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Biomass-Based Diesel: Fueling the Renewable Fuel Standard

Brent J. Hartman[*]

Congress amended the Clean Air Act with the Energy Policy Act of 2005[1] and the Energy Independence and Security Act of 2007[2] to create the Renewable Fuel Standard (RFS). RFS mandates an increasing amount of fuel from renewable sources that must be blended into the transportation fuel supply of the United States, starting with nine billion gallons in 2008.[3] In 2022, RFS will require the blending of 36 billion gallons of renewable fuel into the fuel supply.

Over the past year, critics have questioned the viability of the RFS.[4] Proponents, however, have maintained the rally cry of "Don't mess with RFS" and advocate that the standard is functioning as intended.[5] One key point raised by critics of RFS is that not one gallon of cellulosic biofuel, one of the four qualifying fuel types, has been produced to meet the RFS requirements.[6] For 2022, Congress set the cellulosic biofuel obligation at 16 billion gallons of the total mandate.[7] Proponents of RFS and the EPA accurately explain that the overall volumetric goal of RFS continues to be achievable each year even though opponents have

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1. Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat 594 (2005).

2. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat 1492 (2007).

3. *See* Envtl. Protection Agency, *Renewable Fuel Standard (RFS)*, EPA.GOV, http://www.epa.gov/otaq/fuels/renewablefuels/index.htm (last updated Feb. 25, 2013).

4. *See* Schneider Electric, *API Says RFS Needs Fixing to Eliminate Three Major Flaws,* THE OILSPOT NEWS (Aug. 13, 2012), http://oilspot2.dtnenergy.com/e_article002496170.cfm?x=blHph7D,bn7DkgBJ,w.

5. *See* Christina Martin, *Don't Mess With the RFS Part 1*, THE E-XCHANGE (Apr. 24, 2012), http://www.ethanolrfa.org/exchange/entry/dont-mess-with-the-rfs-part-1/.

6. Amanda Peterka, *Biofuels: Oil and Gas Industry Challenges EPA's Cellulosic Standards* (Mar. 12, 2012), http://tech.dir.groups.yahoo.com/ group /biofuelwatch/message/5181. Approximately 20,000 gallons were produced in 2011 and issued RINs in 2012, but the fuel was exported to Brazil. Meghan Gordon, *Puzzling Over the US Mandate for a Fuel That Doesn't Exist Yet* (Dec. 10, 2012, 6:24 PM), http://blogs.platts.com/2012/12/10/ cellulosic_case/.

7. Kelsi Bracmort, CONG. RESEARCH SERV., R41106, MEETING THE RENEWABLE FUEL STANDARD (RFS) MANDATE FOR CELLULOSIC BIOFUELS: QUESTIONS AND ANSWERS 2 (2012), *available at* http://www.fas.org/sgp/crs/misc/R41106.pdf.

asked the EPA to adjust the overall goal concurrently with the adjustments made to the cellulosic biofuel category.[8] Furthermore, the cellulosic biofuel industry has not declared technological defeat.

This Article demonstrates that the trend of meeting the overall goals of RFS will continue for at least the next few years. The success of the biomass-based diesel (BBD) category will provide additional time for the cellulosic biofuel industry to develop, extinguishing the primary argument of RFS critics. Of particular interest is the aviation industry's appetite for biofuel. Aviation biofuels will qualify for the BBD category, which will further bolster the category.

Part I will introduce the Renewable Fuel Standard and provides a brief background. This introduction includes the RFS goals, explanation of key terms, qualifying fuels, obligated parties, and the regulatory structure. Part II examines the renewable volume obligations of previous years, as required by the Renewable Fuel Standard. The examination demonstrates that RFS is working as intended and that RFS permits significant regulatory flexibility. Part III forecasts future renewable volume obligations based on various scenarios, focusing on a significant increase to the biomass-based diesel mandate. The forecasts are based on current capacity, developing projects, and the projections of other experts. Part III will also highlight the effect that biodiesel has on the mandate and the effect the efforts of the aviation industry could have on the standard.

Based on the background and forecasts, Part IV concludes that the overall renewable volume obligations of the Renewable Fuel Standard can be met in the short-term, largely due to the biomass-based diesel category. Long-term success of RFS, however, does rely on the ability of the cellulosic biofuel industry to begin production in the coming years and to ramp up quickly thereafter. With RFS obligations not in immediate jeopardy, RFS should not be repealed or significantly amended. Instead, RFS should continue to function as designed so the renewable fuel industry can continue to develop. As this Article demonstrates, the near-term prospects of meeting overall RFS obligations are strong and serious discussions of repeal or amendment should occur only after it becomes clear that the overall obligation cannot be met. The EPA and policymakers must make this clear to the renewable fuel industry to provide a greater degree of political certainty.

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8. *See* Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. 1320, 1332–33 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).

I. GOALS, KEY TERMS, AND THE STRUCTURE OF THE RENEWABLE FUEL STANDARD

Before this Article demonstrates the viability of RFS in coming years, this Part introduces the RFS. The Part provides background on RFS and describes the key terms, goals, and structures to provide a basic understanding of the RFS framework.

A. Goals and Qualifying Fuels

By creating the Renewable Fuel Standard program through the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007 (EISA), Congress sought to ensure that an increasingly greater percentage of transportation fuel is renewable.[9] EISA established volumes of renewable fuel to be met each year, and the EPA administrator determines the appropriate standard each year based on these EISA requirements and projected volumes of availability.[10] Generally, the EPA will issue the upcoming year's proposed rule in the summer and the final rule will follow by November 30.[11] Table 1 below lists the RFS requirements as set by EISA.

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9. Envtl. Protection Agency, *supra* note 3; Regulation of Fuel and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule, 75 Fed. Reg. 14670, 14673 (Mar. 26, 2010) (to be codified at 40 C.F.R. pt. 80) [hereinafter RFS Final Rule]. The program, as revised by EISA, was initially referred to as RFS2 in an effort to avoid confusion with RFS1, the initial program mandated by the Energy Policy Act. Although portions of the RFS1 program remained intact in the initial years of operation, the initial overlap has severely diminished. Because of the decreased overlap, the acronym RFS is used in this Article to describe what is essentially RFS2.

10. RFS Final Rule, *supra* note 9, at 14675. The formula for determining the standards can be found at 40 C.F.R. § 80.1405(c) (2010). In the event that cellulosic biofuel volumes are set below the standard set by Congress, the EPA must provide cellulosic biofuel waiver credits for purchase. *See* 40 C.F.R. § 80.1456 (2010). These credits are not tradable. *Id.* at § 80.1456(b)(3).

11. RFS Final Rule, *supra* note 9, at 14675. The rule has not met the deadline in recent years. Last year, notice of the final rule was released days before the 2012 compliance year and the rule was significantly late for 2013.

TABLE 1: RENEWABLE FUEL STANDARD VOLUME REQUIREMENTS BY FUEL CATEGORY (BILLIONS OF GALLONS)

Year	Advanced Biofuel			Other Renewable	Total
	Cellulosic	Biomass-Based Diesel	Other Advanced		
2009	n/a	.5	.10	10.5	11.10
2010	.1	.65	.20	12.0	12.95
2011	.25	.8	.30	12.6	13.95
2012	.5	1.0	.50	13.2	15.20
2013	1.0	1.28*	.75	13.8	16.55
2014	1.75	>1.0	1.0	14.4	18.15
2015	3.0	>1.0	1.5	15	20.5
2016	4.25	>1.0	2.0	15	22.25
2017	5.5	>1.0	2.5	15	24
2018	7.0	>1.0	3.0	15	26
2019	8.5	>1.0	3.5	15	28
2020	10.5	>1.0	3.5	15	30
2021	13.5	>1.0	3.5	15	33
2022	16.0	>1.0	4.0	15	36

*Starting in compliance year 2013, the EPA has discretion to determine the Biomass-Based Diesel volume, with a 1.0 billion gallon minimum. The number in the table represents the EPA-issued volume.

