84 *Federal Register*, July 29, 2019.

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

[53] 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.

[54] 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.

[55] 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.

[56] U.S. Environmental Protection Agency, "Renewable Fuel Standard Program: Standards for 2020 and Biomass-Based Diesel Volume for 2021, Response to the Remand of the 2016 Standards, and Other Changes; Proposed Rule," 84 *Federal Register*, July 29, 2019.

[57] U.S. Environmental Protection Agency, *Pending Petitions for Renewable Fuel Pathways*, August 28, 2019, https://www.epa.gov/renewable-fuel-standard-program/pending-petitions-renewable-fuel-pathways.

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 volume target 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, logistical challenges, technology setbacks, and uneven support from the federal government.[58] 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 suggest unrealistic targets for some advanced biofuels. 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.[59] Thus far, the largest volume being met under the RFS is for the implied 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% given current fuel consumption rates, the conventional biofuel portion of the RFS requires slightly more ethanol than can technically be blended into gasoline.[60]

While the blend wall remains a concern to some, it may not be as significant an impediment to immediate fuel consumption as previously considered.[61] Indeed, EPA reports "the E10 blendwall is not the barrier that some stakeholders believe it to be."[62] 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

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

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

[60] The U.S. Energy Information Administration (EIA) reports that approximately 142.9 billion gallons of motor gasoline was consumed in the United States in 2018 and approximately 14.4 billion gallons of fuel ethanol was blended into motor gasoline in 2018. This equates to ethanol constituting approximately 10.1% of motor gasoline in the United States in 2018. EIA, *Short-Term Energy Outlook*, Table 4a, July 2019.

[61] Sen. James M. Inhofe, "Inhofe, Senators Urge RFS Policy to Reflect Market Realities," press release, May 1, 2019; Renewable Fuels Association, "DOE Data Show 31 States Broke Through So-Called 'Blend Wall' in 2016," press release, February 2, 2018, https://ethanolrfa.org/2018/02/doe-data-show-31-states-broke-called-blend-wall-2016/.

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

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 is to blend higher levels of ethanol into conventional gasoline. In 2010, EPA granted a Clean Air Act waiver which allows gasoline to contain up to 15% ethanol for use in model year 2001 and newer light-duty motor vehicles. In 2019, EPA issued a final rule allowing year-round E15 sales.[63] However, limited demand, and infrastructure and automobile warranty concerns have precluded widespread offering and purchase of E15.[64] Nonetheless, widespread use of E15 could potentially postpone the blend wall for some time.

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.[65] However, there are infrastructure constraints with the use of E85. For example, the number of E85 fueling stations is limited.[66] 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.[67] The one-time 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 program. The implementation and impacts of the program are affected by many factors that are not easily predicted or 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).[68] Unexpected occurrences (e.g., drought, failed technology, tax incentive expiration, trade disputes) could potentially impact an entire industry, especially for some advanced biofuels in nascent industries compared to conventional transportation fuels.

[63] For more discussion, see CRS Insight IN10979, *Year-Round Sale of E15*, by Kelsi Bracmort.

[64] 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).

[65] 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.

[66] The U.S. Department of Energy reports there were 3,394 E85 fueling stations as of July 2019. U.S. Department of Energy, *Ethanol Fueling Station Locations*, July 24, 2019, https://afdc.energy.gov/fuels/ethanol_locations.html#/analyze?fuel=E85.

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

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

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 subsequently expanded in 2007. Since then some components of the RFS (e.g., corn starch ethanol, biomass-based diesel) have progressed steadily toward meeting statutory requirements and other components (e.g., cellulosic biofuel) have not.

There has been perennial legislative interest, executive activity, and litigation regarding the RFS. Several factors have led to congressional interest in the RFS—including the statutory requirements, the implementation process, stakeholder interests, complementary programs, actions of federal agencies, and agricultural trade issues, among other things. Further, the RFS is a program with elements and objectives that are interpreted differently by the parties that must abide by the underlying statute.

Congress may consider the following RFS items (in no particular order) as it continues to debate the merits and challenges of the RFS:

- **Timing.** Three years remain with annual volumes contained in statute: 2020-2022. After 2022, the EPA Administrator determines the annual volume amounts.
- **Reset.** The EPA Administrator has the authority to modify the volume requirements for future years for the total renewable fuel, advanced biofuel, and cellulosic biofuel categories.
- **Fuel pathways.** Fuel pathways must be approved by EPA in order for a fuel to be eligible for the RFS. The time it takes and the resources EPA has to approve the pathways is unclear.[69]
- **Volume targets.** The statutory targets have not been met for three of the four fuel categories: renewable fuel, advanced biofuel, and cellulosic biofuel. The statutory target for biomass-based diesel has been met. The implied target for conventional biofuel has been met.
- **Environmental impact.** EPA is to provide Congress with a report every three years that assesses the impact of the RFS on environmental issues and resource conservation issues, among other things.[70] There are various perspectives about the environmental impact of the RFS.[71]

[69] Congress has provided EPA with some guidance regarding certain fuel pathway approvals. U.S. Congress, House Committee of the Whole House on the State of the Union, *Department of the Interior, Environment, and Related Agencies Appropriations Bill, 2019*, report to accompany H.R. 6147, 115th Cong., June 19, 2018, H.Rept. 115-765, p. 59; Erin Voegele, "Senators Urge EPA to Process eRIN Applications," *Biomass Magazine*, June 12, 2019.

[70] EISA Section 204. U.S. Environmental Protection Agency, *Biofuels and the Environment: The Second Triennial Report to Congress*, EPA/600/R-18/195, June 29, 2018.

[71] U.S. Government Accountability Office, *Renewable Fuel Standard: Information on Likely Program Effects on Gasoline Prices and Greenhouse Gas Emissions*, GAO-19-47, May 2019; Clean Air Task Force, *EPA's Report on the Environmental Impacts of Biofuels*, July 9, 2018; Biotechnology Innovation Organization, *New Study: Biofuel Use Saved 589.3 Million Tons of Carbon Emissions over the Past Decade*, August 24, 2015.

- **RFS compliance.** A tradeable credit system is used to ensure obligated parties comply with the RFS. At times, the availability and cost of the credits (i.e., RINs) and the transparency of the market has been a concern to some.[72]
- **Small refinery exemptions.** Small refineries may petition the EPA Administrator for an exemption from the RFS mandate if they can prove compliance would subject them to disproportionate economic hardship.[73] Some Members of Congress contend that the process for issuing small refinery exemptions could benefit from greater transparency.[74]

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[72] For more information, see U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Environment, *Background on Renewable Identification Numbers under the Renewable Fuel Standard*, Testimony of Brent Yacobucci, 115th Cong., July 25, 2018.

[73] 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.

[74] Sen. Deb Fischer, "Fischer, Duckworth Strive to Bring More Transparency to RFS Small Refinery Waiver Process," press release, June 14, 2019, https://www.fischer.senate.gov/public/index.cfm/2019/6/fischer-duckworth-strive-to-bring-more-transparency-to-rfs-small-refinery-waiver-process.