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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 must contain a minimum volume of biofuel.¹ The mandated minimum volume increases annually and can be met using both conventional biofuel (e.g., cornstarch ethanol) and advanced biofuel. 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, weather, the *blend wall*, and limited federal assistance) have led to challenges. These challenges include delays by the Environmental Protection Agency (EPA) in setting the annual volume standards and a lack of cellulosic biofuel production. Further, it is not clear how changes in gasoline consumption and declining oil and gasoline prices will impact the biofuel industry. Challenges in implementing the RFS have led to investigations of the RFS by some in Congress and to court rulings on EPA's regulations.² Because of concerns about the implementation and feasibility of the RFS, some Members of Congress have questioned whether it is time to amend or repeal the RFS, or whether the best course is to maintain the status quo.³

This report provides a basic description of the RFS, including some of the widely discussed issues.⁴

The Statute

The RFS was established by the Energy Policy Act of 2005 (P.L. 109-58; EPA05) 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 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 identifies four renewable fuel categories: conventional biofuel, advanced biofuel, cellulosic biofuel, and biomass-based diesel, each with its own target volume in the statute. To date, the total annual volumes required have been met mostly with conventional biofuel (e.g., cornstarch ethanol). In later years, the mandate holds steady the conventional biofuel volume amounts and increases the requirement of advanced biofuels. For instance, the RFS cellulosic biofuel requirement increases over time from less than

¹ 42 USC 7545(o).

² Thus far, the 114th Congress has held seven hearings in which the Renewable Fuel Standard (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.

³ 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*, 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*, 114th Cong., 1st sess., November 3, 2015. House Energy and Commerce Committee, "Upton and Whitfield Comment on EPA's Final RFS Rule," press release, November 30, 2015. Senator Chuck Grassley, "Grassley: EPA Drops the Ball With Renewable Fuels Rule," press release, November 30, 2015; Congressman Collin Peterson, "Peterson Statement on 2014-2016 RFS Targets," press release, December 4, 2015. Additionally, legislation has been proposed in the 114th Congress that would amend or repeal the RFS (e.g., S. 1584, S. 577, S. 934, H.R. 434, H.R. 703, H.R. 704, and H.R. 3228).

⁴ This report presents information that can be found in more detail in CRS Report R40155, *Renewable Fuel Standard (RFS): Overview and Issues*, by Mark A. McMinimay and Kelsi Bracmort.

1% of the RFS in 2010 to 44% of the RFS in 2022.⁵ The statutory language does not explicitly 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 does mandate the production of certain biofuels.

Statutory Compliance

The EPA regulates compliance with the RFS using a tradable credit system.⁶ Obligated parties⁷ submit credits—called renewable identification numbers (RINs)⁸—to EPA that equal the number of gallons in their annual obligation.⁹ 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.¹⁰ RINs are valid for use in the year they are generated and the following year.¹¹ 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.¹² 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.

⁵ Calculations include the annual mandate required by statute in 2007 and do not take into account EPA’s revision of the cellulosic biofuel mandates for 2010 through 2016. EPA is statutorily obligated to revise the cellulosic mandate downward if the agency finds there is insufficient domestic supply.

⁶ 42 USC 7547(o)(5).

⁷ 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 that imports gasoline or diesel fuel into the 48 contiguous states or Hawaii during a compliance period.

⁸ A 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.

⁹ For more information, see CRS Report R42824, *Analysis of Renewable Identification Numbers (RINs) in the Renewable Fuel Standard (RFS)*, by Brent D. Yacobucci.

¹⁰ For 2016, the overall renewable fuel percentage standard is 10.10%, the advanced biofuel percentage standard is 2.01%, the biomass-based diesel percentage standard is 1.59%, and the cellulosic biofuel percentage standard is 0.128%. 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.

¹¹ §80.1427(6)(i) in the EPA RFS regulations. Exporters of renewable fuel 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.

¹² 42 USC 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:

- much 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 more selective renewable biomass definition, 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 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. 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 overall RFS, possibly making it a more highly-valued fuel.¹³

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

In addition, some biofuels generate more RINs per volume than others because of the equivalence value (EV) of the biofuel. Biofuels vary in energy content, and the EV takes this into account.¹⁵ The EV of a renewable fuel represents the number of gallons that can be claimed for compliance

¹³ 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).

¹⁴ 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.

¹⁵ 40 CFR 80.1415.