As depicted in Table 1, fuel volume requirements are separated into four categories of qualifying fuel: cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel.[12] The categories are not exclusive, and some fuels will meet the requirements of multiple categories.[13] Notably, the definition of "renewable fuel" is a threshold definition for all other fuels, so all other fuels qualify for the "renewable fuel" category. Additionally, a fuel that qualifies as biomass-based diesel or cellulosic biofuel will also qualify as advanced biofuel. Nevertheless, the EPA must set four different volume requirements for each year.

Under the RFS program, a "renewable fuel" must be all of the following: produced from renewable biomass (crops, crop residue,

12. *Id.*
13. *Id.*

planted trees and planted tree residue, animal waste and byproducts, pre-commercial thinning from certain forestland, biomass, algae, yard, or food waste); a replacement of transportation fuel or heating oil; and a reduction in lifecycle greenhouse gas (GHG) emissions by 20 percent when compared to the 2005 GHG emission baseline.[14]

Advanced biofuel is renewable fuel, excluding ethanol from cornstarch, which produces 50 percent less GHG emissions than the 2005 baseline.[15] This category encompasses cellulosic biofuel and biomass-based diesel.

Cellulosic biofuel is "renewable fuel derived from any cellulose, hemi-cellulose, or lignin that has lifecycle greenhouse gas emissions that are at least 60 percent less than" the average GHG emissions from the replaced fuel, gasoline, or diesel in 2005.[16]

Biomass-based diesel (BBD), the focus of this Article, is a renewable fuel that reduces the 2005 baseline GHG emissions by at least 50 percent and meets other criteria.[17] First, the fuel must be transportation fuel (including jet fuel), transportation additive, or heating oil.[18] Second, it must be biodiesel or non-ester renewable diesel.[19] For purposes of RFS, biodiesel is mono-alkyl ester, which meets the standards of ASTM D6751,[20] and non-ester renewable diesel is renewable diesel that is not mono-alkyl ester and is used

14. 40 C.F.R. § 80.1401 (2010). All reductions are measured against the 2005 GHG emissions for the fuel that renewable fuel is replacing. *Id*. To determine a fuel's GHG emissions, EISA requires an analysis of the full lifecycle, from production to end use, including direct and indirect emissions. RFS Final Rule, *supra* note 9, at 14677, 14790. EPA considers the average production plant in 2022 when calculating GHG emissions of production. *See id.* at 14785–86.

15. *Id.*

16. *Id.*

17. *Id.*

18. *Id.* The definition of "heating oil" was recently expanded by the EPA to include oil generated from renewable biomass used as fuel to generate heat in buildings where people conduct activities, including work, homes, and recreation facilities. Regulation of Fuels and Fuel Additives: Modifications to Renewable Fuel Standard and Diesel Sulfur Programs, 77 Fed. Reg. 61281, 61282 (Oct. 9, 2012) (to be codified at 40 C.F.R. pt. 80). Fuel oil for process heat and power production is not included in the definition. *Id.*

19. 40 C.F.R. § 80.1401 (2010).

20. ASTM International, formerly known as the American Society for Testing and Materials, provides international standards for materials. *ASTM About*, ASTM INTERNATIONAL, http://www.astm.org/ABOUT/overview.html (last visited Mar. 26, 2013).

as heating oil, jet fuel, or fuel in an engine designed for conventional diesel.[21]

Fuels that meet one or more of these definitions qualify for RFS and can generate renewable identification numbers (RINs). RINs and other compliance issues are discussed in the next part.

B. RFS Compliance: Obligated Parties, RVOs, and RINs

Once the annual standards are set for each fuel type discussed above, obligated parties must meet the standards. Under RFS, an "obligated party" is any refiner or importer of diesel or gasoline located in any state except Alaska.[22] A party only blending the fuel is not an obligated party.[23]

Each obligated party must demonstrate satisfaction of the renewable volume obligation (RVO) by using renewable identification numbers (RINs).[24] To determine the RVO, EPA regulations provide a formula for each category of fuel.[25] RINs are unique, thirty-eight digit numeric codes representing a volume of renewable fuel.[26] RINs must be generated if the produced or imported fuel qualifies for a D-code and the fuel is demonstrated to be renewable biomass through reporting and recordkeeping.[27] Each pathway, which accounts for the fuel type, feedstock, and production process, is assigned the appropriate D-code.[28] The EPA has already identified numerous pathways and parties can petition the EPA to approve additional pathways.[29]

With an approved pathway, the producer will be able to generate RINs after the next update to the EPA Moderated Transaction System, which is updated quarterly.[30] Once registered,

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21. *Id.* For RFS measurement purposes, biodiesel has a temperature standardization of 60 degrees Fahrenheit. *Id*. at § 80.1426(f)(8)(ii).

22. *Id.* at § 80.1406(a)(1). Alaska and the U.S. territories may opt in to RFS. *Id.* at § 80.1406(a)(2).

23. *Id.* at § 80.1406(a)(1).

24. *Id.* at § 80.1406(b). A party with multiple facilities may aggregate the facilities to meet the RVO. *Id.* at § 80.1406(c). The formulas to determine compliance are available at 40 C.F.R. § 80.1427(a) (2010). The regulations also allow facilities to carry a deficit into the subsequent year, but facilities may not carry deficits in consecutive years. *Id.* at § 80.1427(b).

25. *See* 40 C.F.R. § 80.1407 (2010).

26. *Id.* at § 80.1401, 1425.

27. *Id.* at § 80.1426(a)(1).

28. *See id.* at § 80.1426(f).

29. *See id.* at § 80.1426 (2010).

30. Envtl. Protection Agency, *Fuels and Fuel Additives: Guidance on the Petition Process for Evaluation of New Renewable Fuels and Pathways under 40 CFR 80.1416*, EPA.GOV, http://www.epa.gov/otaq/fuels/renewablefuels/compliancehelp/lca-petition-instructions.htm (last visited Feb. 18, 2013).

the assigned RIN corresponds to the volume of renewable fuel. The RIN does not become a marketable credit until the RIN is separated from the volume of fuel, ending the association between the RIN and the specific volume of fuel.[31] An obligated party, renewable fuel owner, or exporter may separate the RIN from the batch of renewable fuel.[32] There are many situations where RINs must be separated, but RINs are primarily separated after the fuel has been blended.[33] Once separated, the RIN becomes marketable and freely transferable by any registered party.[34] Separated RINs are the currency of RFS.

Not all renewable fuels are necessarily equal. A RIN-gallon may be greater than a standard gallon due to assigned equivalence values.[35] In the initial RFS program rule, the EPA adopted an energy-based equivalent value system to create a "level playing field."[36] In essence, the equivalence value is determined by the fuel's energy output in comparison with ethanol, which is assigned an equivalence value of 1.0.[37] Of particular note, one standard gallon of biodiesel (mono-alkyl ester) equals 1.5 RIN-gallons.[38] The EPA has developed a formula to determine the equivalence value for renewable fuels that are not assigned an equivalence value in the regulations.[39] Parties petitioning the EPA for a new fuel pathway may also petition for an equivalence value, if one does not exist for the fuel type.[40]

Equivalence values play an important role in driving overall compliance with RFS goals. This is particularly true of the BBD category, where a fuel that qualifies for the category will typically generate at least 1.5 RINs per actual gallon. The impact and importance of equivalence values will be quite apparent in examining the past, current, and future RFS requirements.

