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Cellulosic Biofuel: Dead on Arrival?

Meredith Pressfield[*]

Congress enacted the Renewable Fuel Standard in 2005 to increase the development and commercialization of biofuels. The Renewable Fuel Standard—amended in 2007—however, has failed to achieve any of its production targets for cellulosic biofuel. For example, despite the legislation calling for the production of 500 million gallons of cellulosic biofuel by 2012, the industry produced a modest 20,069 gallons that year. This Note provides a brief history of the Renewable Fuel Standard, as enacted and as amended, in order to provide context for its analysis of the U.S. Court of Appeals for the District of Columbia Circuit's decision in American Petroleum Institute v. Environmental Protection Agency. *This Note explores the hurdles that confront the development and production of commercial-scale cellulosic biofuel. It argues that, as enacted and as amended, the Renewable Fuel Standard provides insufficient incentives to spur the development of commercial-scale cellulosic biofuel.*

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INTRODUCTION

Cellulosic biofuel:

> On a blackboard, it looks so simple: Take a plant and extract the cellulose. Add some enzymes and convert the cellulose molecules into sugars. Ferment the sugar into alcohol. Then distill the alcohol into fuel. One, two, three, four—and we're powering our cars with lawn cuttings, wood chips, and prairie grasses instead of Middle East oil.[1]

Unfortunately, the "simple" promise of large-scale cellulosic biofuel production has proven more difficult in practice. Congress enacted the Renewable Fuel Standard (RFS) as part of the Energy Policy Act of 2005 (EPAct)[2]—and amended and extended it in the Energy Independence and

1. Evan Ratliff, *One Molecule Could Cure Our Addiction to Oil*, WIRED MAG. (Sept. 24, 2007), http://archive.wired.com/science/planetearth/magazine/15-10/ff_plant?currentPage=all.

2. Energy Policy Act of 2005, Pub. L. No. 109-58, § 1501, 119 Stat. 594, 603 (2005).

Security Act of 2007 (EISA)[3]—to promote the advancement of biofuels as transportation fuel. EISA required the production of 100 million, 250 million, and 500 million gallons of cellulosic biofuel in 2010, 2011, and 2012, respectively.[4] Anticipating that the cellulosic biofuel industry might fail to produce such high volumes, EISA also gave the Environmental Protection Agency (EPA) authority to waive a portion of the cellulosic biofuel requirement if the agency predicted that commercial production would fall short of the mandate.[5] Ultimately, the EPA had to drastically reduce the cellulosic biofuel mandate to five million gallons, 3.94 million gallons, and 8.65 million gallons for 2010, 2011, and 2012, respectively.[6] However, the cellulosic biofuel production industry consistently failed to meet even such reduced production targets. The industry failed to produce a single commercial gallon in 2010 or 2011 and produced a modest 20,069 gallons in 2012, which represents a mere 0.004 percent of the 2012 statutory mandate and 0.232 percent of the EPA's reduced 2012 mandate.[7] Although the biofuel industry remains optimistic about its ability to develop commercial-scale cellulosic biofuel, the RFS may fail to catalyze the development. This Note faults Congress for passing an unrealistically high mandate without sufficient support programs and neutering the EPA's ability to stimulate cellulosic biofuel production.

This Note begins by tracking the development of the RFS from codification through implementation. Congress enacted the RFS as part of the Clean Air Act's (CAA) attempt to reduce transportation emissions by increasing the use of renewable transportation fuels.[8] In order to encourage and accelerate the migration from traditional fuels to biofuels, Congress directed the EPA to promulgate RFS regulations sufficient to achieve the production of thirty-six billion gallons of renewable fuel in 2022.[9] These regulations require refiners (and transportation fuel importers) to demonstrate to the EPA that they met the required annual volume of each type of renewable fuel (including cellulosic biofuel)[10] or face a penalty.[11]

Although the industry failed to produce any cellulosic biofuel in 2010 or 2011, in 2011 alone, the refining industry faced an aggregate penalty of $6.8

3. *See* Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492, 1492 (2007) ("An Act To move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government, and for other purposes.").

4. *Id.*

5. 42 U.S.C. § 7545(o)(7)(A) (2012).

6. Biofuels Issues and Trends, U.S. Energy Information Administration, 21 (2012).

7. *2013 RFS Data*, EPA, http://www.epa.gov/otaq/fuels/rfsdata/2013emts.htm (last updated June 7, 2014).

8. *See* Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66496 (Dec. 15, 2009); 40 C.F.R. § 80(I)(a) (2007).

9. 42 U.S.C. § 7545(o)(2)(B)(i)(I).

10. *Id.* § 7545(o)(3)(B)(ii)(I).

11. 40 C.F.R. § 80.1460(b) (2013).

million for failing to demonstrate the use of the mandated 3.94 million gallons of cellulosic biofuel—a biofuel that did not exist.[12] In response, the American Petroleum Institute, a trade association whose members include fuel refiners and importers, challenged the EPA's RFS mandates in *American Petroleum Institute v. Environmental Protection Agency* (*API*).[13] There, the court held that the EPA's cellulosic biofuel projection and mandate exceeded its statutory authority.[14] The court faulted the EPA for shaping the cellulosic biofuel mandate as a technology-forcing mandate and limited the EPA's authority going forward.[15] This Note explores the history of cellulosic biofuel development and analyzes *API*'s likely impact on the future of cellulosic biofuel.

As background, Part I introduces and traces the history of the RFS and provides an overview of the biofuel volume mandates and industry compliance mechanics. Part II presents the economic and environmental promise of cellulosic biofuel to explain the RFS's focus on cellulosic biofuel's unique potential to reduce greenhouse gas emissions. Part III articulates the impact of the court's recent *API* decision on the future of cellulosic biofuel. Parts IV, V, and VI argue that although the RFS effectively provides a guaranteed market for cellulosic biofuel production, Congress's approach to cellulosic biofuel development may have forced the EPA to stunt the industry's growth.

I. BACKGROUND: THE RFS: FROM 2005 TO 2013

A. The Introduction of the RFS

Congress established the RFS program under the CAA as part of the 2005 EPAct[16] to promote growth in the renewable fuel industry.[17] The EPAct required the production of at least four billion gallons of renewable fuel in 2006 and 7.5 billion gallons by 2012.[18] It defined renewable fuel as fuel "produced from plant or animal products or wastes."[19] It also specifically mandated the production of a minimum of 250 million gallons of fuel derived from cellulosic biomass annually beginning in 2013.[20]

12. Matthew L. Wald, *A Fine for Not Using a Biofuel That Doesn't Exist*, N.Y. TIMES (Jan. 9, 2012), http://www.nytimes.com/2012/01/10/business/energy-environment/companies-face-fines-for-not-using-unavailable-biofuel.html?_r=0.

13. Am. Petroleum Inst. v. EPA (*API*), 706 F.3d 474, 479 (D.C. Cir. 2013).

14. The court also held that EPA had articulated a reasonable explanation for its refusal to lower the 2012 volume mandate for advanced biofuels. *API*, 706 F.3d at 479.

15. *Id.*

16. Energy Policy Act of 2005, Pub. L. No. 109-58, § 1501, 119 Stat. 594, 603 (2005).

17. *See* Energy Independence and Security Act of 2007, Pub. L. No. 110-140, Stat. 1492, 1492 (2007).

18. Energy Policy Act of 2005 § 1501.

19. EPA, EPA FINALIZES REGULATION FOR A RENEWABLE FUEL STANDARD (RFS) PROGRAM FOR 2007 AND BEYOND (2007), http://www.epa.gov/otaq/renewablefuels/420f07019.pdf; *see* 42 U.S.C. § 7545(o)(1)(B) (2012).

20. Energy Policy Act of 2005 § 1501(a)(2)(B)(iii).

B. President Bush Proposed the Alternative Fuel Standard on the Heels of the RFS

Building on the RFS, in his 2007 State of the Union address, President George W. Bush proposed the introduction of an Alternative Fuel Standard (AFS) to "increase the supply of alternative fuels, by setting a mandatory fuels standard to require 35 billion gallons of renewable and alternative fuels in 2017."[21] Despite the President's proposal to increase the development and use of alternative fuels, commentators expressed concern that "the goals would be difficult to attain" and "might do little to reduce gas emissions."[22] Several environmental organizations opposed the bill[23] because it defined "alternative fuel" to include "coal-derived liquid fuels," more commonly known as liquid coal.[24] Some groups even posited that the AFS introduced liquid coal as a "Trojan Horse" that might actually lead to an increase in emissions because liquid coal can produce double the amount of carbon dioxide emissions as compared to gasoline.[25] Instead of adopting the AFS's thirty-five billion gallon target, Congress "one-upped" the mandate and introduced its own RFS proposal with a thirty-six billion gallon target.[26]

C. The 2007 RFS Extended and Expanded the Volume Mandates

The RFS amendments maintained the original RFS's overriding goal while implementing several significant structural changes to the program. For example, under EISA, the RFS continues to require that renewable fuels comprise at least a minimum volume of U.S. transportation fuel.[27] However, EISA also spawned several significant changes to the RFS program. Most notably, EISA shifts the RFS from requiring an overall biofuel volume mandate to requiring mandates for four categories of biofuels: cellulosic biofuel, biosmass-based diesel, advanced biofuels, and renewable biofuels.[28]

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21. *President Bush's 2007 State of the Union Address*, WASH. POST (Jan. 23, 2007), http://www.washingtonpost.com/wp-dyn/content/article/2007/01/23/AR2007012301075.html.