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,¹⁶ 1,000 physical gallons of biodiesel would equal 1,500 RIN gallons of advanced biofuels.

The 2014, 2015, and 2016 RFS Final Rule

EPA announced the final rule for the RFS for 2014, 2015, and 2016 on November 30, 2015.¹⁷ The issuance of this final rule puts the RFS back on its statutory schedule.¹⁸ The final rule calls for 18.11 billion gallons of total renewable fuel for 2016—an approximately 9% increase over the 16.55 billion gallons required in 2013. The final rule contains the following six major actions:

- establishes volume requirements and annual percentage standards for total renewable fuel, advanced biofuel, cellulosic biofuel, and biomass-based diesel for 2014, 2015, and 2016;
- establishes the applicable volume of biomass-based diesel for 2017;
- rescinds the cellulosic biofuel standard for 2011;
- denies waiver petitions for the 2014 RFS submitted by the petroleum industry and eight governors;
- clarifies that, currently, biofuels produced from oil manufactured only from algae grown photosynthetically are an approved fuel pathway for the RFS; and
- finalizes revisions to the annual compliance reporting and attest reporting deadlines for the 2013, 2014, and 2015 compliance years.¹⁹

This final rule is 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 contained in statute, including the volume implicitly allowed for conventional biofuel, and reduced the total advanced biofuel requirement below what was in statute (see **Table 1**). 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. In the past, EPA has repeatedly reduced the volume requirement for cellulosic biofuels, leaving the required amounts for total advanced biofuel and the total conventional biofuel categories unchanged.²⁰ However, for this final rule,

¹⁶ 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.

¹⁷ This final rule is commonly referred to as the three-year rule. 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.

¹⁸ The Clean Air Act requires EPA to issue the annual RFS standards for the upcoming year by November 30th partly so 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.

¹⁹ Attest reporting generally means an audit to verify the information presented. For more information on the attest engagement requirements under the RFS program, see 80 C.F.R. 1464.

²⁰ EPA has done this by having other advanced biofuels backfill for the cellulosic biofuel reduction.

EPA is using two waiver authorities—the general waiver authority and the cellulosic biofuel waiver authority—to reduce the required amounts.²¹ EPA contends that

Despite significant increases in renewable fuel use in the United States, real-world constraints, such as the slower than expected development of the cellulosic biofuel industry and constraints in the marketplace needed to supply certain biofuels to consumers, have made the timeline laid out by Congress impossible to achieve. These challenges remain, even as we recognize the success of the RFS program over the past decade in boosting renewable fuel use, and the recent signs of progress towards development of increasing volumes of advanced, low GHG-emitting fuels, including cellulosic biofuels.²²

Further, EPA reports that

we use the general waiver authority only to the extent necessary in light of real world constraints to make the requirements reasonably achievable, and we use the cellulosic waiver authority for advanced biofuel in a manner that allows advanced biofuel to significantly backfill for missing volumes of cellulosic biofuel...²³

The final rule contains other actions that are of interest to stakeholders. For example, obligated parties and renewable fuel producers are concerned about the treatment of carryover RINs. Carryover RINs may be used to comply with the next year’s mandate. EPA estimates some 1.74 billion carryover RINs may be used to comply with the 2014, 2015, and 2016 standards. EPA decided to preserve the RINs to provide obligated parties with compliance flexibility. Additionally, in the final rule, EPA acknowledges that fuel infrastructure, among other constraints, “could result in an inadequate supply of renewable fuel to the ultimate consumer.”²⁴

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

	2010		2011		2012		2013	
	S	F	S	F	S	F	S	F
Total Renewable Fuel	12.95	12.95	13.95	13.95	15.2	15.2	16.55	16.55
Cap on Conventional Biofuel	12	12	12.6	12.6	13.2	13.2	13.8	13.8
Total Advanced Biofuels	0.95	0.95	1.35	1.35	2	2	2.75	2.75
Cellulosic	0.1	0.0065	0.25	0.006	0.5	0.0105 ^a	1	0.0008
Biomass-Based Diesel	0.65	1.15	0.8	0.8	1	1	≥1	1.28
Date of Final Rule	Nov 2009	Feb 2010	Nov 2010	Nov 2010	Nov 2011	Dec 2011	Nov 2012	Aug 2013

²¹ For more information on RFS waiver authority, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

²² 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.