II. RFS GOALS AND RENEWABLE VOLUME OBLIGATIONS: 2010 – 2013

This Part examines the RFS goals and renewable volume obligations (RVOs) from previous years, demonstrating how RFS

31. *See* 40 C.F.R. § 80.1429 (2010).
32. *See id.*
33. *Id*. at § 80.1429(b)(8).
34. *See id.* at § 80.1428(b), 1429.
35. *See id*. at § 80.1415.
36. Regulation of Fuel and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule, 75 Fed. Reg. 14670, 14709–10 (Mar. 26, 2010).
37. *See id.*; 40 C.F.R. § 80.1415(b)(1) (2010).
38. *See* 40 C.F.R. § 80.1415(b)(2).
39. *See id*. at § 80.1415(c)(1).
40. *See id*. at § 80.1415(c).

has unfolded in the early years of its existence. In all, the EPA estimates that nearly 36 billion ethanol-equivalent gallons have been produced since July 1, 2010.[41] Even more, the overall target established by RFS has been met each year. However, the same cannot be said for each individual category. Of note, the cellulosic biofuel industry has lagged significantly behind where Congress had hoped it would be just a few years after the enactment of the Energy Independence and Security Act of 2007. Conversely, the biomass-based diesel is performing better than expected. This part examines both of these categories of advanced biofuel.[42]

A. Cellulosic Biofuel

In 2022, the cellulosic biofuel category is set to shoulder the largest share of an RFS fuel category at 16 billion gallons. Clearly, Congress wanted RFS to drive cellulosic biofuel production. However, the industry has been slow to develop. The volumes have been well below the EISA-mandated volumes of 250 million in 2011 and 500 million in 2012.[43] The EPA has significantly reduced the required volume in recent years: 6.6 million gallons in 2011 and 8.65 million gallons in 2012.[44] The EPA considers all relevant factors when reducing the cellulosic biofuel mandate: producer production plans and progress, EPA assessment of public comments, volume estimates from the Department of Energy's Energy Information Agency, and other information as available.[45] The EPA is not mandated to reach a minimum degree of certainty

41. Notice of Decision Regarding Requests for a Waiver of the Renewable Fuel Standard, 77 Fed. Reg. 70752, 70754 (Nov. 27, 2012).

42. Ethanol derived from cornstarch, the most prevalent biofuel, contributes to the renewable fuel category. With the growth of the corn ethanol industry over the past decade, the category has also been a success. However, there is little uncertainty that the goals of this category cannot be met; in fact they are capped at 15 billion gallons in 2015. Therefore, this Article does not analyze the category. It is worth noting that the corn ethanol industry would like to see RFS amended to allow a larger share for the category after 2015.

43. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. 1320, 1322 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80); Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards, 77 Fed. Reg. 76790, 76792 (Dec. 9, 2010) (to be codified at 40 C.F.R. pt. 80).

44. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. at 1323 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80); Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards, 77 Fed. Reg. at 76792 (Dec. 9, 2010) (to be codified at 40 C.F.R. pt. 80).

45. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. at 1321, 1324 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).

in its projections. However, the EPA understands its duty to "promote predictability and reduce uncertainty."[46] Yet even with these drastic reductions, the EPA remains firm in maintaining the advanced biofuel requirements and does not anticipate reducing the overall requirement.[47]

Not surprisingly, the drastic reduction has led to an outcry from obligated parties who want RFS repealed.[48] Nevertheless, the first cellulosic biofuel RINs were finally produced in April 2012.[49] There are other cellulosic biofuel facilities producing fuel but not generating RINs by choice.[50] As of January 2012, the nameplate capacity for cellulosic biofuel facilities in the United States is 26.6 million gallons, and the EPA is tracking more than 100 emerging facilities.[51] Nameplate capacity is expected to reach 250 million gallons by 2015.[52] Although the cellulosic biofuel industry has not developed as rapidly as Congress intended, the industry continues to move forward.

B. Biomass-Based Diesel

Although the cellulosic biofuel category has not proven to be the stronghold of RFS as intended, biomass-based diesel (BBD) has thrived under RFS. The BBD category had escalating goals in the initial years of RFS, reaching one billion gallons in 2012. After 2012, EISA directs the EPA that the annual BBD requirement must be at least one billion gallons, the BBD floor.[53] Each year after 2012, the EPA must set the BBD volumes at a level equal to or greater than one billion gallons.

By law, the EPA is directed to set the BBD standard fourteen months in advance of the compliance year. With 2013 marking the first year of a potential increase above the BBD floor, EPA did not

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46. *Id.* at 1325.

47. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59462 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).

48. Mark Green, *Repeal the RFS*, ENERGY TOMORROW (Nov. 27, 2012), http://energytomorrow.org/blog/repeal-the-rfs/#/type/all.

49. Envtl. Protection Agency, *2012 RFS2 Data*, EPA.GOV, http://www.epa.gov/otaq/fuels/rfsdata/2012emts.htm (last updated Jan. 7, 2013).

50. 2012 Renewable Fuel Standards, 77 Fed. Reg. at 1326.

51. *Id.* at 329.

52. *Cellulosic Biofuels Begin to Flow but in Lower Volumes than Foreseen by Statutory Targets*, U.S. ENERGY INFORMATION ASSOCIATION, (Feb. 26, 2013), http://www.eia.gov/todayinenergy/detail.cfm?id=10131.

53. RANDY SCHNEPF & BRENT D. YACOBUCCI, CONG. RESEARCH SERV., R40155, RENEWABLE FUEL STANDARD (RFS): OVERVIEW AND ISSUES (2012).

issue a final rule fourteen months in advance. The EPA intended to finalize the 2013 requirements in early 2012, but the final requirements were delayed so that the EPA could review stakeholder comments and conduct proper analysis of the rule.[54] The rule would have been late at the EPA's initial target date (January 2012), but it was not finalized until September 27, 2012.[55] Although the rule was late, the final rule marked a key turning point for RFS.

The EPA's initial analysis of RFS utilized a control case that estimated 1.82 billion gallons of BBD by 2022.[56] Thus, the EPA largely deferred to the required statutory analysis conducted on the overall program.[57] Industry objected to this method, stating that the market conditions that were initially analyzed over multiple years are now being forced to occur in a year.[58] However, the EPA views RFS as a "forward-looking program," and annual changes are transient; the long term remains the overall focus.[59] Nevertheless, where information was available for 2013, the EPA analyzed the data and compared it to the analysis for 2022.[60]

For the 2013 estimate, the EPA assumed that all volumes above the required 1.0 billion gallon floor set by Congress would be derived from soybean oil.[61] Although the EPA assumes the 2013 BBD standard increase will be met with soybeans, it notes the ability of other oilseeds to penetrate the market, even in 2013.[62] It was also assumed that the overall advanced biofuel requirement would not be reduced.[63] Most of the advanced biofuel requirement will be met by additional BBD and ethanol derived from sugarcane.[64]

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54. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59459 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).

55. *Id.*

56.*Id.* at 59469.

57. *Id.* at 59468–69. This was deemed particularly appropriate because the previous analysis accounted for the mandate as a whole, not just one on the fuel requirements. *Id.* at 58469.

58. *Id*.

59. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59469 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).

60. *Id.*

61. *Id.* at 59459–60; Schnepf & Yacobucci, *supra* note 53.