22. Edmund L. Andrews & Felicity Barringer, *Bush Seeks Vast, Mandatory Increase in Alternative Fuels and Greater Vehicle Efficiency*, N.Y. TIMES (Jan. 24, 2007), http://www.nytimes.com/2007/01/24/washington/24energy.html?_r=0.

23. *See* Hanna L. Breetz, Fueled by Crises: U.S. Alternative Fuel Policy, 1975-2007 (Feb. 2013) (unpublished Ph.D. dissertation, Massachusetts Institute of Technology) (citing John Donnelly, *Bush Plan Sets Targets for Alternative Fuels*, N.Y. TIMES (Apr. 11, 2007), http://www.nytimes.com/2007/04/11/business/worldbusiness/11iht-fuel.4.5239940.html) (on file with author).

24. Alternative Fuel Standard Act of 2007, S. 1158, 110th Cong. § 2 (2007), *available at* http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=c6e6cde6-4526-439c-a7a4-759e27128e30.

25. *See* Breetz, *supra* note 23 (citing ROLAND J. HWANG, NATURAL RES. DEF. COUNCIL, COMPARISON OF CALIFORNIA LOW CARBON FUEL STANDARD WITH BUSH'S "20 IN 10" ALTERNATIVE FUEL STANDARD 10 (2007)).

26. *See id.* at 15.

27. *See* 42 U.S.C. § 7545 (2012).

28. *Id.* § 7545(o)(2)(B).

A full discussion of the political drivers behind the RFS makeover is beyond the scope of this Note. However, a snapshot of biofuel production volumes in 2006 illuminates a prime reason EISA departed from an overall biofuel mandate in favor of four categories of biofuels: the need to further induce cellulosic biofuel innovation. Under the EPAct, the RFS tried to incentivize cellulosic biofuel production by considering one gallon of cellulosic biofuel as equal to 2.5 gallons of renewable fuel for compliance purposes. Despite this cellulosic biofuel advantage, however, the United States produced zero gallons of commercially available cellulosic biofuel in 2006, and instead produced 25 percent more corn ethanol than required by the RFS. Many even projected that corn ethanol production would "continue to outpace all of the [RFS's] subsequent yearly mandates."[29] The EPAct's RFS did not lead to the commercialization of cellulosic biofuel. Instead, it seemed solely to increase the production of corn ethanol.

1. RFS Volume Mandates under EPAct as Compared to EISA

When EISA expanded and extended the RFS, it created four categories of biofuel, increased the annual volume mandates, and extended the program through 2022.

TABLE 1: EPACT MANDATES AS COMPARED TO EISA MANDATES:[30]

Calendar Year	Applicable volume of renewable fuel (in billions of gallons)	
	EPAct (2005)	EISA (2007)
2006	4.00	
2007	4.70	
2008	5.40	9.00
2009	6.10	11.10
2010	6.80	12.95
2011	7.40	13.95
2012	7.50	15.20
2013	N/A	16.55
2014		18.15
2015		20.50
2016		22.25
2017		24.0
2018		26.00
2019		28.00
2020		30.00
2021		33.00
2022		36.00

29. Timothy A. Slating & Jay P. Kesan, *The Renewable Fuel Standard 3.0? Moving Forward with the Federal Biofuel Mandate*, 20 N.Y.U. ENVTL. L.J. 374, 409–10 (2014).
30. 42 U.S.C. § 7545(o)(2)(B)(i)(I).

2. Conceptualizing the RFS Mandate Numbers

Answering two fundamental questions helps contextualize the significance of the RFS mandate. First, how can one conceptualize thirty-six billion gallons of fuel? In 2010, light duty vehicles and trucks[31]—essentially passenger cars and trucks—had an average fuel economy of 21.5 miles per gallon.[32] The average vehicle traveled 11,493 miles per year.[33] Accordingly, an average vehicle that drives the average number of miles uses roughly 535.56 gallons of fuel per year. Therefore, thirty-six billion gallons of biofuel could theoretically[34] translate into approximately sixty-seven million passenger vehicles running exclusively on biofuel in 2022.

Second, beyond its impact on greenhouse gas emissions[35] and U.S. energy security,[36] why should one care about whether the RFS succeeds? The RFS was Congress's "first attempt at mandating the use of any type of renewable energy."[37] It came after six years of congressional debate and six failed bills.[38] As a flagship piece of federal renewable energy policy, the success or failure of the RFS program could pave or obstruct the path towards future federal renewable energy policies.

3. EISA Introduced Mandates for Specific Categories of Biofuel

As mentioned before, EISA created four categories of mandated biofuels: renewable fuel,[39] biomass-based diesel,[40] cellulosic biofuel,[41] and other

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31. 40 C.F.R. § 86.1803-01 (2013).

32. *Table 4-23: Average Fuel Efficiency of U.S. Light Duty Vehicles*, BUREAU OF TRANSP. STAT., http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html (last visited June 29, 2014).

33. *Calculations and References*, EPA, http://www.epa.gov/cleanenergy/energy-resources/.refs.html (last updated May 30, 2014).

34. This ignores blend wall issues.

35. *See* 42 U.S.C. § 7545(o)(2)(A)(i) ("[R]enewable fuel produced from new facilities that commence construction after December 19, 2007, achieves at least a 20 percent reduction in lifecycle greenhouse gas emissions compared to baseline lifecycle greenhouse gas emissions.").

36. *See* RANDY SCHNEPF & BRENT D. YACOBUCCI, CONG. RESEARCH SERV., REP. NO. R40155, RENEWABLE FUEL STANDARD (RFS): OVERVIEW AND ISSUES 26 (2013).

37. Slating & Kesan, *supra* note 29, at 397.

38. *Id.* at 397 & n.124 (citing Clean Air and Water Preservation Act, H.R. 4011, 106th Cong. (as proposed by Mr. Ganske, Mar. 16, 2000); Renewable Fuels Act of 2000, S. 2503, 106th Cong. (as proposed by Sen. Daschle, May 3, 2000); Clean and Renewable Fuels Act, S. 892, 107th Cong. (as proposed by Sen. Harkin, May 15, 2001); Renewable Fuels for Energy Security Act, S. 1006, 107th Cong. (as proposed by Sen. Hagel, June 8, 2001); Energy Policy Act, S. 1766, 107th Cong. (as proposed by Sen. Daschle, Dec. 5, 2001); Fuel Security Act of 2003, H.R. 837, 108th Cong. (as proposed by Rep. Peterson, Feb. 13, 2003); Energy Policy Act of 2003, H.R. 6, 108th Cong. (July 21, 2003); Fuel Choices for American Security Act of 2005, H.R. 4409, 109th Cong. (as proposed by Mr. Kingston, Nov. 18, 2005); Energy Policy Act of 2005, Pub. L. No. 109-58, § 1501, 119 Stat. 594, 603 (2005)).

39. The term "'additional renewable fuel' means fuel that is produced from renewable biomass and that is used to replace or reduce the quantity of fossil fuel present in home heating oil or jet fuel." 42 U.S.C. § 7545(o)(1)(A).

40. The term "'biomass-based diesel' means renewable fuel that is biodiesel as defined in section 13220(f) of this title and that has lifecycle greenhouse gas emissions, as determined by the Administrator, after notice and opportunity for comment, that are at least 50 percent less than the

advanced biofuels.[42] Each category has a volume mandate, but the volume requirements are not always exclusive to one category.[43] The EPA's final rule implementing EISA's changes to the RFS program describes the nonexclusive categorical volume requirements as "nested"[44] because cellulosic biofuel and

TABLE 2: BIOFUEL MANDATES BY BIOFUEL CATEGORY[45] (IN BILLIONS)

Year	Advanced Biofuel			Total Renewable Biofuel
	Biomass-Based Diesel	Cellulosic Biofuel	Total Advanced Biofuel	
2006	N/A			4.00
2007				4.70
2008				9.00
2009	0.5	N/A	0.6	11.10
2010	0.65	0.10	0.95	12.95
2011	0.80	0.25	1.35	13.95
2012	*1.0*	0.50	2.00	15.20
2013		1.00	2.75	16.55
2014		1.75	3.75	18.15
2015		3.00	5.50	20.50
2016		4.25	7.25	22.25

TABLE 2 (CONTINUED): BIOFUEL MANDATES BY BIOFUEL CATEGORY (IN BILLIONS)

Year	Advanced Biofuel			Total Renewable Biofuel
	Biomass-Based Diesel	Cellulosic Biofuel	Total Advanced Biofuel	
2017	*1.0*	5.50	9.00	24.00
2018		7.00	11.00	26.00

baseline lifecycle greenhouse gas emissions. Notwithstanding the preceding sentence, renewable fuel derived from co-processing biomass with a petroleum feedstock shall be advanced biofuel if it meets the requirements of subparagraph (B), but is not biomass-based diesel." *Id.* § 7545()(1)(D).

41. The term "'cellulosic biofuel' means renewable fuel derived from any cellulose, hemicellulose, or lignin that is derived from renewable biomass and that has lifecycle greenhouse gas emissions, as determined by the Administrator, that are at least 60 percent less than the baseline lifecycle greenhouse gas emissions." *Id.* § 7545(o)(1)(E).

42. The term "'advanced biofuel' means renewable fuel, other than ethanol derived from corn starch, that has lifecycle greenhouse gas emissions, as determined by the Administrator, after notice and opportunity for comment, that are at least 50 percent less than baseline lifecycle greenhouse gas emissions." *Id.* § 7545(o)(1)(B)(i).

43. *See* 40 C.F.R. § 14675 (2013).

44. This is likely based on the concept of Russian nesting dolls, where one doll fits inside another doll; here, one category of biofuel fits inside another, larger category.