²³ *Ibid.*

²⁴ *Ibid.*

	2010		2011		2012		2013	
	2014		2015		2016		2017	
	S	P	S	P	S	P	S	P
Total Renewable Fuel	18.15	16.28	20.5	16.93	22.25	18.11	24	TBD
Cap on Conventional Biofuel	14.4	13.61	15	14.05	15	14.50	15	TBD
Total Advanced Biofuels	3.75	2.67	5.5	2.88	7.25	3.61	9	TBD
<i>Cellulosic</i>	1.75	0.033	3	0.123	4.25	0.230	5.5	TBD
<i>Biomass-Based Diesel</i>	≥1	1.63	≥1	1.73	≥1	1.9	≥1	2.0
Date of Final Rule	Nov 2013	Nov 2015	Nov 2014	Nov 2015	Nov 2015	Nov 2015	Nov 2016	TBD ^b

Source: Energy Independence and Security Act of 2007 (EISA; P.L. 110-140); Contact the author for EPA final and proposed rule citations.

Notes: S = Statute, F = Final, P = Proposed, TBD = To be determined by EPA. 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.

- a. RFS Final Rule 2012, *Federal Register*, January 9, 2012. Subsequently vacated under *American Petroleum Institute v. EPA*.
- b. November 2016 for biomass based-diesel volume.

Considerations

Implementation of the RFS has been complex, and compliance with some of its parts has been challenging. These challenges have raised concerns with many stakeholders. This section briefly explains some of the general issues and associated challenges.

Administering Agency

EPA administers the RFS.²⁵ This includes evaluating renewable fuel pathways eligible for the RFS.²⁶ In addition, EPA must 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,²⁷ and ensure that annual compliance by obligated parties is met. All of the above must be completed within a one-year time frame, taking into consideration comments from other

²⁵ 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, etc.).

²⁶ 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.

²⁷ On occasion, EPA has approved annual standards for some biofuels different from what was originally scheduled in statute.

government agencies, the public, and, recently, court decisions. These responsibilities could be viewed as a significant addition to EPA's regulatory workload, and they have required EPA to develop new capabilities to carry them out. It is not clear, more than five years after the 2010 issuance of the amended RFS final rule,²⁸ whether EPA has those capabilities, in large part because it must rely on critical information from the very biofuel plants that it is evaluating and now, more so than previously, on data from refiners and suppliers for gasoline consumption and fuel infrastructure.

One of the concerns some have raised is the accuracy of EPA's projections of the annual renewable fuel production capacity. Using its waiver authority,²⁹ EPA may lower the volume requirements for biofuels if the projected production is lower than what is in the statute. For instance, EPA has used this waiver authority to consistently lower the cellulosic biofuel mandate from 2010 to 2016 because industry has yet to produce enough fuel to meet the mandate. Further, EPA used its authority to lower the total renewable fuel mandate from 2014 to 2016 due to market conditions, among other reasons.³⁰ Legal challenges have been brought against the EPA regarding its 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 that EPA will have to apply to future annual projections.³¹

Another pressing issue for EPA is the timing of the annual announcement of the volume requirements. The latest final rule, issued in late 2015, covered three years—2014, which had completely passed; 2015, which was almost done; and 2016.³² Even if EPA is exercising the highest level of due diligence and using the most dedicated suite of federal resources, the agency's lack of timely rulemaking and inaccurate volume projections can affect private investment. An additional concern is the amount of time it takes the agency to approve new fuel pathways.

Last, the three-year final rule has triggered the "reset" provision of the RFS for the advanced biofuel and cellulosic biofuel categories. 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.³³ It is unclear whether and how EPA will implement this provision and what impacts such an action could have on renewable fuel production and use.

²⁸ EPA, "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule," 75 *Federal Register*, March 26, 2010.

²⁹ For more information, see CRS Report R44045, *The Renewable Fuel Standard (RFS): Waiver Authority and Modification of Volumes*, by Kelsi Bracmort.

³⁰ 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.

³¹ *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.

³² Under the Clean Air Act, each year's standards are required to be announced by November 30 of the previous year. 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.

³³ 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.

Qualifying Biofuels

One potentially confusing aspect of the RFS is understanding which biofuel is eligible for which part of the mandate.³⁴ 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.³⁵ Difficulty in understanding which advanced biofuels qualify for the RFS can lead to more difficulty 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.³⁶ 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, that fuel pathway must be approved by EPA, a process that can take a considerable amount of time.