62. 2013 Biomass-Based Diesel, 77 Fed. Reg. at 59464.

63. *Id.* at 59461.

64. *Id.*

The EPA determined that, without an increase, BBD facilities may not maintain production.[65] An increase, according to the EPA, will create market certainty.[66]

The EPA has already noted that biodiesel, the fuel currently most prevalent in the BBD category, has responded to demand created by RFS.[67] The EPA also anticipates significant volumes of renewable diesel. Renewable diesel facilities are under construction and other refineries could produce renewable diesel with little modification.[68] The EPA's estimate of production is approximately 150 million gallons.[69] This is not an insignificant amount considering that the equivalence value of renewable diesel is 1.7. Thus, the 255 million RINs derived from 150 million gallons of renewable diesel account for more than one quarter of BBD's one billion gallon floor.

Table 2 below shows the annual BBD mandate in three forms: the total actual volume in billions of gallons, the ethanol-equivalent volume in billions of gallons, and the BBD ethanol-equivalent volume percentage of the overall advanced biofuel requirement.

TABLE 2: BIOMASS-BASED DIESEL RFS VOLUME REQUIREMENTS, RIN PRODUCTION, AND SHARE OF OVERALL ADVANCED BIOFUEL CATEGORY

Year	BBD Total	BBD Equivalent*	Share of Advanced
2009	0.5	0.75	100%
2010	0.65	0.975	100%
2011	0.8	1.2	88.8%
2012	1.0	1.5	75%
2013	1.28	1.92	69.8%

*Assumes an equivalence value of 1.5 for all fuels

Of note, Table 2 shows that BBD has been a significant but declining portion of the overall advanced biofuel requirement.

65. *Id.* at 59462.
66. *Id.*
67. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. at 1321, 1335 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).
68. *Id.* at 1335–36.
69. *Id.* at 1336.

However, additional production of BBD RINs can be used to meet the other advanced biofuel RVO if BBD production cannot continue to keep pace with the rapidly escalating overall advanced biofuel requirement. The EPA may be faced with the task of reducing the overall requirement in coming years, just as it is done with the cellulosic biofuel requirement. Opponents of RFS would clearly seize the opportunity to promote repeal efforts as soon as two of the four categories face annual reductions.

C. Other Advanced Biofuel

As noted above, the definition of the advanced biofuel category includes any renewable fuel (besides ethanol from cornstarch) that reduces greenhouse gas emissions by 50 percent. Currently, however, the fuels consisting of the other advanced biofuel category have been limited to imported sugarcane ethanol and fuels from the biomass-based diesel (BBD) category, such as biodiesel and renewable diesel.[70] In 2011, there were approximately 60 million gallons of advanced biofuel produced in the U.S., with an increase to 80 million gallons in 2012.[71]

Sugarcane ethanol imports from Brazil have averaged nearly 400 million gallons over the past few years, with a high of 730 million gallons in 2006.[72] Sugar prices and demand in Brazil have limited exports in recent years.[73] The amount of Brazilian exports in the future will depend on advanced biofuel RIN prices and Brazilian demand.[74] In recent years, with the help of equivalence values of BBD fuels, sugarcane ethanol imports have been able to meet the goals of the other advanced biofuel category.

With rapidly escalating advanced biofuel goals, the EPA will have to monitor the ability of the industry to meet these goals. When determining whether to lower the other advanced biofuel requirement, the first consideration is the biomass-based diesel volume.[75] The EPA has rejected concurrent reductions of the other advanced biofuel category when reducing cellulosic.[76] If volumes

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70. *Id.* at 1332. Additionally, the EPA has recognized the potential of bioelectricity to play a role in RFS if the electricity is used to power electric vehicles. *See id.* at 1333.

71. *Id.* at 1333.

72. *Id.* at 1332.

73. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. at 1321, 1332 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).

74. *Id.*

75. *Id.* at 1322.

76. *Id.* at 1331.

of other advanced biofuel are available, the EPA believes that utilizing these fuels aligns with the goals of EISA.[77] The RVOs should only be lowered based on insufficient volumes.[78] This demonstrates that the EPA will not likely lower the total advanced biofuel category, unless RVOs for the previous year have not been met. Even then, there will have to be legitimate circumstance: insufficient capacity, lack of feedstock, market competition, or infrastructure issues.[79]

The EPA estimates and RVOs should be more precise in the future, as the EPA expects additional production outlook reports from producers in the future.[80] Currently, the EPA assumes that production outlook reports actually under-report the total capacity.[81] These reports will be important in coming years. Although overall RFS mandates have been met, the future will prove challenging as the advanced biofuel requirements begin to significantly increase. Just how far can biomass-based diesel (BBD) push the Renewable Fuel Standard into the future?

III. FORECASTING FUTURE RENEWABLE FUEL VOLUMES

Using the current mandate, current capacity, developing projects, and the projections of other experts, this Part looks ahead to the future of RFS and RVOs. The Part primarily focuses on cellulosic biofuel and biomass-based diesel, two subcategories of advanced biofuel.

A. Cellulosic Biofuel

As past volumes have been 98 percent reductions compared to the EISA-mandated amount,[82] it is unlikely that the volumes will reach the EISA mandate level for the cellulosic biofuel category in

77. *Id.*
78. *See id.* at 1332.
79. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. at 1321, 1332 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).
80. *Id.* at 1325.
81. *Id.* at 1336.
82. *Id.* at 1322–23 (reducing the 500 million gallon statutory goal to 8.65 million gallons); Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards, 77 Fed. Reg. 76790, 76792 (Dec. 9, 2010) (to be codified at 40 C.F.R. pt. 80) (reducing the 250 million gallon statutory goal to 6.6 million gallons).

the coming years. This is particularly true as the EISA mandate reaches one billion gallons in 2013.[83]

Nevertheless, one of the primary purposes of RFS is to grow the cellulosic biofuel industry.[84] The EPA refuses to base cellulosic biofuel volumes and RVOs strictly on demonstrated production.[85] The EPA wants to create a viable market for cellulosic biofuel and not depress the market with low volumes and RVOs.[86] As described above, there are over one hundred emerging facilities, and the nameplate capacity for cellulosic biofuel facilities in the United States is 26.6 million gallons.[87] Thus, one can expect the EPA to continue to increase applicable volumes and RVOs for cellulosic biofuel.[88] The EPA will likely continue to slowly increase the mandated volume in accordance with industry developments.[89] As the EPA has increased the mandate annually, even in the face of a complete lack of production, certainly the EPA will continue to challenge the industry with annual increases.

B. Biomass-Based Diesel

Looking forward, the prospects of the biomass-based diesel (BBD) category are strong, as the EPA has already set volume goals beyond the one billion gallon floor set by the Energy Independence and Security Act of 2007. The EPA has recognized the response of the biodiesel industry and should continue to lean on the industry and other BBD sources as the advanced biofuel goals rapidly escalate.

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83. KELSI BRACMORT, CONG. RESEARCH SERV., R41106, MEETING THE RENEWABLE FUEL STANDARD (RFS) MANDATE FOR CELLUSIC BIOFUELS: QUESTIONS AND ANSWERS, (2012).

84. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. at 1321, 1329–30 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).

85. *Id.* at 1329.

86. *Id.* at 1330.

87. *Id.* at 1325, 1329.

88. *Id.* at 1331.