45. *RFS2: 4 Separate Stds*, EPA, http://www.epa.gov/otaq/renewablefuels/rfs2-4standards.pdf (last visited July 5, 2014).

2019		8.50	13.00	28.00
2020		10.50	15.00	30.00
2021		13.50	18.00	33.00
2022		16.00	21.00	36.00

biomass-based diesel also qualify under the advanced biofuel category, and advanced biofuel also qualifies for meeting the total renewable fuel requirement.[46] The table below offers a visual explanation of the volume requirements and the categorical nesting.

D. Setting the Volume Mandates

EISA sets annual biofuel volume mandates for each category of biofuel. It also requires the EPA Administrator to annually evaluate and potentially adjust the cellulosic biofuel mandate. As part of this annual adjustment process, the Energy Information Administration (EIA) Administrator provides the EPA Administrator with the "projected" production volumes of several categories of transportation fuel, including the volume of cellulosic biofuel.[47] The EPA Administrator then revises the mandates based on EIA's projections.[48] Despite ambitious goals, actual production has never met the volume mandates.[49]

TABLE 3: BIOFUEL PRODUCTION VOLUMES (IN BILLIONS OF GALLONS)

Year		Cellulosic Biofuel	Biomass-Based Diesel	Advanced Biofuel	Renewable Fuel
2011	Statutory RFS	0.25	0.80	1.35	13.95
	Volume Produced	0.00	1.12	0.22	13.61
2012	Statutory RFS	0.50	1.00	2.00	15.20
	Volume Produced	0.000022	1.15	0.61	12.99

The RFS also includes two waiver provisions. First, the EPA Administrator[50] may waive, in whole or in part, any of the renewable fuel standards upon her discretion or in response to a petition made by a state or regulated party.[51] Second, the statute requires that "for any calendar year for which the projected volume of cellulosic biofuel production is less than the minimal applicable volume" established by the statute, the EPA Administrator "shall reduce" the mandated volume to "the projected volume available during

46. 40 C.F.R. § 14675.
47. 42 U.S.C. § 7545(o)(3)(A).
48. *Id.* § 7545(o)(3)(B)(i).
49. *2013 RFS Data*, *supra* note 7.
50. The EPA Administrator may grant a waiver after consulting with the Secretary of Agriculture and the Secretary of Energy. *See* 42 U.S.C. § 7545(o)(7).
51. *Id.* § 7545(o)(7)(A).

that calendar year."[52] If the Administrator reduces the cellulosic biofuel mandate, she also has discretion to adjust the applicable volume of renewable fuel and advanced biofuels.[53]

When the Administrator reduces the cellulosic biofuel volume mandate, she must introduce cellulosic biofuel waiver credits. The statute requires the Administrator to sell the credits "at the higher of $0.25 per gallon or the amount by which $3.00 per gallon exceeds the average wholesale price of a gallon of gasoline" sold in the United States.[54] This requirement allows obligated parties to purchase waivers—instead of fuel—to meet their volume obligations. Commentators contend that the waiver provisions mean that obligated parties should "be indifferent between buying a gallon of gasoline plus a [w]aiver [c]redit verses buying a gallon of cellulosic biofuel for a price equal to or less than the price of the gallon of gasoline plus the cost of the [w]avier [c]redit."[55] The waiver credits operate as a ceiling on the price of cellulosic biofuels, forcing them to compete with the price of gasoline.[56] In years when supply meets or exceeds the cellulosic biofuel mandate, presumably market competition among cellulosic biofuel producers will regulate the price of the fuel.[57]

E. The RFS Compliance System

RFS imposes a complicated compliance system on renewable fuel producers, refiners, blenders, and importers (collectively, "obligated parties").[58] Each year, the EPA Administrator releases the respective mandates for each obligated party, expressed as a Renewable Volume Obligation.[59] An obligated party demonstrates its Renewable Volume Obligation compliance through the use of Renewable Identification Numbers (RINs). A RIN is "a unique number generated to represent a volume of renewable fuel" specifically designed for RFS compliance purposes.[60] Each obligated party must accumulate the appropriate number of RINs to demonstrate RFS compliance.[61]

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52. *Id.*

53. *Id.*

54. *Id.* § 7545(o)(7)(D)(ii). The Administrator adjusts the waiver credits for inflation after 2008. *Id.*

55. Alan Bickerstaff, *An Introduction to Cellulosic Biofuel Waiver Credits*, LAW360 (June 2, 2010, 12:01 PM), http://www.law360.com/articles/169155/an-introduction-to-cellulosic-biofuel-waiver-credits.

56. *Id.*

57. *Id.*

58. Small producers and importers do not have to comply with Renewable Identification Numbers (RINs) generation and volume mandates. *See* 40 C.F.R. § 80.1426(c) (2013); *see also id.* § 80.1455 (detailing the small volume provisions for renewable fuel production facilities and importers who produce or import less than ten thousand gallons of renewable fuel each year).

59. *See* 40 C.F.R. § 80.1406(b).

60. *Id.* § 80.1401.

61. 42 U.S.C. § 7545(o)(3)(B)(ii)(I) (2012); *see also* 40 C.F.R. § 80.1406(a)(1) ("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

At the start of the process, fuel producers and importers generate the RINs. To determine the RINs, a fuel producer or importer assigns an "equivalence value" to each gallon of renewable fuel, or gallon equivalent.[62] An equivalence value designates the number of RINs that the producer or importer can use for a particular gallon of renewable fuel.[63] The EPA provides equivalence values for certain enumerated biofuel categories.[64] In addition, for all other unenumerated renewable fuels, a refiner or importer can apply to the EPA for an alternative equivalence value, or a party may petition the EPA to approve a new renewable fuel pathway.[65]

After generating the fuel and corresponding RINs, the producer then sells the batch of biofuel, complete with its RINs, to an obligated party. After blending the biofuel into the petroleum fuel, the obligated party then uses the RINs to demonstrate compliance.[66] If a party has already met its obligation, it can bank or sell its excess RINs.[67] The statute provides for some flexibility by allowing an obligated party to "rollover" its RINs from one year to the next; a RIN, however, has a "shelf-life of only one year."[68] As discussed above, with regard to cellulosic biofuel, if the EPA Administrator reduces the minimum mandated volume because the projected volume is less than the statutory volume, the Administrator must make available cellulosic biofuel waiver credits. An obligated party can thereby demonstrate compliance by purchasing the biofuel and accompanying RINs or by purchasing the waiver credits.[69]

Failure to comply with RFS mandates[70] or RIN generation and transfer violations[71] leaves a regulated party subject to a CAA civil penalty[72] for every day of such a violation.[73] The noncompliant party also remains subject to a civil penalty in "the amount of economic benefit or savings resulting from each violation."[74]

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compliance period. A party that simply blends renewable fuel into gasoline or diesel fuel, as defined in § 80.1407(c) or (e), is not an obligated party.") (emphasis added).

62. 40 C.F.R. § 80.1415(a)(1).

63. *Id.* § 80.1415(a)(2).

64. *Id.* § 80.1415(b)(1)–(7) (providing that a producer or importer can also apply to the EPA for a different equivalence value of an enumerated fuel if "the producer or importer has reason to believe that a different equivalence value . . . is warranted").

65. *Id.* § 80.1416.

66. Wyatt Thompson et al., *The New Markets for Renewable Identification Numbers*, 32 APPLIED ECON. PERSP. & POL'Y, no. 4, Winter 2010, at 588, 593.

67. 40 C.F.R. § 80.1429.

68. Thompson, *supra* note 66, at 593.

69. 42 U.S.C. § 7545(o)(7)(D)(ii) (2012) ("Whenever the Administrator reduces the minimum cellulosic biofuel volume under this subparagraph, the Administrator shall make available for sale cellulosic biofuel credits at the higher of $0.25 per gallon or the amount by which $3.00 per gallon exceeds the average wholesale price of a gallon of gasoline in the United States.").

70. 40 C.F.R. § 80.1460(a).

71. *Id.* § 80.1460(b).

72. Civil penalties are discussed in CAA sections 205 and 211(d).

73. 40 C.F.R. § 80.1463.

74. 42 U.S.C. § 7545(d)(1).

II. THE ECONOMIC AND ENVIRONMENTAL PROMISE OF CELLULOSIC BIOFUEL

Congress made cellulosic biofuel a cornerstone of the RFS by increasing the cellulosic biofuel mandate to sixteen billion gallons by 2022.[75] The increased cellulosic biofuel mandate represented "the bulk of the increase in the renewable fuels mandate."[76] Understanding why the industry has failed to achieve commercial-scale production requires a deeper look at cellulosic biofuel itself. Cellulosic biofuel is derived from the cellulosic (woody) portions of renewable biomass: plants or plant-derived materials.[77] Feedstock examples include "agricultural wastes, . . . forestry residues such as wood wastes, municipal solid wastes, and wastes from pulp/paper processing; dedicated crops such as fast-growing woody trees (poplars) and shrubs (willows); and grasses such as switchgrass . . . ."[78] At a basic level, cellulosic biofuel production requires the completion of three steps: (1) collecting cellulosic biomass; (2) breaking down the biomass into sugar—the pretreatment phase involving the "deconstruction of cell wall polymers into component sugars"; and (3) converting the sugars to biofuels—the "fermentation" phase.[79]

Although researchers have worked on the development of cellulosic biofuels throughout the twentieth century,[80] no commercial-scale cellulosic biofuel production existed when Congress enacted the RFS under EPAct, nor when it amended the RFS under EISA.[81] Therefore, the 2007 RFS amendments assumed and required significant innovation to achieve the mandated production levels.[82]

A. *Cellulosic Biofuel: The Promise of Emissions Reductions*

Despite the uphill innovation battle, three primary reasons help explain why Congress made cellulosic biofuel the cornerstone of a successful RFS program. First, "cellulose makes up nearly half of all plant biomass," providing a large source of biofuel feedstock.[83] Second, cellulosic biofuel can yield almost "80 percent more energy than is required to grow and convert it."[84] This means that "cellulosic sources can produce as much as five times more energy

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75. *Id.* § 7545(o)(2)(B)(i)(III).