Cellulosic Biofuel Production

Cellulosic biofuel is the fuel category poised to comprise nearly half 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 well below expectations. This is due to several factors, including lack of private investment, technology setbacks, and uneven support from the federal government (among other factors).³⁷ 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 could cause some to question whether the statutory cellulosic biofuel volumes are attainable.

EMTS data indicate a significant jump in the number of cellulosic biofuel RINs issued for cellulosic biofuel production in 2014 and continuing in 2015. A majority of the cellulosic biofuel RINs produced are for two new pathways approved by the EPA in 2014: cellulosic renewable compressed natural gas and cellulosic renewable liquefied natural gas.

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—is

³⁴ 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.

³⁵ Approved RFS fuels and feedstocks are provided by EPA at <http://www.epa.gov/otaq/fuels/renewablefuels/new-pathways/approved-pathways.htm>.

³⁶ 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 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.

³⁷ For more information, see CRS Report R41106, *The Renewable Fuel Standard (RFS): Cellulosic Biofuels*, by Kelsi Bracmort.

viewed by many to be in direct conflict with the biofuel volumes mandated in the RFS.³⁸ 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 remains at 10%, and depending on fuel consumption rates, in the near future the RFS may actually require more ethanol than can technically be blended into gasoline. If ethanol remains the primary biofuel produced to meet the RFS, at some point the blend wall would have to be addressed or the scheduled levels of biofuels in the RFS would not be achievable. The EPA reduced the 2014, 2015, and 2016 advanced biofuel and total renewable fuel standards below what was in the statute, acknowledging that fuel infrastructure is a concern.³⁹ In the longer term, the development of non-ethanol biofuels may obviate these concerns, but currently these fuels are not available in sufficient supply to help meet the expanding RFS mandates.

Some recent developments could alleviate blend wall concerns in the near term. One option would be to blend higher levels of ethanol into conventional gasoline. 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. However, infrastructure and automobile warranty concerns have precluded widespread offering and purchase of E15, gasoline blended with 10.5% to 15% ethanol. Widespread use of E15 could potentially postpone hitting 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.⁴⁰ There are infrastructure concerns with the use of E85. For example, the number of E85 fueling stations is limited, and stations are largely clustered in the Midwest, where many flex-fuel vehicles are concentrated. Most of the rest of the flex-fuel vehicles in the United States are located on the East Coast and in Texas, areas that contain far fewer E85 stations.⁴¹

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 massive 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 proven to be dependent on tax incentives in order

³⁸ For more information, see CRS Report R40445, *Intermediate-Level Blends of Ethanol in Gasoline, and the Ethanol "Blend Wall"*, by Kelsi Bracmort.

³⁹ 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. EPA does not specifically use the term *blend wall* in the final rule. Rather, EPA defines fuel infrastructure as "factors affecting the ability to produce or import qualifying renewable fuels as well as factors affecting the ability to distribute, blend, dispense, and consume those renewable fuels in vehicles."

⁴⁰ The U.S. Energy Information Administration reports that in 2011, there were close to 10 million flexible-fuel vehicles (FFVs) on the road designed to use any mix of gasoline and/or E85. However, most of these FFVs are not using E85.

⁴¹ Bruce A. Babcock and Sebastien Pouliot, *How Much E85 Can Be Consumed in the United States*, Iowa State University Center for Agricultural and Rural Development, CARD Policy Brief 13-PB 15, Ames, IA, November 2013, <http://www.card.iastate.edu/publications/dbs/pdffiles/13pb15.pdf>.

to be economically feasible (e.g., biodiesel).⁴² Unexpected occurrences (e.g., drought, failed technology, tax incentive expiration) can 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. Whether the RFS has met and will meet those congressional intentions remains to be seen.

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).

The second question is perhaps the most difficult to answer. Many questions have been raised about the challenges in achieving the ambitious RFS targets, given concerns over the blend wall and the slow development of some advanced biofuels. Additionally, the delay in announcing final annual standards by EPA has led to significant uncertainty for biofuel producers, feedstock growers, and refiners. Whether the RFS should be eliminated, or 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 2014, 2015, and 2016, 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 congressional debate regarding 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, although it is not clear what impact decreasing oil and gasoline prices may have on the industry. 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.

⁴² For more information, see CRS Report R41282, *Agriculture-Based Biofuels: Overview and Emerging Issues*, by Mark A. McMinimy.

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For additional information on policy relating to the RFS and biofuels, please consult any of the CRS policy specialists identified below.

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