89. A recent decision by the United States Court of Appeals for the District of Columbia, which vacated and remanded the 2012 cellulosic biofuel volume requirement, perhaps put some limits on the ability of the EPA to utilize RFS as a technology forcing mechanism. *See* American Petroleum Institute v. EPA, No. 12-1139, 2013 WL 276044, at *11–13 (D.C. Cir. 2013); *but see* Rhead Enion, *D.C. Circuit's biofuels mandate ruling,* LEGAL PLANET (Jan. 29, 2013), http://legalplanet.wordpress.com/2013/01/29/d-c-circuits-biofuels-mandate-ruling/ (suggesting the EPA can easily maneuver around the ruling). Nevertheless, the court was clear that it could not find support for the EPA setting aspirational goals beyond reasonable interpretations of EIA projections. *See* API v. EPA, 2013 WL at *11.

In determining the required physical volume and RVO for BBD, the EPA must consider multiple factors such as environmental impact, impact on energy security, expected rate of production, infrastructure compatibility, cost to consumers, and other economic impacts, such as food prices and job creation.[90] The EPA considers only these factors, as Congress did not provide any overarching goals that the EPA must strive to achieve.[91]

The EPA believes that expansion beyond the statutory minimum volumes of BBD can play an important role in providing advanced biofuels to the transportation fuel market, but the EPA also recognizes that all statutory factors must be considered. This view is contrary to those set forth by some of the comments submitted to the EPA.[92] For example, comments suggested both the view that Congress intended that the BBD requirement increase every year and the view that Congress's intent was to increase the minimum only if the volumes were already being produced.[93] The EPA believes it is prudent to slowly increase the BBD requirements to continue to drive BBD production.[94]

The EPA has also noted that it does not have the authority to raise the categorical requirements for total advanced biofuel or total renewable fuel until 2022.[95] Thus, EPA actions only dictate the proportion of renewable fuels required, not the quantity.[96]

The actual production rate of biodiesel is already at 1.3 billion gallons.[97] The EPA also notes that many of these plants are operating below capacity.[98] EPA Moderated Transaction System data suggests that BBD production was 1.07 billion gallons in 2011.[99] The production excess provides additional RINs that can be used in 2012.[100] The EPA credits RFS with driving BBD

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90. 42 U.S.C. § 7545(o)(2)(B)(ii) (2009).
91. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59462 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).
92. *Id.* at 59460.
93. *Id*.
94. *Id.* at 59461.
95. *Id.* at 59460.
96. *Id*. Of course, because of equivalence values, the total actual volumes could differ. However, the ethanol-equivalent gallons required by RFS remain constant. *Id.*
97. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59459 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).
98. *Id.* at 59466.
99. *Id.* at 59461.
100. *Id*.

production.[101] Biodiesel capacity in the U.S. as of early 2012 was 2.5 billion gallons.[102] However, this number only includes an estimated 191 facilities, while 216 facilities are registered with the EPA.[103] Others may fall beyond the regulatory arm of RFS due to the small quantities produced.[104] The turnaround time to bring idled biodiesel facilities back online is only a few months; others can ramp up current production quickly.[105] Additionally, the EPA recently approved the use of esterification for the production of biodiesel using approved feedstock, opening up additional pathways that can be used to generate RINs.[106]

Another factor driving BBD production is that BBD production facilities can be constructed and begin production in approximately a year.[107] Also, biodiesel can be produced from multiple feedstocks: cooking oil, soybean oil, canola oil, and animal fats.[108] There are countless efforts underway to develop new feedstock for biofuel production, including various non-food crops for biodiesel. Producers generally have the ability to utilize multiple feedstocks.[109] These methods are supported by the United States' recently achieved status of net exporter of diesel gasoline in 2011.[110]

Another factor that could significantly impact the future of BBD volume requirements is the aviation industry's thirst for renewable aviation fuel. Under RFS, renewable jet fuel can qualify for RFS. However, RFS does not require a certain percentage of jet fuel to be renewable. Nevertheless, development of renewable jet fuel provides an enormous opportunity for biofuel producers.

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101. *Id*.

102. *Id.* at 59466. Estimated biodiesel capacity increased 4 percent between August 2011 and January 2012. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. 1320, 1334 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80) (estimating a 2.4 billion gallon capacity).

103. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59466 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).

104. *Id.*

105. *Id.* at 59459.

106. Regulation of Fuels and Fuel Additives: Identification of Additional Qualifying Renewable Fuel Pathways Under the Renewable Fuel Standard Program, 77 Fed. Reg. 700, 721–24 (Jan. 5, 2012) (withdrawn on March 5, 2012 by 77 Fed. Reg. 13009, pending further comment).

107. 2013 Biomass-Based Diesel, 77 Fed. Reg. at 59466.

108. *Id.* at 59459.

109. *Id*.

110. Matthew Philips, *How the U.S. Became 'The China of Refined' Gasoline,* BLOOMBERG BUSINESSWEEK (Mar. 2, 2012), http://www.businessweek.com/articles/2012-03-02/how-the-u-dot-s-dot-became-the-china-of-refined-gasoline.

The total amount of jet fuel used for commercial and military purposes in the United States is close to the amount of renewable fuel to be required by RFS in 2022: 36 billion gallons. In 2012, United States passenger and cargo air carriers consumed 33.5 billion gallons of jet fuel, two-thirds of which was used domestically.[111] The Department of Defense is also a significant user of jet fuel, using 4.6 billion gallons in 2009.[112] There are significant efforts underway to begin to address these markets.

One notable effort is the Commercial Aviation Alternative Fuels Initiative (CAAFI). CAAFI is a coalition of stakeholders, including Federal Aviation Administration, Aerospace Industries Association, Airlines for America, and the Airports Council International-North America.[113] Industry also plays a significant role in CAAFI. CAAFI explores and promotes the development of alternative jet fuel sources.[114]

There are also regional efforts, notably the Sustainable Aviation Fuels Northwest (SAFN)[115] and the Midwest Aviation Sustainable Biofuels Initiative (MASBI).[116] SAFN, a collaboration between Boeing, Alaska Airlines, airport systems, and others, explores opportunities and challenges for renewable jet fuel. Similarly, MASBI, a collaboration between Boeing, United Airlines, and others, is developing a roadmap to deliver sustainable aviation fuels to the Midwest.

Like the civil aircraft industry, the Department of Defense is also taking action to integrate renewable fuel into its supply chain. Of note, the Navy and the Air Force have been at the forefront of the effort. The Air Force set a goal to acquire half of its aviation fuel for domestic use from alternative fuels by 2016.[117] Similarly, the Navy set a goal to reduce by half its non-tactical petroleum use

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111. *Total Jet Fuel and Aviation Gas Fuel Consumption U.S. Civil Aviation Aircraft*, FED. AVIATION ADMIN. (2012), http://www.faa.gov/data_research/aviation/aerospace_forecasts/2001-2012/media/Table%2022.pdf.

112. *Green Aviation: A Better Way to Treat the Planet*, NAT'L AERONAUTICS AND SPACE ADMIN., (2013), http://www.aeronautics.nasa.gov/pdf/green_aviation_fact_sheet_web.pdf.

113. *About CAAFI*, COMMERCIAL AVIATION ALTERNATIVE FUELS INITIATIVE, http://www.caafi.org/about/caafi.html (last visited Feb. 18, 2013).

114. *Id.*

115. *Home*, SUSTAINABLE AVIATION FUELS NORTHWEST, http://www.safnw.com (last visited Mar. 26, 2013).

116. *MASBI*, MIDWEST AVIATION SUSTAINABLE BIOFUELS INITIATIVE, http://www.masbi.org (last visited Mar. 26, 2013).