76. 40 C.F.R § 14748.

77. *See* Slating & Kesan, *supra* note 29, at 386.

78. Deepak Rajagopal et al., *Recent Developments in Renewable Technologies: R&D Investment in Advanced Biofuels*, ANNUAL REV. RESOURCE ECON., May 2009, at 621, 621–644.

79. Edward M. Rubin, *Genomics of Cellulosic Biofuels*, 454 NATURE 841, 841 (2008).

80. *See generally* Barry Solomon et al., *Grain and Cellulosic Ethanol: History, Economics, and Energy Policy*, 31 BIOMASS & BIOENERGY 416 (2007) (reviewing the history of cellulosic ethanol development).

81. *API*, 706 F.3d at 476.

82. *Id.*

83. GREAT LAKES BIOENERGY RESEARCH CTR., WHY IS IT SO DIFFICULT TO MAKE CELLULOSIC ETHANOL? (2010), *available at* https://www.glbrc.org/sites/default/files/Cellulosic_Ethanol.pdf.

84. Ratliff, *supra* note 1.

than they take to grow, harvest, and deliver."[85] Accordingly, the commercialization of cellulosic biofuel could lead to significant reductions in transportation emissions.

Third, cellulosic feedstock does not compete with food crops. Most cellulosic feedstock, which includes switch grasses and poplar, is derived from potentially low-cost, diverse, nonfood feedstocks.[86] In contrast, meeting the fifteen billion gallon mandate for conventional biofuels, which will most likely be met with ethanol from corn,[87] will probably require increased corn planting such that "even with [an] increased harvest, biofuel production will consume around 45 percent of the U.S. corn crop, compared with 22 percent in 2007."[88] In contrast, studies estimate that the United States can support the growth of over one billion tons of cellulosic feedstock on available farmland without displacing food crops.[89] This prediction is largely based on the ability to grow cellulosic feedstock on "marginal agricultural land."[90] Noting this potential, the U.S. Department of Energy and the U.S. Department of Agriculture (USDA) "identified more than 1.3 billion dry tons per year" of domestic cellulosic biofuel feedstock—enough to "replace 30 percent of the U.S. crude oil consumption by around 2030."[91] Cellulosic feedstock can also benefit the environment because it can "hold the topsoil, capture carbon, aid in cleaning and purifying runoff and . . . provide habitats for indigenous wildlife" while being grown.[92] Therefore, picking the cellulosic biofuel lock holds great promise.

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85. Jonathan Volinski, *Shucking Away the Husk of a Crop Gone Wrong: Why the Federal Government Needs to Replant Its Approach to Corn-Based Ethanol*, 25 TUL. ENVTL. L.J. 507, 509 (2012) (citing Sean Charles Starr, Comment, *Sweet Rewards: How U.S. Trade Liberalization and Penetration of Brazilian Ethanol into the U.S. Market Can Stimulate America's Domestic Economy and Strengthen America's International Influence*, 8 DEPAUL BUS. & COM. L.J. 275, 293 (2010) (quoting Vanessa M. Cordonnier, *Ethanol's Roots: How Brazilian Legislation Created the International Ethanol Boom*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 287, 312 (2008))).

86. *See* KELSI BRACMORT ET AL., CONG. RESEARCH SERV., REP. NO. RL34738, CELLULOSIC BIOFUELS: ANALYSIS OF POLICY ISSUES FOR CONGRESS 3 (2011).

87. Bonnie L. Keeler et al., *U.S. Federal Agency Models Offer Different Visions for Achieving Renewable Fuel Standard (RFS2) Biofuel Volumes*, 47 ENVTL. SCI. & TECH. 10,095, 10,095 (2013).

88. David Rotman, *The Mess of Mandated Markets*, MIT TECH. REV. (Feb. 19, 2008), http://www.technologyreview.com/review/409577/the-mess-of-mandated-markets/ ("Since it became apparent that the biofuel standards would become law, the price of corn has risen 20 percent, to around $5.00 a bushel . . . . [P]rices will probably stay around that level for at least the next three years. Because corn is the primary feed for livestock in this country, that means higher prices for everything from beef to milk and eggs.").

89. Ratliff, *supra* note 1 ("[A]bout two-thirds of what we throw into our landfills today contains cellulose and thus potential fuel.").

90. Rubin, *supra* note 79, at 841.

91. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-446, BIOFUELS: POTENTIAL EFFECTS AND CHALLENGES OF REQUIRED INCREASES IN PRODUCTION AND USE 113 (2009), *available at* http://www.gao.gov/assets/160/157718.pdf.

92. Vanessa M. Cordonnier, *Ethanol's Roots: How Brazilian Legislation Created the International Ethanol Boom*, 33 WM. & MARY ENVTL. LAW & POL'Y REV. 287, 312 (2008) (citing *Bales of Opportunity*, 54 FARM & HOME RES., no. 2, 2003, at 16, 18, *available at* http://pubstorage.sdstate.edu/ AgBio_Publications/articles/FHR54-2.pdf).

B. *"The Problem Is Cellulose"*[93]*: Scientific and Economic Hurdles to the Commercialization of Cellulosic Biofuel*

Despite scientific development, cellulosic biofuel remains scientifically and economically challenging because it has high production costs due to conversion and capital costs.[94] First, although cellulose has the potential to offer an enormous source of energy, harnessing such energy proves difficult. Cellulose is "a tough molecule to break down."[95] At the most basic level, "cellulosic biomass is more difficult to convert into a fuel than starch-based biomass as a result of its crystalline recalcitrant structure."[96] Cellulosic biofuel production proves challenging because it requires a complex chemical process[97] to convert the plant material into simple sugars to use for ethanol.[98] Furthermore, feedstock has "not been domesticated"—which can include selective breeding—to reduce the inherent challenges and inefficiencies of breaking down the biomass into component sugars.[99]

Beyond feedstock challenges, the pretreatment phase remains costly. Cellulosic production faces scientific hurdles relating to "economically pretreating the biomass feedstock to break down its plant cell walls and fermenting the resulting sugars into biofuel."[100] A recent study also points out that several cellulosic biorefineries have entered the development and/or construction phase, but the study admits that "significant hurdles no doubt remain for the efficient commercial-scale production of cellulosic biofuels."[101] Therefore, research largely focuses on finding "more efficient, less expensive ways to easily separate the cellulose" and chop it "into smaller pieces for glucose for fermentation."[102]

Second, cellulosic biofuel production also requires comparatively high capital investment.[103] The supply chain costs for a cellulosic biofuel refinery can constitute up to 20 percent of the cost of the cellulosic biofuel.[104] Cellulosic biofuel can "cost at least twice as much to produce as conventional

93. Ratliff, *supra* note 1.

94. WILLIAM T. COYLE, ECON. RESEARCH SERV., NEXT-GENERATION BIOFUELS: NEAR-TERM CHALLENGES AND IMPLICATIONS FOR AGRICULTURE 10 (2010).

95. Ratliff, *supra* note 1.

96. George W. Huber & Avelino Corma, *Synergies between Bio- and Oil Refineries for the Production of Fuels from Biomass*, 46 ANGEWANDTE CHEM. INT'L ED., no. 38, Sept. 2007, at 7184, 7187.

97. In greater detail, "the breakdown of biomass involves the release of long-chain polysaccharides . . . and the subsequent hydrolysis of these polysaccharides into their component 5- and 6-carbon chain sugars." Rubin, *supra* note 79, at 844.

98. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 91, at 118.

99. *Id.*

100. Slating & Kesan, *supra* note 29, at 394 (citing N.W.Y. Ho et al., *Biofuels from Cellulosic Feedstocks*, *in* 3 COMPREHENSIVE BIOTECHNOLOGY 51, 53–55 (Murray Moo-Young ed., 2d ed. 2011)).

101. *Id.* at 395.

102. GREAT LAKES BIOENERGY RESEARCH CTR., *supra* note 83.

103. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 91, at 118.

104. *Id.* at 116.

corn starch ethanol."[105] Some studies also estimate that the capital costs for cellulosic biofuel range from three to four times greater than those for corn ethanol plants.[106] A 2007 study also estimated that a cellulosic biofuel plant capable of producing fifty million gallons per year would cost approximately $250 million, as compared with a corn ethanol plant with the same capacity, which would cost approximately $76 million.[107]

High production costs hamper cellulosic biofuel's ability to compete with corn-based ethanol—and certainly with gasoline—at the pump. A USDA study "estimated cellulosic ethanol production costs at $2.65 per gallon, compared with $1.65 for corn-based ethanol."[108] Studies, however, are quick to acknowledge that such numbers are strictly estimates because no commercial production plants, and therefore "no actual cost data for commercial operations," existed at the time of such studies.[109]

III. *AMERICAN PETROLEUM INSTITUTE V. ENVIRONMENTAL PROTECTION AGENCY*

Tired of paying fines for purchasing a phantom fuel, a group of refiners sued the EPA, claiming the cellulosic biofuel mandate level exceeded the EPA's statutory authority.[110] In *API*, the U.S. Court of Appeals for the District of Columbia Circuit addressed the EPA's decision-making discretion relating to the cellulosic and advanced biofuel volume mandates. API and the National Petrochemical and Refiners Association claimed that (1) the EPA had merely considered EIA's projection, which did not satisfy the requirement that the EPA base its projection on the EIA estimate, and (2) the cellulosic biofuel volume requirement was unrealistically high and the statute required the EPA Administrator to reduce the mandate based on the projected volume.[111]

A. API Contested EPA's Cellulosic Biofuel Projection

The court rejected API's first claim that the EPA did not base its 2012 projection for cellulosic biofuel production on an EIA estimate. As discussed, the EPA projected that the industry would produce 5 and 6.6 million gallons of cellulosic biofuel in 2010 and 2011, respectively. The industry failed to generate and sell a single gallon in either year. The EPA justified the cellulosic mandate levels, explaining that "it [was] appropriate to set the applicable volume [requirement] at a level that provide[d] an incentive for developing cellulosic biofuel facilities to come on line as expeditiously as possible."[112] It

105. *Id.* at 112.
106. *See id.* at 118.
107. *See id.*
108. COYLE, *supra* note 94, at 10.
109. *Id.*
110. *API*, 706 F.3d at 477.
111. *Id.*
112. Regulation of Fuels and Fuel Additives: 2011 Renewable Fuel Standards, 75 Fed. Reg. 76,790, 76,797 (Dec. 9, 2010) (to be codified at 40 C.F.R. pt. 80).

had designed the cellulosic biofuel mandate to function as a technology-forcing mandate by setting the volume mandate so high that the industry could not meet it with existing technology and plant capacity.

Focusing on the methodological variations between the EPA and the EIA, the court emphasized the agencies' differing approaches to estimating the anticipated biofuel production capacity. The EIA used "a 'standard utilization factor' of 25 percent of full-capacity production," while the EPA "looked to the start-up dates of the facilities as anticipated by the facilities' owners."[113] The court accepted the EPA's approach, considering it "little more than a technocratic exercise of agency discretion" and explained that "Congress didn't contemplate slavish adherence by the EPA to the EIA estimate."[114] Therefore, the court applied *Chevron* deference to the EPA's production estimation methodology. However, the court quickly limited the scope of its deference to the EPA's methodology by rejecting the EPA's actual calculation.

B. The Court Held That the EPA Cannot Make the Cellulosic Biofuel Mandate a Technology-Forcing Mandate

The court upheld API's second claim that the EPA improperly viewed the cellulosic biofuel production with a "tilt . . . toward 'promoting growth' in the cellulosic biofuel industry."[115] The court explained that promoting the growth of cellulosic biofuel "has no basis" in the RFS.[116] The EPA argued that the cellulosic biofuel mandate represented its goal of balancing domestic production and import potential with the advancement and growth of the cellulosic biofuel industry.[117] The court disagreed and faulted the EPA for taking such a "decidedly non-technocratic bent," and for using the mandated estimates to promote the growth of the cellulosic biofuel industry.[118] It explained that neither the text nor the structure of the RFS legislation supported the EPA's decision to create an overly optimistic standard designed to spur technology growth.[119] The court rejected the EPA's cellulosic biofuel projection under the RFS because the EPA's methodology "did not take neutral aim at accuracy" and, therefore, "it was an unreasonable exercise of agency discretion."[120]

1. Statutory Language Prevents EPA from Setting a Technology-Forcing Mandate for Cellulosic Biofuel

113. *API*, 706 F.3d at 477.
114. *Id.* at 478.
115. *Id.* at 479.
116. *Id.*
117. *Id.*
118. *Id.*
119. *Id.*
120. *Id.* at 474.

Focusing on the statutory text, the court provided two primary reasons for rejecting the EPA's technology-forcing mandate for cellulosic biofuel. First, the statute requires the EPA to predict "what will *actually* happen" because it references the "projected"—as opposed to an aspirational—volume of cellulosic biofuel.[121] Second, although the court granted the EPA leeway to deviate from the EIA's production estimation methodology, it explained that the RFS's requirement that the EPA's biofuel production estimate be "'based on' [the] EIA's estimate" implies that the statute restricts the EPA to using "an outcome-neutral methodology over an aspirational one."[122]

2. Statutory Structure Precludes EPA from Setting a Technology-Forcing Mandate for Cellulosic Biofuel

The court also provided two structural reasons for rejecting the EPA's attempt to create a technology-forcing mandate for cellulosic biofuel. First, the statute requires the EPA Administrator to reduce the cellulosic biofuel mandate when the projected volume available is less than the volume required by the mandate.[123] Unlike other categories of biofuel, the court explained that the cellulosic biofuel mandate has an escape hatch: for any year in which the "projected volume of cellulosic biofuel production is less than the minimum" mandated volume, "the Administrator shall reduce the applicable volume of the cellulosic biofuel required" to the volume projected.[124] In such years, the EPA Administrator can also choose to reduce the mandated volume for biofuels.[125] This statutorily required reduction provides a "non-discretionary safety valve"—escape hatch—for refiners and importers that cannot meet the standard.[126] The court further explained that "only with regard to cellulosic biofuel did Congress adopt so cautious an approach—perhaps because of the industry's embryonic character."[127]

Second, although it recognized that Congress created the RFS program in part to spur growth of the renewable fuel industry, the court found that the EPA did not have unfettered discretion to design each element of the RFS program to force technology growth.[128] The court contrasted the cellulosic biofuel program structure with previous technology-forcing programs, finding that here the "EPA applie[d] the pressure to one industry (the refiners), yet it is another (the producers of cellulosic biofuel) that enjoys the requisite expertise, plant, capital and ultimate opportunity for profit."[129] The court explained that such a structure gives rise to an "asymmetry in incentives" because the refiners face

121. *Id.* at 480.
122. *Id.*
123. *See* 42 U.S.C. § 7545(o)(7)(D)(i) (2012).
124. *Id.*
125. *Id.*
126. *API*, 706 F.3d at 479.
127. *Id.*
128. *Id.*
129. *Id.* at 480.

the fines, but have no control over the development of cellulosic biofuel technology required to reach the aspirational mandate.[130] In effect, the court held that (1) the EPA cannot create a technology-forcing standard for cellulosic biofuel and (2) even if it could, the EPA implemented an impermissibly designed standard.

More recently, in January 2013, the EPA proposed a fourteen million gallon mandate for cellulosic biofuel.[131] Following the *API* decision, the EPA reduced the mandate to six million gallons. In sum, in 2007 Congress statutorily anticipated the production of 250 million gallons of cellulosic biofuel in 2012. In 2013—six years later—the EPA's most recent mandate requires the production of six million gallons, 2.4 percent of the original mandate.

IV. TECHNOLOGY-FORCING MANDATES

A. *Successful Examples of Technology-Forcing Mandates: The Catalytic Converter and the Montreal Protocol*

Previous examples of technology-forcing regulations can provide lessons for the RFS. Under a technology-forcing mandate scheme, the regulator sets a standard that cannot be achieved with current technologies.[132] This scheme requires industry innovation and the commercialization of new technologies. The theory supporting technology-forcing mandates holds that "the preferred outcome of the government/regulator is a technological fix of the problem that can only be brought about by applying regulatory pressure on firms."[133] The government's role is to "prod firms to expend their R&D dollars on the development of new technologies."[134]

Notably, the CAA amendments of 1970 implemented a technology-forcing mandate by requiring a 90 percent reduction in vehicle emissions.[135] Despite a few setbacks,[136] the CAA's technology-forcing mandate led to the introduction of the catalytic converter. The CAA's technology-forcing mandate succeeded because the mandate exerted pressure on the industry capable of pursuing such a technological advancement. Facing the mandate, automakers

130. *Id.*

131. Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards, 78 Fed. Reg. 9282, 9284 (proposed Feb. 7, 2013) (to be codified at 40 C.F.R. pt. 80).

132. *See* David Gerard & Lester Lave, *Experiments in Technology Forcing: Comparing the Regulatory Processes of US Automobile Safety and Emissions Regulations*, 7 INT'L J. TECH. POL'Y & MGMT. 761, 763 (2007).

133. *Id.*

134. David Gerard & Lester B. Lave, *Implementing Technology-Forcing Policies: The 1970 Clean Air Act Amendments and the Introduction of Advanced Automotive Emissions Controls in the United States*, 72 TECHNOLOGICAL FORECASTING & SOC. CHANGE 761, 764 (2005).

135. *See* Clean Air Act Amendments of 1977, Pub. L. No. 95-95, § 201, 91 Stat. 685, 751 (1977).

136. *See* GERARD & LESTER, *supra* note 134, at 770 ("[I]n April of 1973, EPA granted a one-year delay of the 1975 HC and CO standards, but still set interim standards that required roughly 50 [percent] reductions.").

invested in the research and development of the catalytic converter. Carmakers like GM and Ford[137] invested in catalytic converter research, development, and production. There, a technology-forcing mandate put the pressure (and the reward) on the parties capable of innovating.

Scholars also often cite the Montreal Protocol as a successful example of technology-forcing regulation. In 1974, two scientists sounded the alarm bell: chlorofluorocarbons (CFCs), widely used in everyday consumer products, were depleting the stratospheric ozone layer. By 1985, research had shown the ozone layer beginning to thin over Antarctica.[138] This finding led to the signing and implementation of the 1987 Montreal Protocol to ban CFCs. Scholars note "how quickly substitutes became available and widely adopted after the negotiation of the [Montreal] Protocol . . . ."[139] In fact, some of the leading CFC producing companies, like DuPont, quickly invented CFC substitutes themselves.[140] DuPont realized that it would not only benefit from selling the replacement product domestically, but also from the increased international demand for a CFC substitute.[141] Thus, four short years after the Montreal Protocol, DuPont began selling CFC alternatives.[142] Similar to how the CAA's technology-forcing standard led to the introduction of the catalytic converter, the federal government, in its implementation of the Montreal Protocol, applied the pressure and reward to the industry capable of developing the necessary technology to replace CFCs.