117. *DoD's Energy Efficiency and Renewable Energy Initiatives*, ENVIRONMENTAL AND ENERGY STUDY INSTITUTE (2011), http://files.eesi.org/dod_eere_factsheet_072711.pdf.

by 2015.[118] Another goal of the Navy is to utilize alternative energy for half of its entire energy consumption by 2020.[119] In the summer of 2011, the Navy, along with the Department of Energy and the United States Department of Agriculture, announced a joint program under the Defense Production Act to provide $510 million to assist the rapid scale-up of the biofuel industry.[120]

Even with such strong initiatives, there have not been significant volumes produced. Currently, besides cost, there are two limiting factors to the deployment of renewable aviation fuel. One factor is that renewable fuels must go through a lengthy and costly ASTM approval process. The ASTM standards for standard jet fuel were specifically written for jet fuel produced from petroleum. Thus, even if all other characteristics are equivalent to petroleum-based jet fuel, jet fuel produced with renewable biomass cannot meet the ASTM specification simply because it is not made from petroleum. However, there are currently two ASTM approved renewable aviation fuels: fuel produced via Fischer-Tropsch and fuel produced via Hydroprocessed Esters and Fatty Acids. Highlighting the second limiting factor, blend limits, these fuels can only be used as a blend with traditional petroleum-based fuel up to 50 percent. Thus, cost-competitive renewable jet fuel could only capture half of the current market.

However, there is progress for additional pathways. Of course, the current approved ASTM specifications may be opened up to non-blended fuels after additional testing and consideration. In the very near future, likely in 2013, ASTM is expected to approve a specification for jet fuel produced from an alcohol-to-jet-fuel process. These approvals by ASTM would expand the potential market that renewable aviation fuel could address.

In another potential development that will help bolster the BBD category, the EPA recently expanded the definition of home-heating oil, which is included in the definition of biomass-based diesel.[121] This will result in additional RIN generation. Envergent Technologies acknowledged that the definitional change would result in immediate production of 3.5 million gallons and up to

118. *Id.*
119. *Id.*
120. Jim Lane, *US Government to Invest $510 Million in Advanced, Drop-In Biofuels*, BIOFUELS DIGEST (Aug. 16, 2011), http://www.biofuelsdigest.com/bdigest/2011/08/16/usda-doe-usn-to-invest-510m-in-advanced-drop-in-biofuels/.
121. Envtl. Protection Agency, *Renewable Fuels: Regulations & Standards*, EPA.GOV, http://www.epa.gov/otaq//fuels/renewablefuels/regulations.htm (last visited Feb. 18, 2013).

nearly 50 million within two years of EPA action.[122] Of course, industry-wide implementation of the new definition will create millions more available RINs for immediate and future use.[123]

Even with such great potential, there are a few limits to BBD, particularly biodiesel. For ground transportation purposes, biodiesel is approved for use at all blend levels.[124] However, engine warranties may limit the maximum acceptable blend, typically B20 (20 percent biodiesel, 80 percent conventional diesel), but some are as low as B5.[125] The warranty issue is less prevalent when BBD is used as home heating oil.[126] The 2013 BBD requirement represents less than 3 percent of total highway and non-road diesel consumption.[127] Additionally, some states already have biodiesel blending requirements, collectively representing 13 percent of total diesel consumption.[128] Other states utilize tax incentives and rebates to encourage biodiesel production and blending. These states collectively represent 37 percent of total diesel consumption.[129]

Infrastructure and distribution issues facing BBD have been considered by the EPA.[130] Weighing comments from both the National Petroleum Refiners Association and the National Biodiesel Board, the EPA acknowledged potential challenges but believes the refining industry can address these issues.[131] Of note, the National Biodiesel Board stated that B5 and conventional

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122. Regulation of Fuels and Fuel Additives: Modifications to Renewable Fuel Standard and Diesel Sulfur Programs, 77 Fed. Reg. 61281, 61282 (Oct. 9, 2012) (to be codified at 40 C.F.R. pt. 80).

123. *See id.* The EPA notes that the expanded definition also results in allowing fuels that actually reduce GHG emissions more than previous types of "home heating oil" because less processing is required. *Id.* at 61286.

124. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59466 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).

125. *Id.* B20 refers to a fuel blend of 20 percent biodiesel and 80 percent petroleum-based diesel. Similarly, B5 refers to a fuel blend of 5 percent biodiesel and 95 percent petroleum-based diesel.

126. *Id.* at 59466–67.

127. *Id.* at 59466.

128. *Id.* at 59467. The EPA notes six states: Minnesota, Oregon, Washington, Pennsylvania, New Mexico, and Louisiana. *Id.*

129. *Id.* at 59467.

130. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59458 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80); Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. 1320, 1336 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).

131. 2013 Biomass-Based Diesel, 77 Fed. Reg. at 58467–68.

diesel are already treated as fungible in many markets.[132] The EPA does not foresee issues related to the diesel market's ability to absorb the additional biodiesel required by RFS.[133] Therefore, with such significant potential and surmountable limitations, the BBD category, including biodiesel, renewable diesel, and renewable jet fuel, may be able to provide significant quantities of fuel to help RFS meet future goals.

C. BBD on its Current Path

Although biodiesel has been able to supply quantities to support the BBD category and the overall RFS requirements, slow increases in the overall volume will not likely drive RFS and the biofuel industry for many more years. Table 3 below estimates 2014 and 2015 volume totals and then increases the required volume by ten percent annually.

TABLE 3: BIOMASS-BASED DIESEL PROJECTIONS BASED ON PROJECTED MODEST ANNUAL INCREMENTS

	EISA RFS Requirements[134]				Projected RFS Requirements (Based on Current BBD Increases)			
	RF	Advanced Biofuel			RF	Advanced Biofuel		
	RF	BBD	CELL	Other	RF	BBD	CELL	Other
2014	15	≥1.0	1.75	1.0	15	1.56	.034	1.38
2015	15	≥1.0	3.0	1.5	15	1.82	.069	2.70
2016	15	≥1.0	4.25	2.0	15	2.00	.138	4.11
2017	15	≥1.0	5.5	2.5	15	2.20	.277	5.42
2018	15	≥1.0	7	3.0	15	2.42	.415	6.95
2019	15	≥1.0	8.5	3.5	15	2.66	.623	8.38
2020	15	≥1.0	10.5	3.5	15	2.93	.934	9.67
2021	15	≥1.0	13.5	3.5	15	3.22	1.40	11.76
2022	15	≥1.0	16	4.0	15	3.55	2.10	13.58

132. *Id.* at 59468; *Biodiesel: An Industry and Technical Overview for OEM Dealers, Sales Reps & Service Technicians,* NATIONAL BIODIESEL BOARD, (Aug. 12, 2011), http://www.kcenergy.org/images/Events/Biodiesel/Aug. &20 12th%20presentations/Howell-Weaver_KS%20Clean%20Cities%20 Biodiesel%20Workshop%20OEM%20Presentation_081211%20final.pdf.

133. 2013 Biomass-Based Diesel, 77 Fed. Reg. at 58467.

134. Energy Independence and Security Act, 42 U.S.C.A. § 17021–22 (West 2012).

The volumes listed in Table 3 are physical volumes, not ethanol-equivalent volumes. However, when utilizing equivalence values, these numbers meet the overall RFS mandate required by EISA. The table makes a number of assumptions: (1) it approximates the 2014 and 2015 volumes based on prior volumes as well as the RFS final rule that analyzed the RFS programmatic impact assuming 1.82 billion gallons (the EPA will conduct additional analyses for totals exceeding 1.82);[135] (2) it assumes 10 percent annual growth to total BBD volume requirement after 2015; and (3) it assumes cellulosic biofuel output doubles from 2014 to 2017, then slows to 50 percent growth through 2022.