B. The Fuel Industry's Structure Weighs Against the Use of a Technology-Forcing Mandate for Cellulosic Biofuel

Unlike the structure of automobile and chemical production industries in which the manufactures themselves invest heavily in the necessary research and development, the fuel industry is largely divided into two separate processes: (1) drilling and extraction and (2) refining. The two categories are complementary but do not always overlap. Therefore, pressuring the refining industry to achieve advancements in drilling and extraction—or biofuel development—does not necessarily create pressure on the extraction or biofuel development industries.[143]

137. However, some carmakers, like Chrysler, did not have catalytic converter research and development programs. *See* Gerard & Lave, *supra* note 136, at 770.

138. *See* Elizabeth R. DeSombre, *The Experience of the Montreal Protocol: Particularly Remarkable, and Remarkably Particular*, 19 UCLA J. ENVTL. L & POL'Y 49, 70 (2000).

139. *Id.* at 59.

140. *Id.*

141. *Id.*

142. Press Release, DuPont, DuPont Position Statement on Montreal Protocol (June 10, 2013), http://www.dupont.com/corporate-functions/our-company/insights/articles/position-statements/articles/montreal-protocol.html.

143. Not every refining company handles oil drilling and gas extraction or works in (bio)fuel development. The major players in the oil drilling and gas extraction industry (and each company's respective market share) include ConocoPhillips (8.2 percent), Chevron Corporation (7.7 percent), Royal Dutch Shell PLC (6.1 percent), and BP PLC (5.8 percent). The major players in the refining

The court in *API* latched on to the disjointedness of the industry. It highlighted that this industry disconnect weighs against allowing a technology-forcing mandate because in technology-forcing mandates, "government pressure join[s] forces with industry specialization and competence."[144] With respect to cellulosic biofuel, by contrast, the "EPA applies the pressure to one industry (the refiners) . . . yet it is another (the producers of cellulosic biofuel) that enjoys the requisite expertise, plant, capital and ultimate opportunity for profit."[145] Simply stated, the refining industry is not structured to support rapid cellulosic biofuel innovation and production.

V. CONGRESS CREATED A GUARANTEED MARKET FOR COMMERCIAL CELLULOSIC BIOFUEL

Congress recognized that the fuel industry's structure weighed against the use of a technology-forcing mandate as a (proverbial) "stick" to force innovation. Therefore, it adopted a "carrot" approach by effectively guaranteeing a market for any commercially available cellulosic biofuel.

A. The RFS Promises a Guaranteed Market for Commercial Cellulosic Biofuel

Although the court in *API* rejected the EPA's attempt to structure the cellulosic biofuel mandate as a technology-forcing mandate, the court effectively affirmed that the RFS statute guarantees a market for commercial cellulosic biofuel production. This guaranteed market should function as a carrot, incentivizing innovation: if cellulosic biofuel producers sufficiently demonstrate their ability to commercialize cellulosic biofuel, the EIA will include such production projections in its annual cellulosic biofuel projection. In turn, when the EPA bases its mandate on the EIA's projection, it will only reduce the statutory cellulosic biofuel mandate if projected production levels cannot meet such a standard. As such, the RFS guarantees a market for commercial cellulosic biofuel production, telling producers: if you make it commercially available, we will force refiners to purchase it.

This guaranteed market incentive system should provide financial security for potential investors. Yet, only 20,069 gallons of cellulosic biofuel reached the commercial market as of 2012.[146] This raises the question: if there is a guaranteed market for cellulosic biofuel, why has commercial cellulosic biofuel not entered the market? The answer may be that guaranteeing a market for

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industry (and each company's respective market share) include ExxonMobil Corporation (15.6 percent), Valero Energy Corporation (15.5 percent), Phillips 66 Company (14.7 percent), Chevron Corporation (10.7 percent), Royal Dutch Shell PLC (10.4 percent), and Marathon Petroleum Company (9.7 percent). Therefore, the refining industry largely operates separately from the oil drilling and gas extraction industry. This shows that pressuring refiners does not automatically pressure the fuel inputs industry.

144. *API*, 706 F.3d at 480.

145. *Id.*

146. *2013 RFS Data*, *supra* note 7.

cellulosic biofuel does not provide enough market certainty for sufficient private investment in innovation and development.

B. The Cellulosic Fuel "Escape Hatch" Stunts Industry Growth

Congress built a mandatory "escape hatch" into the RFS by requiring the EPA to reduce the mandate to the projected production volume. This escape hatch allows the industry to develop at its own pace. By requiring the EPA Administrator to reduce the cellulosic fuel mandate to the level of projected production, the RFS does little to light the fire of innovation. The court's decision in *API* effectively eliminates the EPA's ability to penalize the failure to develop cellulosic biofuel.

However, the escape hatch might have been a necessary evil if Congress was unwilling to reduce the overall cellulosic biofuel mandate. This begs the question: how did Congress decide to propose sixteen billion as the target mandate? One RFS scholar conducted several interviews with congressional staffers and only a few interviewees offered (largely unsatisfying) explanations that the sixteen billion number "was a 'symbolic' and 'imaginary' number, rooted in the desire to have cellulosic ethanol beat out corn ethanol, 16-to-15."[147] This reasoning appears to apply logic similar to that in Congress's decision to increase the RFS to thirty-six billion gallons, perhaps symbolically one billion gallons greater than President Bush's AFS proposal.

Although the biofuel industry supported the RFS amendments and remained confident in its ability to achieve the high mandates, some industry representatives testified to the technological challenges that stood in the way of the industry's ability to produce such high volumes of cellulosic biofuel. For example, in 2007, Bob Dinneen, president and chief executive officer of the Renewable Fuels Association, testified to the Senate Committee on Energy and Natural Resources that although the technology existed to convert cellulosic feedstock to ethanol, the commercialization of cellulosic biofuel remained a "question of economics."[148] He noted that hurdles to commercialization included stimulating sufficient capital investment for production facilities and improving the efficiency of the cellulose-to-ethanol process.[149] Venture capitalist Vinod Khosla testified to the Senate Committee on Finance that a high standard coupled with "an automatic relief valve" would incentivize private industry to invest heavily in the research, development, and demonstration projects necessary to produce commercial-scale cellulosic biofuel.[150] Mr. Khosla evidenced his confidence in industry's ability to deliver

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147. Breetz, *supra* note 23, at 258.

148. *Biofuels for Energy Security and Transportation Act of 2007: Hearing on S. 987 before the S. Comm. on Energy and Natural Resources*, 110th Cong. 28 (2007) (statement of Bob Dinneen, CEO, Renewable Fuels Association); *see also* Breetz, *supra* note 23.

149. *Id.*

150. *Grains, Cane, and Automobiles: Tax Incentives for Alternative Fuels and Vehicles: Hearing before the S. Comm. on Finance*, 110th Cong. 7 (2007) (statement of Vinod Khosla, Founder, Khosla Ventures) ("[W]e should set a very high Renewable Fuels Standard (RFS) with an automatic relief

with his prediction that it could produce thirty-nine billion gallons of biofuel by 2017 and 139 billion gallons by 2027.[151] Mr. Khosla continues to invest in cellulosic biofuel development; Khosla Ventures recently purchased $42.5 million in convertible debt and $42.5 million shares from KiOR, a renewable fuel company, to support its development of two commercial-scale cellulosic biofuel plants.[152]

During the same committee hearing, in response to Senator Salazar's question of whether the RFS proposal was "too timid," National Renewable Energy Lab Professor Bruce Dale agreed that the proposal was "too timid" and noted that the government could impose a "higher standard."[153] However, Dr. Dale also pointed out that even though the industry could produce cellulosic biofuel for approximately $2.50 per gallon, this price would still not allow it to compete with gasoline. In 2007, he predicted that in five years or less the industry would be able to produce cellulosic biofuel for around $1.20 per gallon. A recent Bloomberg New Energy Finance study reports that in 2012 the cost of producing cellulosic biofuel hovered around $3.55 per gallon.[154] The biofuel industry has not yet brought Mr. Khosla and Dr. Dale's predictions to fruition.[155]

On the other hand, the industry has made several promising technological developments. For example, it has reduced the cost of cellulosic biofuel enzyme separation by 72 percent in the past five years.[156] Furthermore, the National Renewable Energy Laboratory recently reported that it has demonstrated the possibility of producing a cost-competitive cellulosic biofuel at $2.15 per gallon.[157] It is difficult to put an exact price on the cost of commercial cellulosic biofuel, however, because as of December 2013, the industry had sold only 213,432 gallons of cellulosic biofuel.[158] Therefore, despite the high cost of cellulosic biofuel, the industry has made great progress in the past few years. This also serves as a reminder that despite the best

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valve, as the President has proposed, so all new technology developers have an incentive to invest in R&D, knowing that, if they can produce the products, a large market exists.") [hereinafter *Grains Hearing*]; *see also* Breetz, *supra* note 23, at 259.

151. *Grains Hearing*, *supra* note 150, at 7.

152. Justin Doom, *Kior to Get $100 Million from Khosla and Gates for Biofuel Plant*, BLOOMBERG (Oct. 21, 2013, 7:45 AM), http://www.bloomberg.com/news/2013-10-21/kior-to-get-100-million-from-khosla-and-gates-for-biofuel-plant.html.

153. *Grains Hearing*, *supra* note 150, at 29.

154. *Cellulosic Ethanol Heads for Cost Competitiveness by 2016*, BLOOMBERG NEW ENERGY FIN. (Mar. 12, 2013), http://about.bnef.com/press-releases/cellulosic-ethanol-heads-for-cost-competitiveness-by-2016/ [hereinafter *Cost Competitiveness*]. Note, however, that the predictions rely on industry self-reporting.

155. The testimonies of Mr. Dinneen, Mr. Khosla, and Dr. Dale only serve to represent a balance of views from an industry lobbyist, private investor, and public scientist. Moreover, testimonies from 2007 do not take into account the economic challenges—stated modestly—that arose in 2008.

156. *Cost Competitiveness*, *supra* note 154.

157. NAT'L RENEWABLE ENERGY LAB, CLEAN ENERGY INNOVATION AT NREL CONTINUUM: SUSTAINABLE TRANSPORTATION 1 (2013), *available at* http://www.nrel.gov/docs/fy13osti/58775.pdf.

158. The EPA reports that 20,069 gallons were sold in 2012 and 196,363 in 2013, as of November 24, 2013. *See 2013 RFS Data*, *supra* note 7.

models, technological developments prove difficult to predict.

C. Billions of Federal Dollars and (Almost) Not a Drop to Show

The federal government has created several public finance opportunities to support the development of commercial cellulosic biofuel, yet through 2012 the industry had only produced 20,609 commercial gallons. In his 2007 State of the Union address, President Bush highlighted cellulosic biofuel and called for a federal investment of $2 billion in cellulosic biofuel innovation.[159] Specifically, Congress provided the appropriations for bioenergy research and development, which includes cellulosic biofuel development, as provided in table 4.

TABLE 4: CONGRESSIONAL APPROPRIATIONS TO THE DEPARTMENT OF ENERGY[160]

Fiscal Year	Appropriations (in millions of dollars)
2007	196
2008	198
2009	1003*
2010	786
2011	220
2012	200

* This number includes $786 million in additional funding from the American Recovery and Reinvestment Act of 2009.

In 2009, the Department of Energy and the USDA delivered $564 million in American Recovery and Reinvestment Act funding to support the construction and operation of nineteen pilot, demonstration, and commercial-scale operations.[161] Congress also gave the USDA $150 million in discretionary funds to support cellulosic biofuel development in fiscal year 2009.[162] The government has also supported several federal-private partnerships, including a $385 million program launched in 2007, to support the construction of six cellulosic biofuel demonstration plants.[163] Several other federal programs support cellulosic biofuel development, including the 2008 Farm Bill, which includes a tax credit for cellulosic biofuels, an ethanol tariff extension, an agricultural bioenergy feedstock and energy efficiency research extension initiative, biorefinery assistance programs for the support of demonstration and commercial-scale biorefineries, a bioenergy program for

159. Dan Somma et al., *Growing America's Fuel: An Analysis of Corn and Cellulosic Ethanol Feasibility in the United States*, 12 CLEAN TECH. ENVTL. POL'Y 373, 376 (2010).

160. *See* BRACMORT ET AL., *supra* note 86, at 16.

161. *DOE and USDA Award $564 Million to Biorefinery Projects*, EERE NETWORK NEWS (Dec. 2, 2009), http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=15663.

162. *New Farm Bill Speeds Commercialization of Advanced Biofuels*, EERE NETWORK NEWS (May 28, 2008), http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=11789.

163. BRACMORT ET AL., *supra* note 86, at 16.

advanced biofuels, a biomass research and development initiative, a biomass crop assistance program, and other programs tangentially related to cellulosic biofuel.[164] The Emergency Economic Stabilization Act of 2008 also expanded certain renewable energy tax and trade incentives to apply to renewable fuels.[165] As is apparent, the federal government has created several significant financial support programs to help bring cellulosic biofuel to the market.

D. Private Investment in Cellulosic Biofuel

Despite federal financial support, the commercialization of cellulosic biofuel still faces significant economic hurdles. The USDA notes that "[h]igh production and initial construction costs for untested technologies and processes on a large scale increase investment risk and affect the willingness of investors to underwrite projects."[166] A 2011 Congressional Research Service report provides an overview of early private investment, reporting that private industry has entered into a variety of partnerships aimed at commercializing cellulosic biofuel.[167] The report highlights a partnership between Royal Dutch Shell and Imogen Corporation, a $30 million investment by Mascoma (an ethanol producer) with support from General Motors and Marton Oil, and a joint collaboration between Monsanto and Mendel Biotechnology, Inc.[168] However, some of those plants, including Mascoma, have lost funding.[169] British Petroleum also abandoned its decision to build a $300 million cellulosic biofuel plant in Florida.

While some companies have canceled plans to build commercial-scale cellulosic biofuel plants, others have continued their investments. For example, KiOR opened the first domestic cellulosic biofuel plant in Missouri in October of 2012.[170] The plant cost $213 million and will be able to produce up to thirteen million gallons annually.[171] KiOR has plans to build another facility in Missouri as well.[172] Ineos Bio also recently announced the opening of a $130 million commercial-scale cellulosic biofuel production plant capable of

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164. *See* Food, Conservation, and Energy Act of 2008, Pub. L. 110-246, 122 Stat. 1651 (2008).

165. *See* Emergency Economic Stabilization Act of 2008, Pub. L. No. 110-343, 122 Stat. 3765 (2008).

166. COYLE, *supra* note 94, at 10.

167. *See generally* BRACMORT ET AL., *supra* note 86.

168. *Id.* at 15.

169. Andy McGlashen, *As Key Partner Departs, Future Dims for Michigan Cellulosic Biofuel Plant*, MIDWEST ENERGY NEWS (Aug. 6, 2013), http://www.midwestenergynews.com/2013/08/06/as-key-partner-departs-future-dims-for-michigan-cellulosic-biofuel-plant/.

170. *See Production Facilities*, KIOR, http://www.kior.com/content/?s=6&s2=56&p=56&t=Production-Facilities (last visited Apr. 21, 2014).

171. *Id.*; *see also* Christopher Martin & Mario Parker, *BP Cancels Florida Ethanol Plants, Extends Renewable Exit*, BLOOMBERG (Oct. 25, 2012, 12:57 PM), http://www.bloomberg.com/news/2012-10-25/bp-cancels-plans-to-build-florida-cellulosic-ethanol-plant.html.

172. *See Production Facilities*, *supra* note 170.

producing eight million gallons annually.[173] In addition, POET-DSM Advanced Biofuels, LLC, a joint venture between Royal DSM and POET, LLC, plans to open a $250 million plant capable of producing twenty to twenty-five million gallons of cellulosic biofuel annually, beginning in 2014.[174] Moreover, DuPont anticipates a 2014 opening for its $200 million facility capable of producing up to thirty million gallons annually,[175] meaning this facility will "require a capital investment of about $7 per gallon of annual capacity."[176] Lastly, Canergy LLC, Chemtex, and Beta Renewable plan to begin constructing a 25-million-gallon-per-year cellulosic biofuel facility in 2014 and estimate the plant to go online in 2016.[177] Thus, many companies have invested significant capital to build commercial-scale cellulosic biofuel plants.

Although many of these plants have significant planned production capacity, many other plants in the pipeline will likely produce "10 million gallons or less."[178] The Renewable Fuels Association maintains a database of biorefinery locations and production capacities.[179] One hundred seventy-three operational biorefineries use corn as the feedstock.[180] Those plants report an aggregate nameplate capacity of 11.7505 billion gallons per year, with an average individual plant capacity of 67.92 million gallons per year.[181] Therefore, the average corn ethanol plant has the capacity to produce more than double the planned capacity of the largest proposed cellulosic biofuel plant. Building off those calculations, the industry would need to build up to three hundred new cellulosic biofuel plants that would each produce approximately one hundred million gallons annually in order to meet the RFS mandates.[182]

VI. *API* HINDERS THE DEVELOPMENT OF CELLULOSIC BIOFUEL

Although private industry continues to invest in the commercialization of

173. Press Release, INEOS Bio, INEOS Bio Produces Cellulosic Ethanol at Commercial Scale (July 31, 2013), *available at* http://www.ineos.com/businesses/ineos-bio/news/ineos-bio-produces-cellulosic-ethanol/.

174. Press Release, POET, Construction Update: Project Liberty Remains on Schedule for Early 2014 Startup (Sept. 26, 2013), *available at* http://poet.com/pr/liberty-construction-update-sept-2013.

175. Press Release, DuPont Biofuel Solutions, DuPont Advances Commercialization of Cellulosic Ethanol with Iowa Biorefinery Groundbreaking (Nov. 30, 2012), *available at* http://biosciences.dupont.com/media/news-archive/news/2012/dupont-advances-commercialization-of-cellulosic-ethanol-with-iowa-biorefinery-groundbreaking/.

176. *Id.*

177. Press Release, Chemtex, Canergy Selects Chemtex and Beta Renewables for Its Cellulosic Ethanol Project in California (Apr. 30, 2013), *available at* http://www.reuters.com/article/2013/04/30/idUSnGNX2hSYMz+1ce+GNW20130430.

178. Kevin Bullis, *The Cellulosic Ethanol Industry Faces Big Challenges: The Advanced-Biofuels Industry is in Danger of Withering Away*, MIT TECH. REV. (Aug. 12, 2013), http://m.technologyreview.com/news/517816/the-cellulosic-ethanol-industry-faces-big-challenges/.