As demonstrated in Part III(D)(1), the 2014 advanced biofuel mandate can be met. Once again, overall RFS goals will be met largely in part due to the success of biodiesel and the BBD category.

Continuing on the current BBD trajectory will lead to a sharp increase in the required volume for the other advanced biofuel category. The total amount required is 2.70 billion gallons, an increase of 1.32 billion gallons. If meeting the required timing, the 2015 BBD standard will be set in November of 2013. If the EPA is going to continue to lean on BBD to help drive RFS and meet the overall advanced biofuel mandate, the EPA will not be providing a very strong signal to the biodiesel industry by setting the volume at 1.82 billion gallons. Even with a low volume requirement, it is true that the industry could reach maximum capacity to provide additional RINs for the advanced biofuel category. However, the EPA can demonstrate strong support for RFS by providing a larger increase to the BBD volume requirements and RVO. Otherwise, by the end of 2013, it becomes apparent that the EPA is fighting a battle it cannot win with RFS. The goals will face reduction, potentially slowing industry growth.

D. Test Case: Biodiesel Max Capacity as the Biomass-Based Diesel Volume Requirement

With such significant potential for BBD, what if the EPA was to begin driving BBD production via RFS? The test case below highlights the mandated production volumes if the EPA began setting the mandate at the current maximum capacity of BBD facilities at the start of a compliance year, starting in 2015. Table 4, below, depicts such a scenario.

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135. 2013 Biomass-Based Diesel, 77 Fed. Reg. at 58469.

TABLE 4 BBD VOLUME SET AT BIODIESEL MAX CAPACITY IN 2015

	EISA RFS Requirements[136]				Projected RFS Requirements BBD RVO at Max Capacity			
	RF	Advanced Biofuel			RF	Advanced Biofuel		
	RF	BBD	CELL	Other	RF	BBD	CELL	Other
2014	15	≥1.0	1.75	1.0	15	1.56	.034	1.38
2015	15	≥1.0	3.0	1.5	15	2.75	.069	1.31
2016	15	≥1.0	4.25	2.0	15	3.03	.138	2.57
2017	15	≥1.0	5.5	2.5	15	3.33	.277	3.73
2018	15	≥1.0	7	3.0	15	3.66	.415	5.09
2019	15	≥1.0	8.5	3.5	15	4.03	.623	6.34
2020	15	≥1.0	10.5	3.5	15	4.43	.934	7.42
2021	15	≥1.0	13.5	3.5	15	4.87	1.40	9.29
2022	15	≥1.0	16	4.0	15	5.36	2.10	10.86

All volumes listed in Table 4 are physical volumes, not ethanol-equivalent volumes. However, when utilizing equivalence values, the numbers meet the overall RFS mandate required by EISA. Table 4 makes a number of assumptions: (1) an initial biodiesel capacity of 2.5 in 2013 (same as 2012 capacity); (2) 10 percent annual growth to total BBD capacity; and (3) cellulosic biofuel output doubles from 2014 to 2017, then slows to 50 percent growth through 2022.

1. Test Case: 2014 Analysis

Table 4 demonstrates the significant role BBD can play in the upcoming years to keep RFS on track to meet its overall goals. Even with minimal cellulosic growth, RFS can easily meet the overall goals through 2015. For example, in 2014, when accounting for the equivalence value of BBD (2.34 billion RINs), only 1.41 billion gallons of advanced biofuel must be produced. Imported sugarcane ethanol, averaging 400 million gallons per year over the past few years with a 730 million gallon maximum, can cover approximately half of the volume.[137] Using a more conservative number for this analysis, it will be assumed that sugarcane ethanol imports will be approximately 475 million

136. Energy Independence and Security, 42 U.S.C.A. at § 17021–22.

137. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. 1320, 1332 (Jan. 9, 2012) (to be codified at 40 C.F.R. pt. 80).

gallons, or one-third of the remaining advanced biofuel requirement. Additionally, other advanced biofuels, such as renewable diesel, aviation fuel, or increased cellulosic production, can help close the remaining gap. For example, renewable diesel production is estimated to be approximately 150 million gallons. With an equivalence value of 1.7, renewable diesel can generate 255 million RINs. Assuming a steady and consistent growth of other advanced biofuels,[138] approximately 140 million gallons will be produced in 2014. This estimate may include some renewable jet fuel with an equivalence value of 1.6, for an estimated equivalence value of 1.0 assigned to these volumes. Accounting for 475 million RINs from sugarcane ethanol and 255 million RINs from renewable diesel, the advanced biofuel category would be 540 million RINs short of the goal. Assuming equivalence values, an additional 360 million gallons of biodiesel would close the remaining gap, without accounting for cellulosic biofuel RINs or equivalence values for the 140 million gallons of advanced biofuel. Adding 360 million gallons to the 1.56 billion already produced, the total volume would remain under 2 billion physical gallons, which is well below the 2.5 billion capacity that the EPA noted in early 2012. In 2014, the mandate can be met even without accounting for cellulosic biofuel RINs and other additional sources of RINs.

2. Test Case: 2015 Analysis

For the decade between 2012 and 2022, 2015 is anticipated to have the largest percentage jump over the prior year for the total advanced biofuel requirement, increasing 32 percent from the 2014 requirement. However, in the scenario contemplated in Table 4, 2015 is the first year where biodiesel capacity would be set at the BBD volume requirements. After accounting for equivalence values, the BBD category generates 4.13 billion of the required 5.5 billion RINs. This leaves 1.37 billion gallons of advanced biofuel to be produced. How the remaining gallons will be provided would be the same as the 2014 analysis above where 1.41 billion gallons were required. However, in 2015, because the biodiesel capacity would already be maxed out, the EPA would not be able to rely on additional biodiesel production to close the final gap, which will be an extra 360 million gallons given the 2014 scenario.

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138. 60 million in 2011 and 80 million in 2012 would constitute steady, continued growth. *Id*. at 1333. This analysis assumes a growth rate of 33 percent annually to the amount of other advanced biofuel produced.

Therefore, in the 2015 scenario, RFS would require greater imports of sugarcane ethanol. If the recent maximum amount of 730 million gallons are imported in 2015, 640 million gallons would remain. Should renewable diesel production grow from 150 million gallons to 250 million gallons,[139] 425 million RINs would be produced. This would leave 215 million RINs left to reach the RFS goal.

Accounting for additional growth in the other advanced biofuel category, 190 million physical gallons will be produced in 2015.[140] The remaining amount of advanced biofuel to be produced would be reduced to a manageable 25 million ethanol-equivalent gallons. Accounting for some level of cellulosic biofuel production and a projected requirement of 69 million physical gallons in 2015, it is reasonable to assume that cellulosic ethanol could close the gap. Even if cellulosic biofuel is still slow to reach substantial production levels, the remaining gap could be closed when accounting for the equivalence value of the 190 million physical gallons of other advanced biofuel.[141]

One issue with the above analysis is the reliance on imports of sugarcane ethanol from Brazil.[142] There are several potential ways

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139. Considering the 150 million gallon amount in 2014 was based on a 2012 estimate, the estimate seems feasible considering that Diamond Green Diesel is expected to begin operation of an approximately 150 million gallon per year facility in 2013. *Method 2B Application: Renewed Diesel Pathway Life Cycle Analysis Report*, ERI SOLUTIONS. INC. (2011), *available at* http://www.arb.ca.gov/fuels/lcfs/2a2b/apps/dgd-rpt-120112.pdf (noting 420,000 gallons per day).

140. 2012 Renewable Fuel Standard, 77 Fed. Reg. at 1333. This analysis assumes a growth rate of 33 percent annually to the amount of other advanced biofuel produced.

141. For example, butanol, which received serious attention from biofuel companies such as Gevo, Butamax, and ZeaChem, has an equivalence value of 1.3. If half of the 190 million gallons of advanced biofuel are biobutanol, the advanced biofuel standard can be met without any cellulosic biofuel production. It is estimated that Gevo alone could produce 300 million gallons per year in 2014. *Biofuels Digest's Bioenergy Information Zone,* BIOFUELS DIGEST, http://www.biofuelsdigest.com/bdigest/biofuels-digest-supercontent/free-industry-data/ (last visited Feb. 18, 2013). Of course, significant cellulosic biofuel production would limit sugarcane ethanol imports from Brazil.

142. This is particularly true given that the United States is approaching the "blend wall," the point at which the United States cannot increase the proportion of ethanol in our fuel because of blending limitations. Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards; Proposed Rule, 78 Fed. Reg. 9282, 9301 (Feb. 7, 2013) (to be codified at 40 C.F.R. pt. 80); Jim Lane, *If you have the stones: the Ethanol blend wall, revisited*, BIOFUELS DIGEST (Jan. 18, 2013), http://www.biofuelsdigest.com/bdigest/2013/01/18/if-you-have-the-stones-the-ethanol-blend-wall-revisited/. Until recently, the blend of ethanol in gasoline typically could not exceed 10 percent. This is not the case for flex fuel vehicles that can handle E85, or fuel containing 85 percent ethanol and 15 percent gasoline.

to limit the amount of sugarcane ethanol imports needed. BBD could drive the advanced biofuel category very close to the finish line, but it would likely fall short in 2015 without significant biodiesel industry growth. The scenario in Table 4 above estimates 10 percent annual growth starting with a 2.5 billion gallon capacity in 2013. With 15 percent annual growth, the total amount of non-biodiesel advanced biofuel would contract by 190 million gallons, reducing the amount of required sugarcane ethanol imports from 730 million to 540 million gallons.

Another way to increase the share of non-imported fuel would be with technological breakthroughs for other advanced biofuels and, in particular, through fuels eligible for the BBD category like renewable aviation fuel. Another potential for growth would come from the cellulosic biofuel industry. As noted above, Congress saw significant potential for a vast amount of biofuel from cellulosic material. The EPA must exercise its authority through RFS to achieve this goal, particularly as the long term production goal appears challenging.

3. Test Case: Beyond 2015

2015 will be the first tough but achievable year, but the EPA will have the benefit of two additional years of monitoring developments in the cellulosic and advanced biofuel industry. Additionally, the EPA should set an aggressive 2015 standard, leaving the overall advanced biofuel requirement intact. This action should allow the biofuel industry three years of growth before the EPA will have to consider the 2016 RFS requirements. The gap should continue to widen in 2016 and beyond if the cellulosic biofuel industry does not gain a foothold. However, even if the cellulosic industry continues a slow growth trajectory, the EPA will also have the benefit of monitoring key developments: the impact of renewable aviation fuels, the rise of renewable diesel, a return of the biodiesel tax credit, and even greater biodiesel production. Even in the scenario listed in Table 4, the 5.36 billion

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However, the EPA recently approved the use of E15 in most motor vehicles. Partial Grant and Partial Denial of Clean Air Act Waiver Application Submitted by Growth Energy to Increase the Allowable Ethanol Content of Gasoline to 15 Percent, 75 Fed. Reg. 68094 (Nov. 4, 2010) (approving E15 for use in vehicles in model years 2007 and newer); Partial Grant of Clean Air Act Waiver Application Submitted by Growth Energy to Increase the Allowable Ethanol Content of Gasoline to 15 Percent, 76 Fed. Reg. 4662 (Jan. 26, 2011) (approving E15 for use in vehicles in model years 2001 through 2006).

gallons of BBD noted in 2022 would be less than 10 percent of the amount of diesel used in 2012.[143]

The scenario in Table 4 provides a more appealing option in 2015 than the current path in Table 3. Because the 2015 volume requirements seem more readily achievable due to the significant amount of BBD, the EPA will be able to push forward with an aggressive RFS approach. When the 2016 BBD requirements must be set at the end of 2014, the EPA can set an aggressive target that covers more than half of the advanced biofuel goal after equivalence values are considered. This will allow the EPA to keep the RFS driving biofuel growth at least until November 2015 when the EPA would have to decide on a reduction to the advanced biofuel category for 2016. Instead of RFS appearing unworkable at the end of 2013, as it would in Table 3, the EPA could use the BBD category to demonstrate the success of RFS. Such a success could delay the difficult decision of an RFS reduction until late 2015. Essentially, the EPA will have the benefit of monitoring an additional two years of a rapidly emerging industry. Thus, a great deal of RFS pressure can be relieved based solely on when the EPA has to set volume requirements and RVOs. To ensure that the EPA bides enough time to grow the industry, the EPA should send strong signals by increasing the BBD volumes and RVOs to full capacity.

The EPA must continue to push the industry until it is absolutely clear that the industry cannot keep pace with the escalating requirements. RFS is a forward-looking program aimed to rapidly grow an industry. The EPA seems to indicate that it will use the appropriate tools to keep RFS on track.

IV. CONCLUSION

With increasing calls to amend or repeal RFS and with rapidly escalating goals in the coming years, the Renewable Fuel Standard has entered a critical period. This is particularly true considering the slowly developing cellulosic biofuel industry. However, due largely to thriving biodiesel, the biomass-based diesel category has helped keep the RFS on track. The category is poised for further growth as the current volume requirements are still approximately

143. *Table 4a—US Crude Oil and Liquid Fuel Supply, Consumption, and Inventories,* U.S. ENERGY INFO. ADMIN., (Feb. 2013), *available at* http://www.eia.gov/forecasts/steo/tables/pdf/4atab.pdf. The table notes 3.77 million barrels of distillate fuel used each day. A barrel of oil is equivalent to 42 gallons. Thus the total amount of distillate fuel used in 2012 is approximately 57.7 billion gallons.

half of the current capacity and other qualifying fuel types in the category, renewable diesel and renewable jet fuel, may see considerable growth in the near term. Furthermore, the overall advanced biofuel goals are attainable through 2015, even without significant growth from the cellulosic biofuel industry. While the RFS goals in 2016 and beyond look difficult to achieve, the EPA should take an aggressive approach now, particularly in the BBD category, to provide additional time for other advanced biofuels to reach commercial scale.

The EPA recognizes that RFS is forward-looking.[144] The EPA can utilize a bold strategy, i.e., a significant increase in the mandated volumes for the BBD category, to ensure that RFS goals remain attainable. Based on the timing of RFS decision-making, the strategy allows the industry an additional two years to develop. More importantly, this time could prove valuable to the industry, providing significant volumes of renewable fuel that provide environmental, economic, and energy security benefits. With RFS able to provide such sizeable benefits, its importance should not be understated. Biomass-based diesel has played a major role in the current achievements of the RFS. As RFS moves toward a stronger reliance on advanced biofuels, the EPA should utilize the regulatory tools available under RFS to continue to use the BBD category to fuel RFS.

144. Regulation of Fuels and Fuel Additives: 2013 Biomass-Based Diesel Renewable Fuel Volume, 77 Fed. Reg. 59458, 59469 (Sept. 27, 2012) (to be codified at 40 C.F.R. pt. 80).