179. *See Biorefinery Locations*, RENEWABLE FUELS ASS'N, http://www.ethanolrfa.org/bio-refinery-locations/ (last updated May 30, 2014).

180. *Id.*

181. *Id.*

182. Bullis, *supra* note 178.

cellulosic biofuel, continuous changes to the mandate signal regulatory uncertainty that may stunt much-needed private investment. Moreover, *API* reduces the refiners' incentive to invest in cellulosic biofuel development. Before *API*, refiners had a great incentive to invest in the development of cellulosic biofuel because they would face fines for not meeting their mandatory volume obligations, even if no cellulosic biofuel existed in the market. However, *API* dramatically reduces and likely eliminates the EPA's ability to pressure the refiners to support the development of commercial cellulosic biofuel. Failures in recent years to produce commercial cellulosic biofuel may help the refiners push through proposals to dramatically amend, and perhaps repeal, the RFS.[183] Private industry is beginning to invest in small- and medium-scale cellulosic demonstration and production facilities. These facilities allow the industry to prove its technology on a smaller scale to induce larger investments in the future. Congressional action to reduce the potential future guaranteed cellulosic biofuel market would dampen investment appetites at the exact instant the private industry appears poised to make significant long-term investments. Such action could forever stunt the commercialization of cellulosic biofuel.

A. Congress Chose Not to Enact a Technology-Agnostic Mandate in Order to Promote Cellulosic Biofuel

Some criticize the RFS for effectively picking the technology winners. Critics argue that the government has a "relatively poor record in picking which future technologies will best succeed . . . ."[184] This line of analysis posits, for example, that by mandating the development of cellulosic biofuel, the RFS "may exclude or retard the development of other, potentially preferable alternative energy sources."[185] For example, University of Iowa Professor Bruce Babcock contends that the RFS fails "the neutrality test of an efficient policy," which could stunt the development of other, potentially more preferable alternative energy sources.[186]

Many contrast the RFS with California's Low Carbon Fuel Standard (LCFS), a technology-agnostic approach to increasing the use of renewable transportation fuel. The LCFS requires a 10 percent reduction in the carbon intensity of California's transportation fuels by 2020.[187] Whereas the RFS requires the production of specific categories of biofuel, the LCFS measures the

183. *See, e.g.*, RFS Elimination Act of 2013, H.R. 1462, 113th Cong. (as proposed by Mr. Goodlatte, Apr. 10, 2013).

184. Gary E. Marchant, *Sustainable Energy Technologies: Ten Lessons from the History of Technology Regulation*, 18 WIDENER L.J. 831, 836 (2009).

185. SCHENPF & YACOBUCCI, *supra* note 36, at 18.

186. Bruce A. Babcock, *High Crop Prices, Ethanol Mandates, and the Public Good: Do They Coexist?*, 13 IOWA AG REV. 1, 3 (2007) ("Competition between alternative energy sources would reveal the most efficient set and allow the United States to meet its policy objectives at least cost.").

187. Cal. Exec. Order No. S-01-07 (2007).

life cycle carbon intensity of each fuel source.[188] However, some have predicted that California may achieve the 10 percent reduction even without additional innovation in biofuel technology or production.[189]

Unfortunately, technology-agnostic policies do not always lead to the development of the best technologies in the long term. By focusing on the "quest for cost-efficiency in meeting near-term" targets, technology-agnostic policies reward near-term innovation at the expense of long-term innovation that poses more risk but may also offer more reward.[190] Such policies may inadvertently stunt the development of more advanced technologies. For example, policies like the LCFS might "lock-in" the "near term capital intensive technologies with modest GHG improvements" but lead to an "inability to find markets for more advanced technologies that may offer greater long-term gains."[191] Therefore, a technology-agnostic policy might not provide the necessary incentive for sufficient investment to achieve the development of commercial-scale cellulosic biofuel.[192] This Note has explained that the commercialization of cellulosic biofuel could lead to significant reductions in transportation emissions. A technology-agnostic approach might prevent the long-term investments necessary to achieve these results.

B. A Carbon Tax Will Likely Not Achieve Commercial Cellulosic Biofuel

Some also suggest replacing the RFS with a carbon tax, arguing that a carbon tax would provide a more economically efficient path to biofuel innovation and commercialization.[193] Although politically challenging, a "carbon tax is an efficient economic instrument to reduce carbon emissions."[194] It could, in theory, incentivize cellulosic biofuel innovation. The most recently introduced climate change bill[195] proposes a carbon tax of $20 per ton of carbon dioxide. This proposed tax would only lead to a tax of about eighteen cents per gallon.[196] Therefore, cellulosic biofuel could only be profitable if it

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188. *Id.*

189. *See* ALEXANDER E. FARRELL & DANIEL SPERLING, UNIV. CAL. DAVIS INST. OF TRANSP. STUDIES, A LOW-CARBON FUEL STANDARD FOR CALIFORNIA PART 1: TECHNICAL ANALYSIS 12 (2007).

190. *See* Björn A. Sandén & Christian Azar, *Near-Term Technology Policies for Long-Term Climate Targets—Economy Wide Versus Technology Specific Approaches*, 33 ENERGY POL'Y 1557, 1557 (2005).

191. FARRELL & SPERLING, *supra* note 189, at 36.

192. *Cf.* Daniel Sperling & Sonia Yeh, *Low Carbon Fuel Standards*, ISSUES IN SCI. & TECH., Winter 2009, at 57, 63 (noting that a "major challenge" for the LCFS is to avoid fuel shuffling as opposed to a net change in emissions).

193. *Id.* at 61 ("Former Federal Reserve chairman Alan Greenspan, car companies, and economists on the left and the right all have supported carbon and fuel taxes as the principal cure for both oil insecurity and climate change.").

194. Govinda R. Timilsina et al., *Why does a carbon tax on fossil fuels stimulate biofuels?, 70* ECOLOGICAL ECON., 2400, 2410 (2011).

195. Climate Protection Act of 2013, S. 332, 113th Cong. (2013).

196. *How Much Carbon Dioxide is Produced by Burning Gasoline and Diesel Fuel?*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/tools/faqs/faq.cfm?id=307&t=11 (last visited July 4, 2014).

costs less than eighteen cents more than regular gasoline at the pump costs today, which appears highly unlikely in the near future. This issue further emphasizes the importance of creating a large guaranteed market for cellulosic biofuel. It also illustrates the challenges involved in choosing among different policy instruments in order to spur innovation.

CONCLUSION

Congress designed the RFS to spur the development of cellulosic biofuel. To achieve commercial-scale cellulosic biofuel production, the RFS essentially requires refiners to purchase any commercial cellulosic biofuel on the market. However, the RFS does nothing to force producers to innovate and develop the fuel. *API* eliminated the EPA's ability to pressure refiners into developing cellulosic biofuel. As a result, the future of cellulosic fuel depends on producers' internal motivation to innovate.

Cellulosic biofuel cannot compete with gasoline or ethanol today.[197] Without significant technological and production advances, cellulosic biofuel will likely become cost-competitive only if the price of oil reaches $191 per barrel.[198] The ability to transform cellulosic biofuel technology to commercial-scale production and to secure the significant capital investment required to develop large production facilities remain the dominant limiting factors to commercial-scale cellulosic biofuel development. Despite political pressure to eliminate or drastically amend the cellulosic biofuel mandate, however, Congress should refrain from tinkering with the overall statutory mandate levels to effectively encourage the long-term private industry capital investments necessary to bring about commercial-scale cellulosic biofuel.[199]

The EPA has drastically reduced the annual cellulosic biofuel mandates every year. For 2013, the EPA reduced the mandate from one billion gallons to fourteen million gallons.[200] As of November 24, 2013, the industry had produced 196,363 gallons of cellulosic biofuel during the 2013 calendar year.[201] However, on November 15, 2013, the EPA released its proposed 2014 mandates, setting the cellulosic biofuel mandate at seventeen million gallons for 2014.[202] Although seventeen million is significantly lower than the statute's

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The EIA estimated that burning a gallon of gasoline produces about 19.64 pounds of carbon dioxide. *Id.* Accordingly, a gallon of gas produces 0.0089086 tons of carbon dioxide. *Id.*

197. Bullis, *supra* note 178.

198. COMM. ON ECON. & ENVTL. IMPACTS OF INCREASING BIOFUELS PROD., NAT'L RESEARCH COUNCIL, RENEWABLE FUEL STANDARD: POTENTIAL ECONOMICS AND ENVIRONMENTAL EFFECTS OF U.S. BIOFUEL POLICY 3 (2011).

199. The need for regulatory stability to incentivize long-term investments can often conflict with the regulatory flexibility necessary in such ambitious mandates. *See* Marchant, *supra* note 184, at 848–49.

200. EPA, EPA FINALIZES 2013 RENEWABLE FUEL STANDARDS (2013), *available at* http://www.epa.gov/otaq/fuels/renewablefuels/documents/420f13042.pdf.

201. *2013 RFS Data*, *supra* note 7.

202. Press Release, EPA, EPA Proposes 2014 Renewable Fuel Standards / Proposal Seeks Input to Address "E10 Blend Wall," Reaffirms Commitment to Biofuels (Nov. 15, 2013), *available at*

call for 1.75 billion gallons, the EPA's 2014 mandate would represent an 8557.43 percent increase in production from 2013 to 2014. Time will tell whether the United States can produce commercially-competitive cellulosic biofuel.

http://yosemite.epa.gov/opa/admpress.nsf/6424ac1caa800aab85257359003f5337/81c99e6d27c730c485257c24005eecb0!OpenDocument.